ENVIRONMENTAL GEOLOGIC IMPACT STATEMENT

Realignment of M 66 from Phelps Road to 1.7
Miles North of Missaukee-Kalkaska County Line
Control Section Nos. 57013, 40031

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This report presents the results of a detailed geologic and hydrogeologic investigation of the area affected by the proposed M 66 route and its possible alternates. The alternates commence south of the Missaukee-Kalkaska County Line where a large wetland area exists, containing springs which are the headwaters for Filer Creek as shown in Figure 1.

This study was made by Frank G. Belobraidich, Geologist, Testing Laboratory Section, at the request of J. H. Raad, Supervisor, Environmental Liaison Unit, Transportation Planning Division, to aid in evaluating the environmental impact of the proposed M 66.

Information Sources

The environmental geology of the M 66 project area was partially determined from Glacial Geology Maps distributed by the Michigan Department of Natural Resources. Surface drainage information was obtained by field investigation and from USGS topographic quadrangles. Subsurface data were collected from water well and oil well drillings along with flight auger borings by the Geophysical Unit, Michigan Department of State Highways. Soil information was obtained from U.S. Department of Agriculture Maps and the MDSH "Field Manual of Soil Engineering." The information compiled from the above sources is shown in Figures 1 through 5.

GENERAL GEOLOGIC SETTING

Surface Formations

The glacial drift of Missaukee and Kalkaska Counties is approximately 500 ft thick and is composed of various mixtures of sand, clay, pebbles, and cobbles.

Three types of glacial deposits may be readily distinguished in the Filer Creek vicinity; moraines, ground moraines, and outwash plains. The name of the moraine south of Filer Creek is the Fletcher Moraine which is part of the larger West Branch morainic system. The Crawford Lake Moraine to the north forms a part of the much larger system called the Port Huron morainic system. These moraines were formed at the front margin of the glacier when that margin stood in a nearly stationary position. The relationship between the rate at which the glacier advanced and the rate at which its margin was wasted back by melting determines the position of the ice front. During this time, slow but constant forward movement of the glacial ice mass continually brought forward its load of boulders, gravel, sand, and clay to the stationary front. The melting ice, heavily laden with coarse debris, caused significant water action resulting in extensive sorting and formation of these granular moraines.

Ground moraines are level to gently undulating plains of unstratified glacial material developed during periods when the ice front melted from the position of one moraine to the next. Glacial materials were deposited partly by accretion beneath actively moving ice and partly from debris carried in the basal part of the ice as it melted. Ground moraines can be found between Johnson Rd and Robby Rd just east of Burkett Rd as shown in Figure 2.

Outwash plains were formed by flowing rivers along the edge of the melting glacier. These are level to gently undulating plains composed of sorted and stratified sand and gravels. When the glacier halted, building the Crawford Lake Moraine, great volumes of water flowed from the melting ice, and the sediment-laden stream meandered back and forth over a broad area forming the Manistee River plain as shown in Figure 2. The major streams started as channels along the ice fronts and were dewatered by lower outlets and were turned into strips of marshy lowlands, as in the lowland area of Filer Creek.

Soils

The lithologic character and the forms of the glacial deposits are important in the explanation of the chemical and physical character of the soils. The unconsolidated glacial drift in this study is influenced by being mixed with limestone and shale of the Devonian Epoch. Diversity of the soils association and textural gradation of one parent soil into another results in a soil complex with a wide range in moisture conditions. Surface formations laid down during the last stages of the glacial period are almost entirely constructional so that areas have remained flat and water covered. These soils developed under conditions of excessive moisture. Soils developed under conditions of low moisture have been possible because of the perviousness and thickness of the glacial deposit.

The Soils Map (Fig. 3) is divided into three categories: well drained granular soils, poorly drained granular and cohesive soils, and organic deposits. The well drained granular soil associations in this study area consist of Roselawn-Emmet, Wexford-Emmet, and Rubicon-Grayling Soil Series. Roselawn-Emmet and Wexford-Emmet Soils are extensive in the southern portion of the study and occur on rolling to hilly moraines. The extent of these morainic deposited soils are shown as moraines on the Surface Geology Map (Fig. 2) and well drained granular soils on the Soils Map (Fig. 3).

Because of the perviousness of the soil and free downward percolation of water, the land is primarily dry and well drained. Roselawn and Wexford soils are usually sands and the Emmet generally consists of sandy loam. The association of the Emmet with the Roselawn and Wexford is a diversity of textural gradations between the individual soils. Layers and pockets of silt, sandy clay, and very fine sand may be found at any depth causing a possible perched water table. The depth to the water table in these soils is normally deep.

