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**ASSESSMENT OF  
POTENTIALLY IRRIGABLE LAND  
IN EASTERN MCLEAN COUNTY, ND**

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**Water Resources  
Investigations No. 62A**



**North Dakota State Water Commission  
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## INTRODUCTION

In 1995 a general inventory of acreage potentially suitable for irrigation was conducted for eighteen counties in central North Dakota (Olson and Schuh 1995). The purpose of the inventory was to identify general areas for further assessment, and to provide a conservative estimate of gross acreage that might be available for development. One of the counties evaluated was McLean County. The inventory found that there were currently a total of about 15,000 acres allocated for irrigation in 79 water permits, in McLean County. Actual use from 1991 to 1993 varied from as little as 4,060 acres to as much as 6,993 acres of irrigation. Of this a total of 9,853 acres had been approved for irrigation using ground water. Actual irrigation from ground water from 1991 to 1993 varied from as little as 2,235 acres to as much as 4,867 acres. Surface water permits totaled 5,790 acres, with actual use from 1991 through 1993 varying from 1,997 acres to 1,517 acres. For irrigation from ground water, the inventory found that about 32,500 acres of land overlying aquifers would be considered as potentially irrigable based on soil suitability alone. However, ground water limitations (both supply and quality) would likely limit potential irrigation to about 17,500 acres.

In addition to ground-water sources, additional development may be possible from surface water, principally from Lake Sakakawea and Lake Audubon, and from the Missouri River. It was estimated that under the Garrison Diversion Unit Reformulation Act of 1986 about 2,560 acres might be developed for irrigation in McLean County using water from the McClusky canal. Under the Turtle-Lake Irrigation and Wildlife Area Conceptual Plan (USBR and others, 1993) as much as 13,700 acres might be developed for irrigation in the Lake Nettie area using combined surface water and ground water sources. These plans are discussed in more detail in the inventory report (Olson and Schuh 1995). In addition, Olson and Schuh (1995) identified five tracts of land with general characteristics suitable for potential irrigation development using surface water. Some of these potential development plans overlap. The overall estimate of potential irrigable acreage using surface water sources and with minimal restrictions was about 35,500 acres.

The purpose of this report is to conduct a more detailed evaluation of potential irrigation development from ground-water sources in eastern McLean County. Most of the area included is north of Turtle Lake, and overlies the Horseshoe Valley, Strawberry Lake, and Lake Nettie aquifers. A smaller area overlying the Mercer aquifer south of Turtle Lake is also included. Criteria for this evaluation are more stringent, detailed, and comprehensive than those used in the previous report (Olson and Schuh 1995). They include selection of soil series without major irrigation limitations, screening for land tracts having those series using the McLean County Soil Survey (USDA 1979) on a series scale, rather than on a broader association scale, and identifying potential water supplies on a section scale, using the North Dakota County Study for McLean County (Klausing 1974). Potentially irrigable tracts are identified for further and more detailed examination by land owners wishing to

develop for irrigation. While the scale of analysis is more detailed, and while all mapped locations identified should be promising prospects for future development, it is stressed that actual development should always be preceded by detailed on-site examination for all essential properties. Aquifer maps and soil maps provide good indicators of potential water and soil availability, but they are not without error, and in a heterogeneous environment they can be mistaken or oversimplified at some locations. In particular, water quality must be examined locally. Based on the distribution of samples from the Lake Nettie aquifer system, about 72% of the wells sampled would be suitable for irrigation of moderately salt tolerant crops, while some of the other aquifers were somewhat higher or lower. Detailed criteria for soil and water evaluation are described in each section below.

#### Identification of Land Tracts

The scale used in this report for identification of potential irrigable lands is a 40-acre tract. The soil series are identified specifically on each tract, while water availability is based on a broader criterion; whether a suitable supply is likely to be found at some location on the section in which the tract is located. These criteria are described in more detail below. Actual tract units are identified and located using the location and numbering system used by the U.S. Bureau of Land Management. The system is illustrated in Figure 1. The first number denotes the township north of a base line, the second number denotes the range west of the fifth principal meridian, and the third number denotes the section in which the land tract is located. The letters A, B, C, and D designate, respectively, the northeast, northwest, southwest, and southeast quarter section, quarter-quarter section, and quarter-quarter-quarter section (10-acre tract). For example, the land tract described by 147-080-04AD consists of 40 acres located in the SE 1/4 of the NE 1/4 of sec. 4, T. 147 N., R. 80 W.