The second category is poorly drained granular and cohesive soils. Soils in this category range in texture from a deep sand to a mottled clay. Soils found in this group are Ogemaw, Saugatuck, Newton, Selkirk, and Bergland Soils Series. The Ogemaw, Saugatuck, and Newton soils are the more granular soils. The Ogemaw soils consist of loamy sand over fine sandy loams to clays. A distinguishing feature is a dark reddish-brown cemented subsoil or hardpan. Saugatuck soils are a wet sandy soil and, like the Ogemaw, have a sandy layer cemented into a hardpan. In many places the soil is water-soaked within a few inches of the mixed sand and peaty organic surface. It is permanently saturated at a depth of 3 or 4 ft. Saugatuck soils occur principally in small bodies, in long strips, or in bordering swamps.

The Newton surface texture is a sand or loamy sand with a high percentage of organic matter. The Newton series are poorly drained deep sands with the water table at or near the surface. These occur in wet depressions and on the borders of swamps and lakes.

The Selkirk and Bergland series are a silt loam to clay soils with the surface layer high in organic matter. The water table is at or near the surface. These poorly drained soils are found in small depressions throughout the study but are primarily located in the northern portion.

Organic deposits, the third category, are dominantly plant matter and constitute a distinct class when compared with soils composed of mineral or inorganic matter.

The organic deposits have accumulated in permanently wet situations where the underdrainage is obstructed and in stream valleys. The organic soils are also formed on slopes permanently wet from seepage springs and lakes which have been completely filled by vegetation. Deposits composing the soil, or from which the soil has been derived, range in thickness in the Filer Creek area from 1 to 20 ft and differ in the character of the mineral substratum of marl, sand, or clay. A difference in age, stage of decomposition of the plant matter, and amount of admixture of foreign mineral matter can alter the average depth of the water table. Less decomposed and coarser material is designated as Rifle Peat, and the more decomposed is designated as Lupton Muck.

Rifle Peat is a coarse woody or loamy material very high in organic matter which is underlain by fibrous material or by a coarser-textured woody mass of plant matter showing very little decomposition. The mineral substratum in most areas is sand, and in the larger deposits of the Rifle Peat, small islands of Saugatuck, Rubicon, and Newton soils can be found. The largest deposits of Rifle Peat are found in the Manistee River Valley, its tributaries, and old lake basins on till and outwash plains.

Lupton Muck occurs in small bodies in the valley of the Manistee River. This is a granular loamy muck, high in organic matter, comparatively fine in texture and showing evidences of marked physical change and decomposition of the parent plant matter. This material may extend to a depth ranging from 2 to 3 ft before a coarser, more fibrous and less decomposed peaty material is reached. The water table, under natural conditions, is very near the surface.

GENERAL HYDROGEOLOGIC SETTING

Surface Drainage

A youthful stage in the geologic erosional cycle characterizes the surface configuration. Due to the porous nature of the granular surface deposits the land surface is almost entirely constructional, as streams have not yet had time to develop complete dendritic systems.

This study lies within the Manistee River watershed which follows an old glacial drainage valley in a westerly direction. There are no major tributaries of the Manistee River but there are several interlocking micro-watersheds draining the surface via small creeks as shown in Figure 4.

On the south side of the Manistee River, drainage is in a northern direction by Ham Creek and Filer Creek. The northern portion of the study is drained in a southern direction by the Nelson and Waterhole Creeks. As shown in Figure 4, small creeks from springs and surface drainage flow into Filer Creek from the east and west.

A few surface bodies of water are remnants of once larger glacial lakes which have no inlet or outlet. Loon Lake is largest and lies in the southeast portion of the study area. Also, scattered throughout are smaller ponds. South of Smithville a large wetland area contains many flowing springs which are the headwaters for Filer Creek (Fig. 3). This muck and peat wetland area is underlain in places by an impervious clay layer preventing rapid downward percolation of the water.

Ground Water

Ground water movement, its recharge and discharge, are controlled by the texture of unconsolidated materials overlying the bedrock. The glacial features encountered by the proposed M 66 are granular moraines and outwash plains. These porous features allow a relatively free movement of the ground water. Regional ground water movement is in a northwesterly direction. Although local ground water movement varies (just as surface drainage may vary within a major watershed), the small topographic divides in this study represent the approximate ground water divides. Ground water is a subdued replica of the surface topography and flows from higher elevations in the morainic deposits (possibly recharge or storage areas) to the more stable lower levels of the Manistee River.

This study is concerned with the appearance of ground water discharge in the form of springs in the organic deposits on the granular outwash plains in the vicinity of the Missaukee-Kalkaska County Line.

Three principal variables responsible for the spring discharge are: the aquifer's permeability, the area contributing recharge to the aquifer, and the quantity of recharge. The granular moraines to the south and east allow partial recharge of the ground water. The outwash, with a high permeability, allows free movement of the ground water into a relatively small area where the land surface intersects the water table and discharge results. As can be seen on the Inferred Water Table Map (Fig. 5) the inferred ground water contour elevations in the Filer Creek area coincide with the dashed lines representing the ground surface of the same elevation. This represents the approximate location where the discharge of ground water, as springs, appears at the surface. Section 13 of Figure 5 contains Boiling Springs. This spring is in a depression which is filled with water where turbidity of sediments can be observed by the discharge of ground water.

ANALYSES OF GEOLOGIC AND HYDROGEOLOGIC IMPACT FACTORS

Impact factors associated with highway construction on or near open water areas such as streams, lakes, and wetlands can be significant. Sedimentation during and after construction, degrading of water quality by undiluted surface runoff from deicing programs, and other pollutants associated with motor vehicles can all have significant environmental impact.

Proposed routes for the relocations of M 66 are designated as Original Line, and Alternates I and II, in Figure 1. The Original Line route crosses Filer Creek twice. This cold, clear, spring-fed creek is crossed first near its headwaters where banks are steep and granular, then over a ponded portion of the creek. This would be a most detrimental crossing due to the greater distance of water being crossed and the peat and muck deposits in which it lies. The excavation or displacement of this organic material would greatly increase the siltation of the creek. Rerouting of the creek by channelization, if necessary, could also be an important factor.

The Original Line has a shorter crossing of the peat and muck deposit but the deposit is deep, approximately 14 ft in places, and lies between a large portion of Filer Creek and spring areas. The disruption of the small rivulets feeding the creek from the spring area is a possibility if proper precautions are not employed. Also, a small creek that flows into Filer Creek would be crossed near the County Line.

Alternate Alignment I, to the east of the headwaters, crosses Filer Creek at the north end just south of the Manistee River. The impacts of sedimentation and surface runoff will not be as significant to Filer Creek as the Original Line and Alternate II due to the fact that its crossing is near the mouth, and the further distance away where it parallels the creek. With proper precautions siltation into the Manistee River can be kept at a minimum.

This alignment to the east of Filer Creek could be a critical area in that the disruption of the ground water flow would be disastrous to Filer Creek. Considerations should be made in setting of the grade so that a possible cut section would not hamper the natural ground water movement. Care in developing a drainage system to avoid direct spillage of pollutants into the headwaters area must be used to prevent a hazardous impact. The crossing of the spring area on this alignment (Fig. 4) is in a shallow muck deposit and will deserve special attention to preserve this discharge of ground water which forms the small rivulets that feed Filer Creek.

Alternate Alignment II does not cross Filer Creek, but runs parallel, in close proximity, along the west side of the creek through a deep muck and peat deposit. This alignment would have a significant impact on Filer Creek by pollutants from surface runoff. The crossing of a creek flowing from west to east the size of Filer Creek itself will have a possible impact due to siltation during construction and runoff from the crossing. Small rivulets flowing toward Filer Creek from the west will cause possible impact without necessary precautions.

Alignment for Alternate II is such that a new bridge would have to be constructed across the Manistee River. The new bridge would have a significant impact whereas the other two alignments would use the existing M 66 bridge.

Swamps are often open expressions of the water table and can be an intake source for pollution that may degrade the water quality. All alignments of this study cross swamp deposits. Interference of natural ground water movement by swamp backfilling could have significant detrimental consequences. This organic deposit, containing springs, makes the possibility of ground water disruption (by blocking the flow or diverting the existing course) a very critical situation.

In Michigan the specifications for swamp backfill material are such that the permeability of the fill is greater than the surrounding muck or peat. This should preclude the possibility of detrimental impact on ground water movement in swamps. The method of muck removal and disposal would have significant impact if proper procedures were not used.

Direct runoff by the sealed surface into the creek would increase the fluctuation of flow with undiluted pollutants if proper drainage were not employed. Because of the distance from the creek, the large area of porous material, and the standing water in the organic soils that would dilute pollutants, Alternate I would have the least impact from runoff.

Soil Erosion

The highway's impact on soil erosion is an important geological factor. With the Michigan Department of State Highway's construction practices and controls, the effects should be very minor. The clearing and grubbing, excavation, filling, and other construction activities are usually immediately followed by a program of reseeding and sodding. Steep cut slopes, embankments, ditches, and other areas subject to wind or water erosion are stabilized as soon as possible.

The areas in the proposed alignments that may of some concern are the granular morainic soils. These soil series tend to have occasional pockets of fine sands and clay. Road cuts made through such deposits could encounter these seepage zones. Many of the granular soils on the more strongly sloping features are subject to wind and water erosion where the vegetation has been removed.