#### Interpretation of Results

While several classification schemes are used to describe soil suitability in this report, the key index rating soil irrigability is the Composite Soil Irrigability Index shown in Table 3, and the index for evaluating water supply is the Water Availability Index shown in Table 4. These are shown for specific land tracts on Figures 2 and 3. A Combined Soil and Water Index rating both is shown on Figure 4. Composite Soil Index, Water Availability Index, and Combined Soil and Water Index are all listed for each tract in Appendix 1.

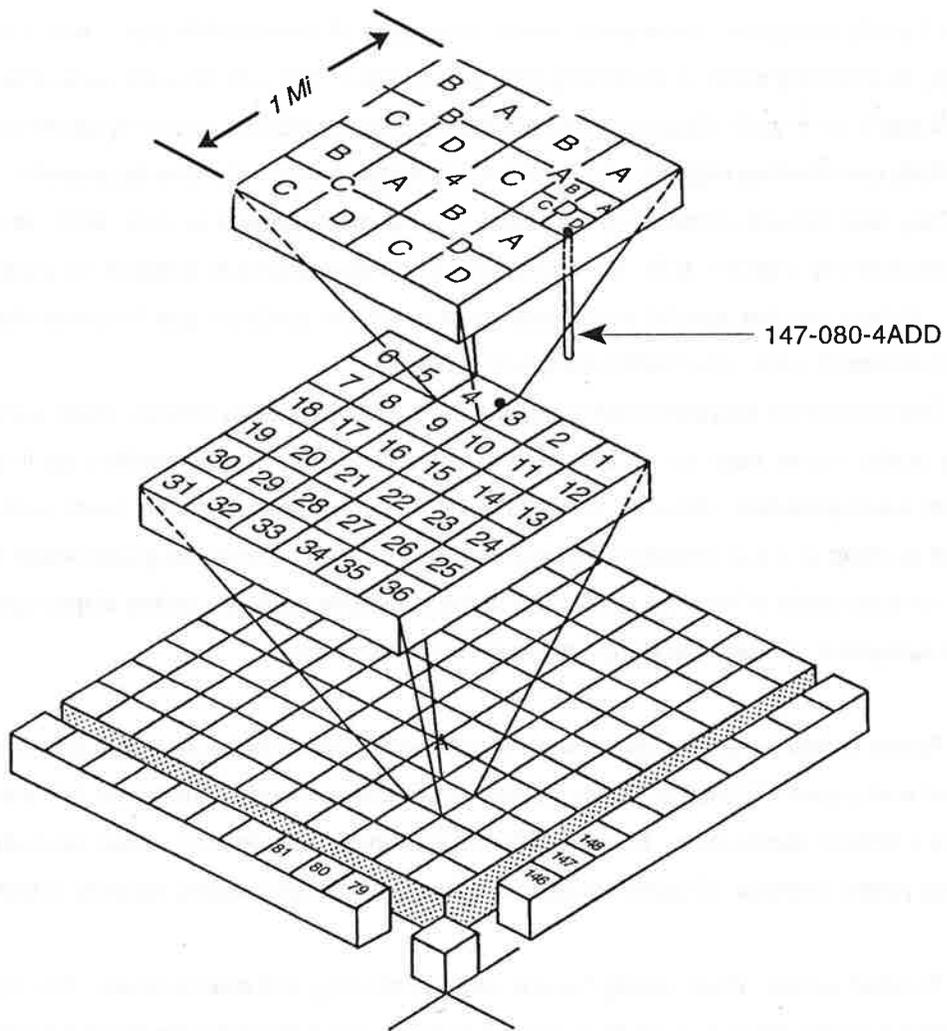


Figure 1. Illustration of map location and numbering system.

## DETERMINING LOCAL SOIL SUITABILITY FOR IRRIGATION

In a previous report Olson and Schuh (1995) estimated acreage available for irrigation in McLean County using soil association maps, estimates of sustainable yield, and estimates of the probability of obtaining water of suitable quality for irrigation. Soil criteria used were acreage estimates of soils suitable for irrigation based on North Dakota State University irrigability classifications (Omodt 1983). Soils classified as irrigable and conditionally irrigable vary in texture from coarse soils to loamy soils. They also include some soils that have special management criteria, such as soil drainage. Some conditionally irrigable soils are stony, and are only marginally suitable for tuber or root crop harvest. Others require special management of irrigation systems due to excessive slope, slow infiltration characteristics, or underlying impeding layers.

This evaluation was designed to apply a more restrictive soils criteria. Soils were screened on a series scale, rather than on an association scale, and only soils classified as irrigable without restriction were included. All soils included were of loamy sand to sandy loam texture, and were classified as deep and well drained to excessively well drained. None had gravel within two feet of the surface, or finer strata within four feet of the surface. Within selected series slopes greater than 6% were not accepted. None were stony. Acceptable series were:

(1) Russo series - nearly level to moderately sloping well drained soils that are moderately deep over sand and gravel. Topsoil is a dark grayish brown coarse sandy loam about 14 inches deep. The subsoil is a coarse sandy loam. Permeability is moderately rapid in the subsoil, and very rapid in the underlying parent material. Organic matter is moderate, and water holding capacity is low.

(2) Parshall series - deep, nearly level to strongly sloping well drained soils. The topsoil is a dark grayish brown sandy loam to a depth of about 5 inches. The subsoil is dark grayish brown and grayish brown fine sandy loam to about 22 inches. Underlying material is fine sandy loam and loamy fine sand. Underlying material is fine sandy loam and loamy fine sand. Organic matter is high, and the available water holding capacity is moderate.

(3) Lihen series - deep, nearly level to hilly, well drained soils. The topsoil is dark grayish brown loamy fine sand about 22 inches thick. The underlying material is grayish brown and light brownish gray loamy fine sand and loamy sand. Permeability is rapid. Available water capacity and organic-matter content are moderate.

(4) Manning series - gently to moderately sloping, somewhat excessively drained soils that are moderately deep over sand and gravel. The topsoil is dark grayish brown coarse sandy loam about 6 inches thick. The subsoil is a dark grayish brown sandy loam about 5 inches thick. The underlying

material is grayish brown and light brownish gray gravelly loamy coarse sand and coarse sandy loam. Permeability is moderately rapid in the subsoil and very rapid in underlying materials. Available water holding capacity is low, and organic-matter content is moderate.

Not included, were the Wabek series, which is sandy and is often associated with the above series, but which often has a gravelly layer within 20 inches of the surface. Eroded phases of this soil would have exposed gravel at the surface, and very low water holding capacities, and would cause harvest difficulties for some crops in some areas. Also not included were the Flaxton series, which has a clay layer at about two feet below land surface. Inability to properly drain these soils could lead to salinization, or formation of saline seeps in some areas. Soils having shallow water tables were also excluded. These series would be found only as minor unmapped inclusions within the series mapping.

The soil evaluation was conducted on the basis of 40-acre tracts, as described above. Each 40-acre tract was classified in one of two groups.

Group 1: includes all 40-acre tracts mapped entirely to one of the four series listed above. No portion of a tract in this group is mapped to another series.

Group 2: includes all 40-acre tracts mapped in one of the four series listed above for more than half of its surface area. Some portion of the tract (less than half) is mapped in other series having greater potential limitations. The portion mapped to other series may be almost negligible, or it may approach as much as half the surface area. The Soil Limitation Area Index (shown Table 1 below) is based on the assumption that each tract is more suitable if a smaller portion of it is in less suitable soil classification, and that it is preferable to have the potentially more limiting soil portions on the edge or border rather than in the interior of the tract. For each 40-acre tract the specific limitation of the less suitable series are listed using the labels in Table 2.

Table 1.

<b>Soil Limitation Area Index: Group 2</b>	
<b>INDEX</b>	<b>Area and Location of Limitation</b>
1	Small area (< 25%) on border
2	small area (< 25%) within tract
3	large area (25 to 50%) on border
4.	large area (25 to 50%) within tract

Table 2.

Soil Limitation Description Index	
LABEL	Nature of the Limitation
FS	Areas of fine (loamy) soil
SF	Shallow fine layer - Fine subsoil at 2 to 4 feet
SG	Shallow gravel - within one foot of the surface
SL	Slope Greater than 6%
W	Wet (poorly drained) soil

To illustrate the use of this index, a 40-acre tract mapped almost entirely to a high suitability series like the Parshall series, but having a slight amount of Wabek series (shallow gravel) along the border would be indexed as SG1. A tract of the same predominant series having a small amount of mapped series having > 6% slope in the interior of the tract would be indexed as SL2. A tract having a shallow clay layer, and a mapped surface area of > 25% but < 50% near the edge of the tract would be indexed as SF3. A tract having a minor, but fairly extensive (> 25% and < 50%) area of poorly drained soil within would be indexed as W4. These are listed for each set of tracts on Table 5.