Mineral Deposits

Test borings indicate that the possibility of covering an economically valuable deposit of gravel with the proposed alignments is remote.

Some oil wells have been drilled in the study area. They are all dry holes and their locations are shown on Figure 1.

Rare Rossil Occurrances

Highway construction through fossil beds is considered to be of minor and favorable geological impact. Excavation into the underlying rock or glacial drift strata are the only way exposures of rare fossils are found. The highway program in Michigan has significantly aided the scientific investigation of the recent geological events of the Pleistocene Epoch. Excavations associated with construction have unearthed many significant remains of flora and fauna that would otherwise have gone undetected.

SUMMARY

The purpose of this study was to detect environmentally sensitive areas where special considerations should be given.

A sensitive area is found in the organic deposit on an outwash plain south of Smithville. This deposit contains Filer Creek; its headwaters are from ground water discharge in the form of flowing springs. Three alignments are proposed for this area and are referred to as Original Line and Alternates I and II.

The Original Line crosses Filer Creek twice through an organic deposit of maximum depths of 14 ft. A small creek that flows into Filer Creek will have to be crossed near the county line.

The crossing of Filer Creek and muck removal would have a significant impact by siltation and runoff.

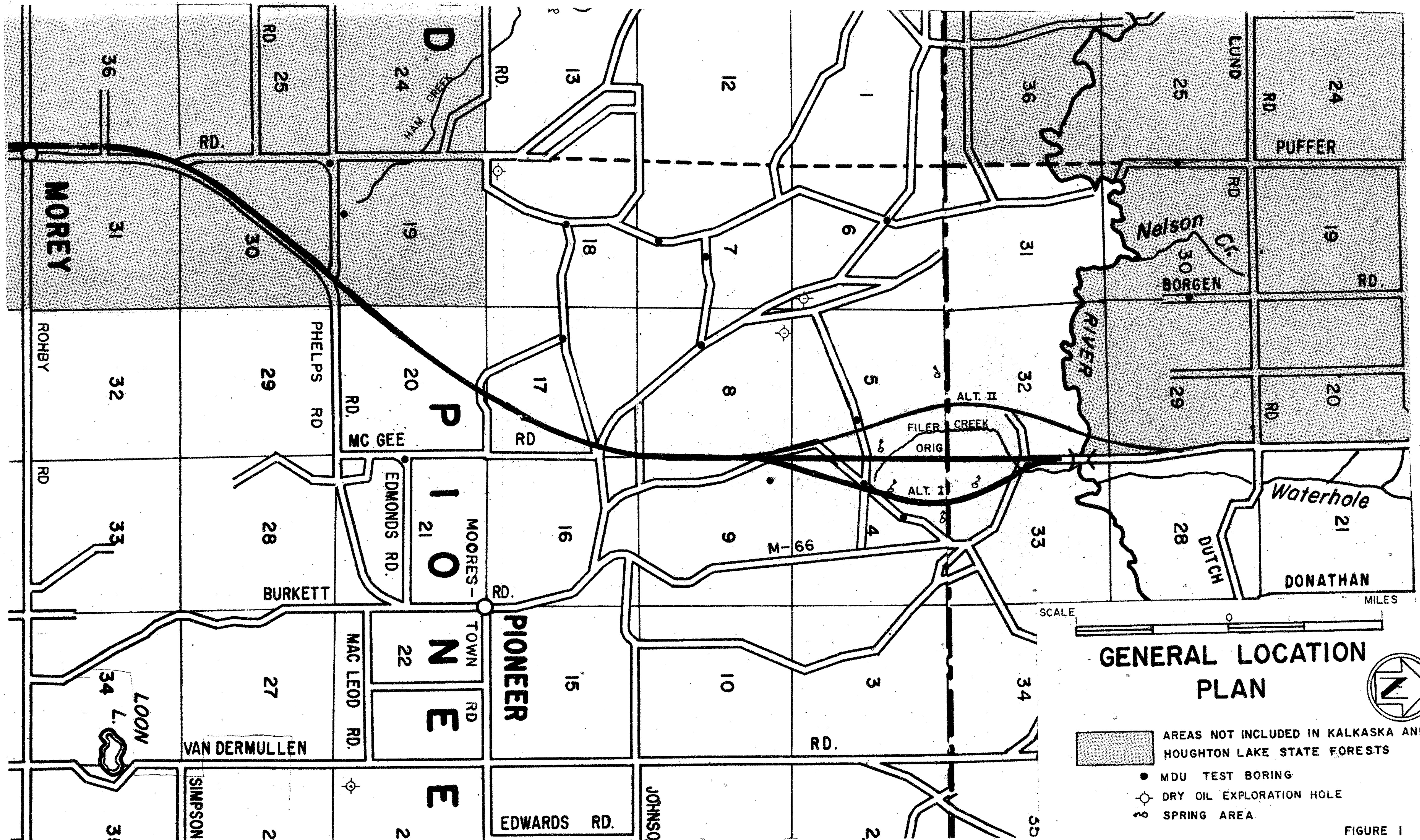
Alternate I swings east of the headwaters of Filer Creek and through spring areas of shallow muck. This alignment crosses Filer Creek at the north end near the Manistee River. Siltation would have little impact by following the "Michigan Guideline Procedures for Control of Siltation." Possible contamination by surface runoff would be minor due to the distance from the creek.

A sensitive area of this alignment are the spring areas. Any disruption of the ground water movement would be critical to Filer Creek. This can be avoided by allowing continued flow of springs during and after construction.

Crossings of small creeks will be encountered as in the other two alignments.

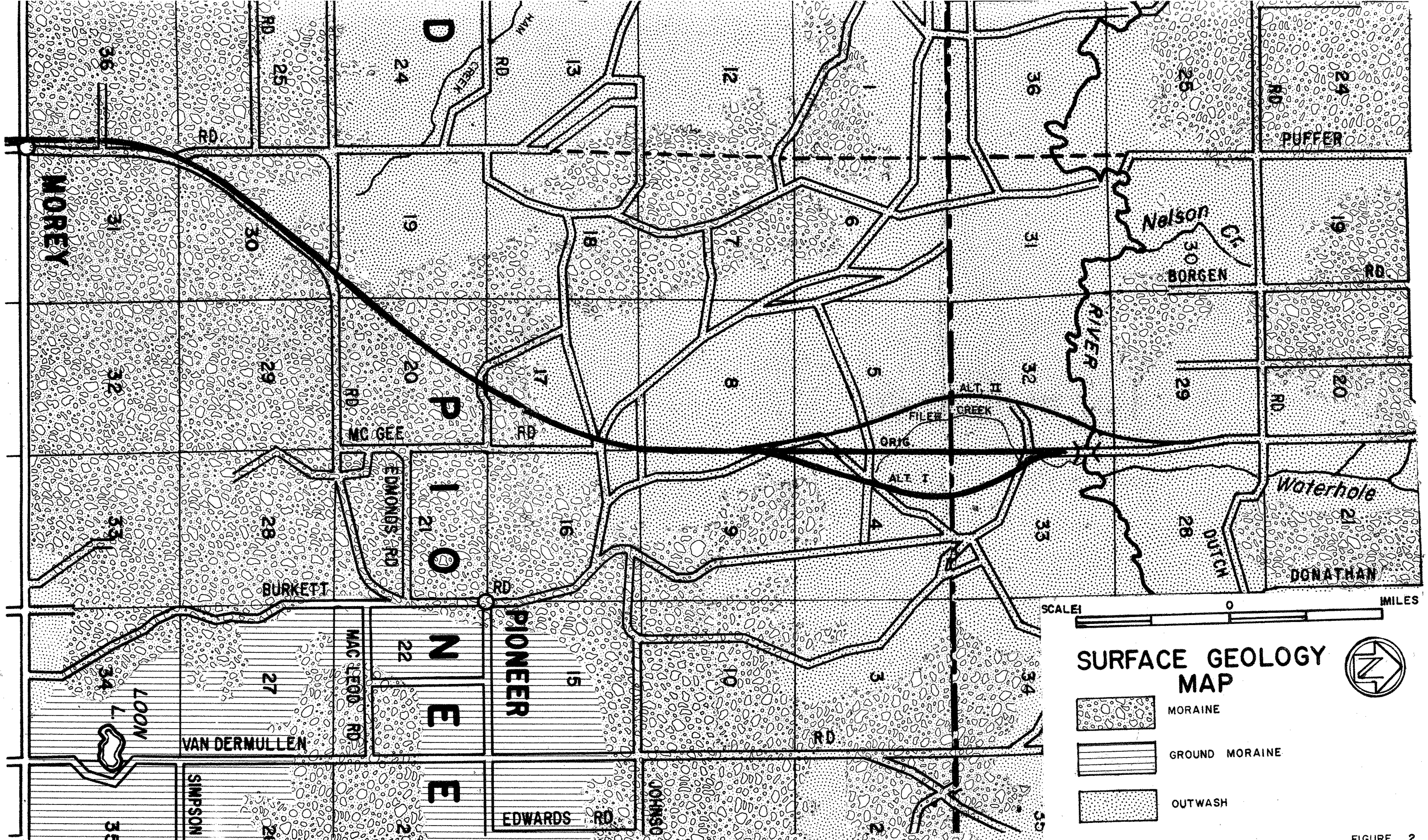
Alternate II parallels Filer Creek on the west side through the deepest muck deposits of the three alignments.