One additional attribute is assessed. It is often advantageous to have larger than 40-acre tracts for irrigation. If a designated 40-acre tract, or set of tracts can be combined with other tracts, either within the same section, or on an adjoining section, to form a single combined tract of 80 acres or more, it is labeled as Y, for yes. If the tract is isolated and combination with adjoining tracts could result in a continuous tract of less than 80 acres, the designated tract is labeled as N, for no. These are listed for each set of tracts on Table 5.

The two soil limitation groups and the Soil Limitation Area Index (for group 2) described above, were combined to form a single composite index of soil suitability for irrigation. The Composite Soil Irrigability Index has three tiers. These are: (1) tracts having no mapped soil related limitations, (2) tracts having small mapped soil limitations along borders, and (3) tracts having somewhat larger mapped soil limitations, or limitations in the interior of the tracts. The Composite Soil Irrigability Index is summarized in Table 3. Locations of soils classified according to the Composite Soil Irrigability Index in Table 3 are shown on Figure 2, where tracts of index 1 are colored red, tracts of index 2 are colored green, and tracts of index 3 are colored yellow. Composite Soil Irrigability Indices are also listed in Appendix 1. There are 274 40-acre tracts, or about 11,000 acres with an index of 1. There are 99 tracts, or about 4,000 additional acres, having an index of 2. There are 153 tracts, or about 6,000 additional acres having an index of 3. Soils having indices of 1 or 2 would have excellent prospects for irrigation development, with a suitable water supply. Soils having an index of 3 are less promising, but

would still be worth considering as potential prospects for irrigation development, with a suitable water supply.

Table 3

<b>Composite Soil Irrigability Index</b>	
INDEX	Area and Location of Limitation
1	Group 1: tract has no limiting mapped soil units
2	Group 2: soil limitation index 1 from (Table 2)
3	Group 2: soil limitation index 2, 3, or 4 from (Table 2)

#### DETERMINING LOCAL GROUND-WATER AVAILABILITY FOR IRRIGATION

Potential ground-water sources for the selected tracts are in the Lake Nettie aquifer system, the Horseshoe Valley and Strawberry Lake aquifers, the Turtle Lake aquifer, and the Mercer aquifer. Aquifer thicknesses vary from a few feet to more than a hundred feet. Potential pumping rates vary from as little as 50 gpm, to as much as 1,500 gpm. A previous general survey (Olson and Schuh, 1995) has indicated that a significant portion of the water is saline, having an electrical conductivity of more than 1,500  $\mu\text{S}/\text{cm}$ , or sodic, having a sodium adsorption ratio (SAR) greater than 6. In the Lake Nettie aquifer system about 72% of the water samples surveyed were of quality suitable for irrigation, using these criteria. In the Horseshoe Valley aquifer about half of the water samples had an SAR greater than 6. In the Strawberry Lake aquifer more than 80% of the water samples were of quality suitable for irrigation, and more than 93 % of samples from the Turtle Lake aquifer were of quality suitable for irrigation. Assuming a hydrologic system wherein discharge occurs primarily through local evapotranspiration, wherein discharge and recharge are approximately balanced, and wherein mean recharge is about 0.17 feet per year, it was estimated that sufficient water could likely be supplied to irrigate about 13,000 acres from these aquifers.

Aquifer saturated thicknesses and potential yields in McLean County were evaluated and mapped by Klausning (1974). For each of the 40-acre land tracts evaluated in this report, potential water availability was assessed using two criteria, as determined from the maps of Klausning (1974). These criteria were pumpability, and extensiveness. Pumpability categories were (1) 50 to 500 gpm, and (2) 500 to 1,500 gpm. Extensiveness categories were (1) aquifer mapped as occupying more than 50% of the section containing the designated 40-acre tract (broad area) , and (2) aquifer mapped as occupying less than 50% of the section containing the designated 40-acre tract (limited area). The extensiveness of the mapped aquifer area underlying the tract is weighted slightly more strongly than