The closeness of this route to Filer Creek would be a critical area because of the deep muck removal and storage. The siltation, fluctuation of flow from surface runoff, and possible disruption of ground water movement makes Alternate II a very critical alignment with significant environmental impacts. Although Alternate II does not cross Filer Creek a new bridge across the Manistee River would have to be constructed. The Original Line and Alternate I will use the existing M 66 bridge.



GENERAL LOCATION PLAN

FIGURE 1



SURFACE GEOLOGY MAP
MORAINE
GROUND MORAINE
OUTWASH
SCALE 1 0 1 MILES
MOREY
PUFFER RD
BORGEN RD
MC GEE RD
BURKETT RD
EDMONDS RD
MAC LEOD RD
VAN DERMULLEN RD
SIMPSON
EDWARDS RD
JOHNSON
PIONEER
DONATHAN
DUTCH
Nelson Cr.
RIVER
Waterhole
LOON L.
FILER CREEK
ALT. I
ALT. II
ORIG
P I O N E E
D

FIGURE 2

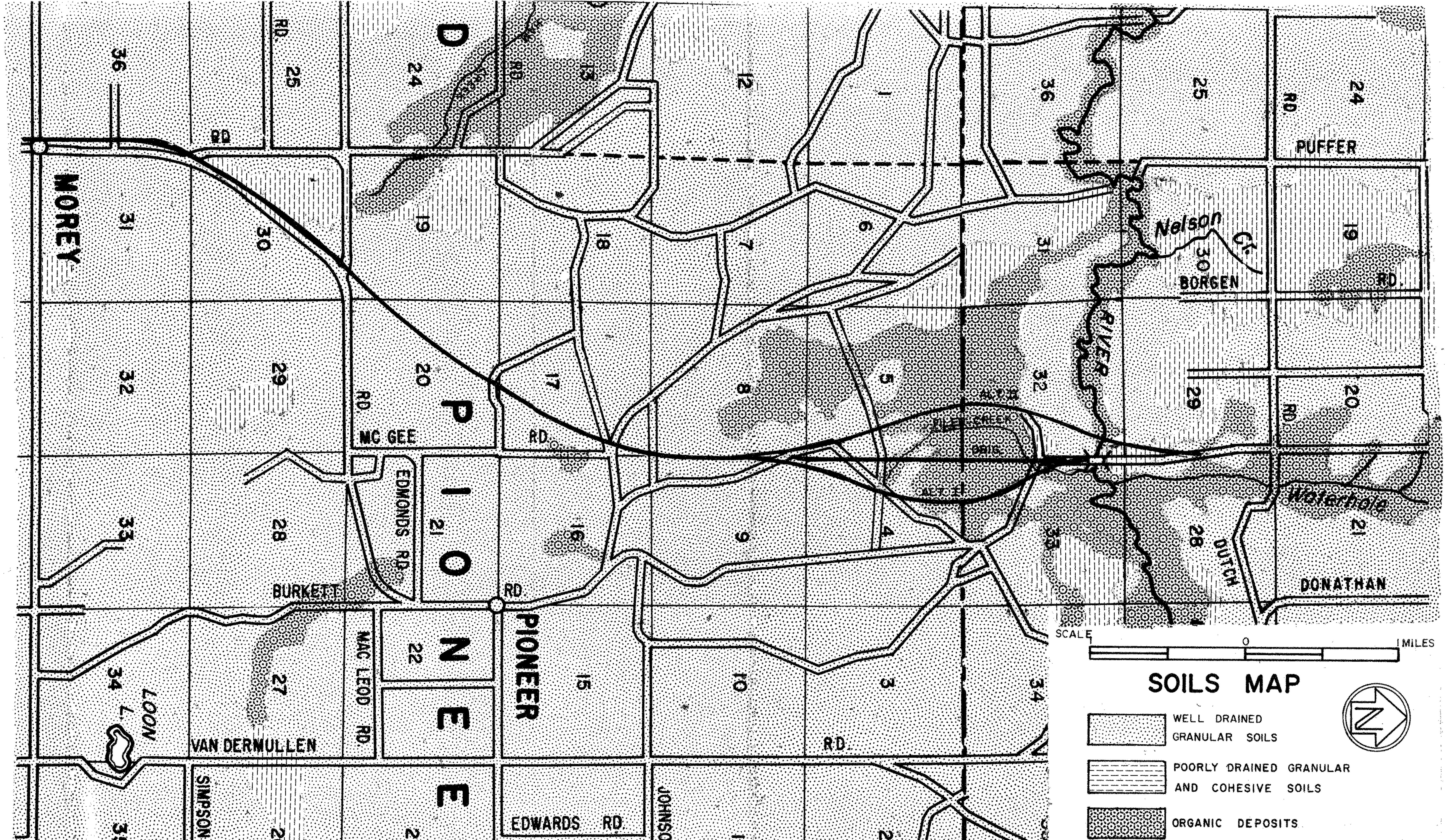
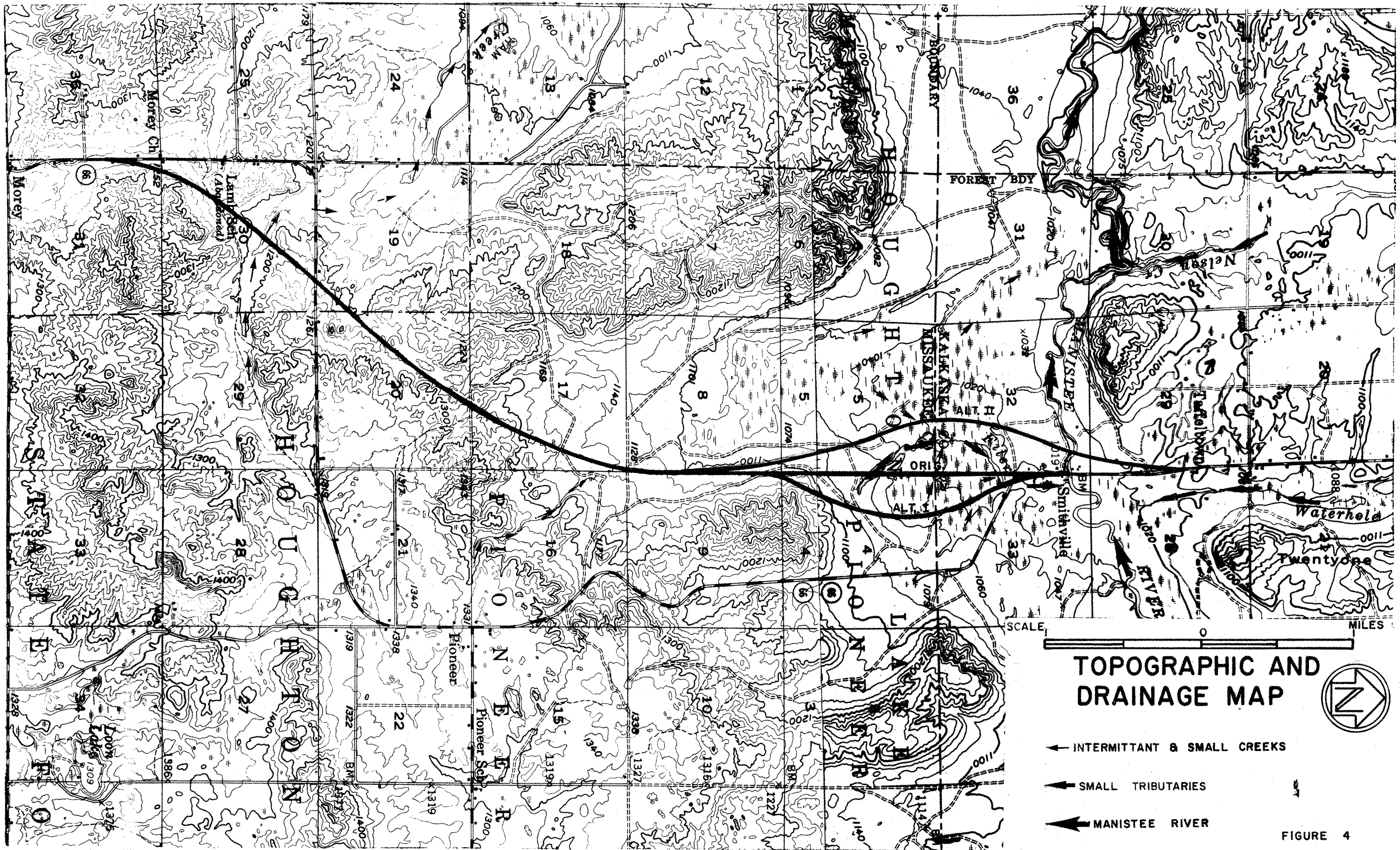

SOILS MAP
SCALE
0
MILES
WELL DRAINED GRANULAR SOILS
POORLY DRAINED GRANULAR AND COHESIVE SOILS
ORGANIC DEPOSITS
N
MOREY
RD
PUFFER
RD
Nelson Cr.
BORGEN
RD.
RIVER
MC GEE
RD.
EDMONDS RD.
BURKETT
RD
PIONEER
D
P
I
O
N
E
E
MAC LEOD RD
LOON L.
VAN DERMULLEN
RD.
SIMPSON
JOHNSON
EDWARDS RD.
Waterhole
DUTCH
DONATHAN
ALT. B
ALT. E

FIGURE 3



TOPOGRAPHIC AND DRAINAGE MAP

FIGURE 4

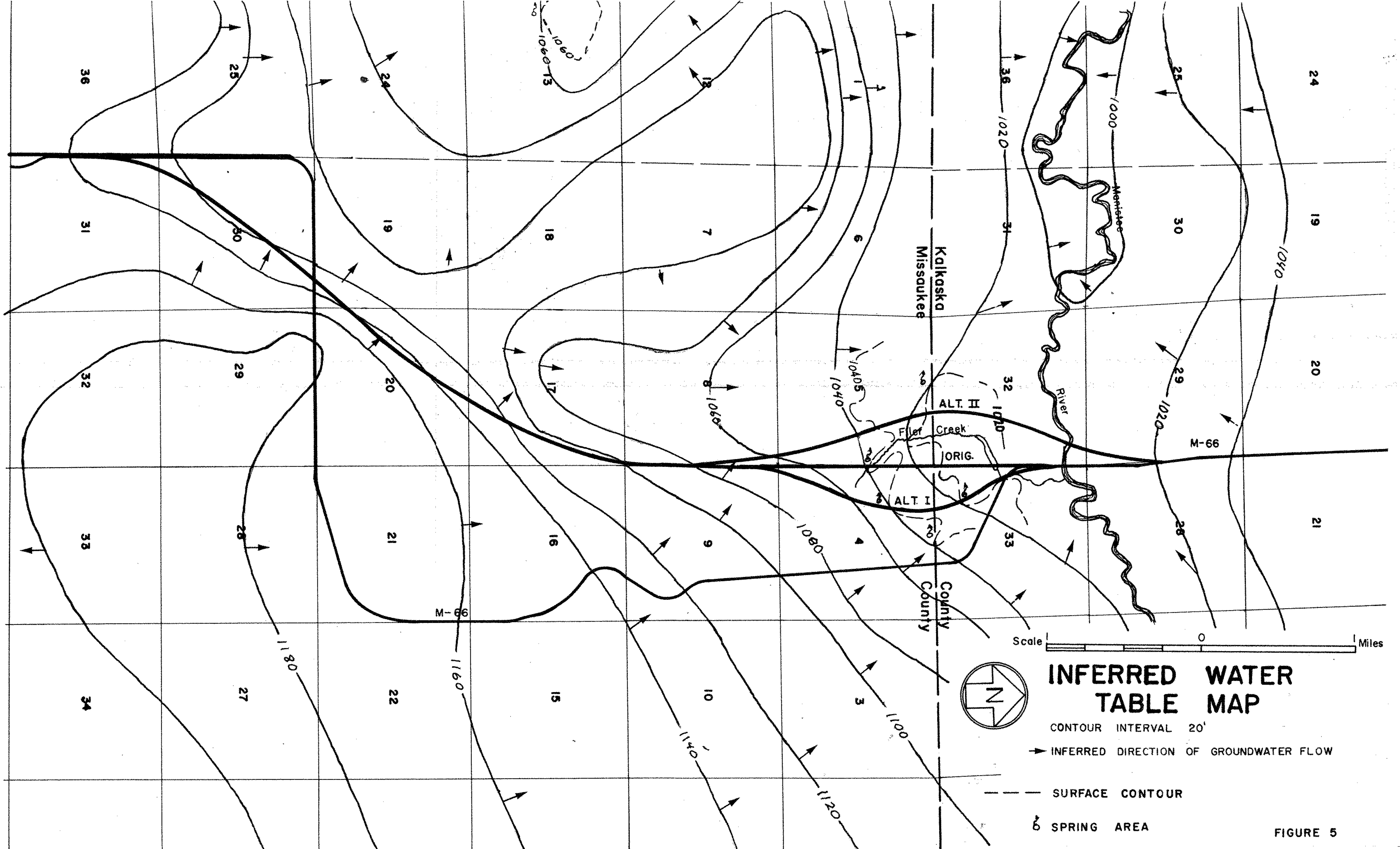

INFERRED WATER TABLE MAP
CONTOUR INTERVAL 20'
INFERRED DIRECTION OF GROUNDWATER FLOW
SURFACE CONTOUR
SPRING AREA
Scale 1 0 1 Miles
Kalkaska County
Missaukee County
M-66
ALT. II
ALT. I
ORIG.
Filer Creek
Manistee River
1000
1020
1040
1060
1080
1100
1120
1140
1160
1180

FIGURE 5