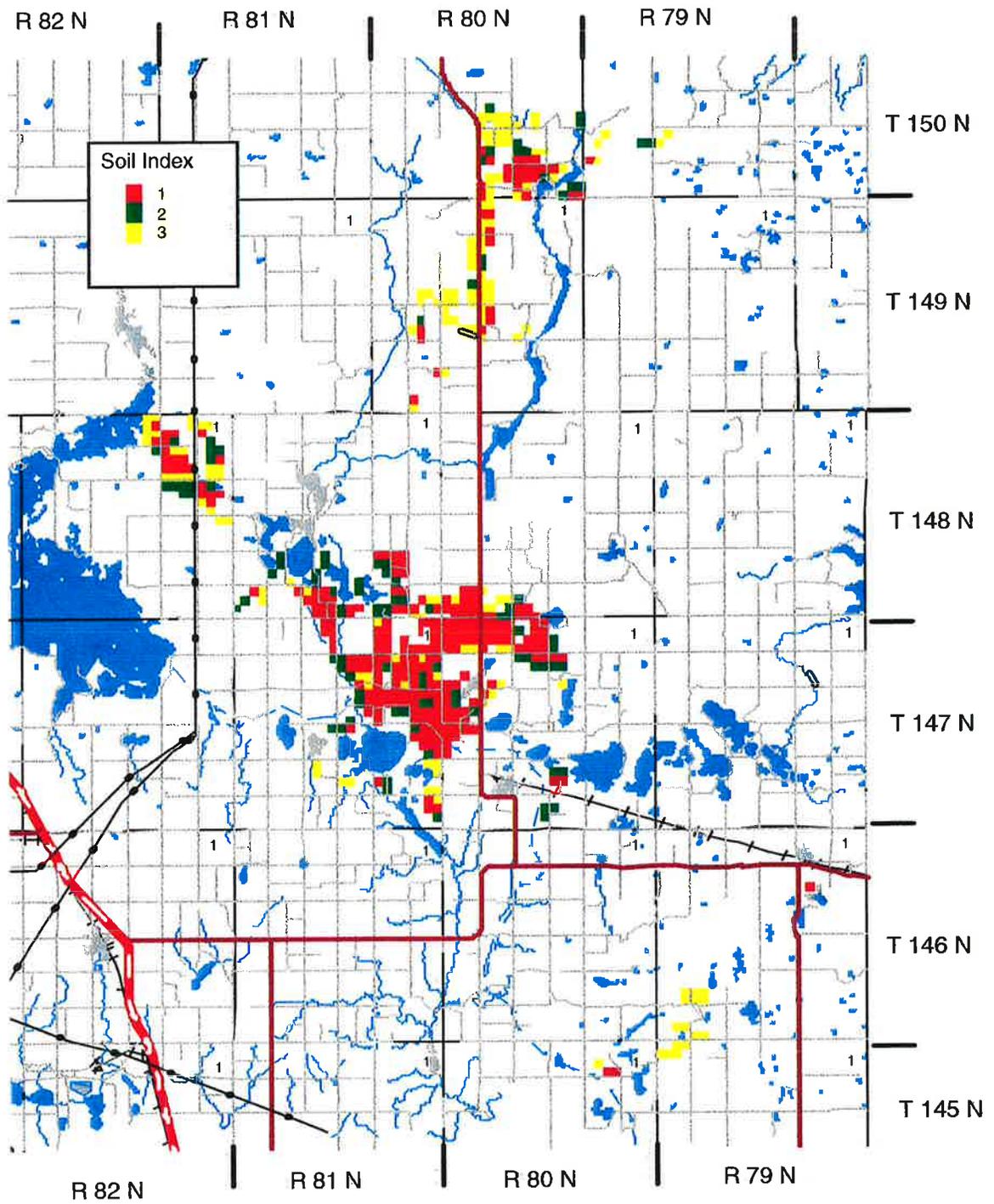


Figure 2. Map of soil irrigability, using the Composite Soil Irrigation Suitability Index from Table 3.

the pumping rate, because a more extensive aquifer gives a higher probability of finding water of suitable quality for irrigation, and somewhat slower pumping rates can be offset by multiple wells, if aquifer area is sufficient. The index derived for water availability is scaled from 1 to 4 as shown on Table 4 below. The lowest of the Water Availability Index numbers indicate the highest probability of finding the amount of water of quality suitable required for irrigation of the designated 40-acre tract in the section on which the tract is located.

A map of tracts according to the Water Availability Index is shown on Figure 3. The likelihood of finding a suitable water supply is graduated from purple for Water Availability Index 1 (Table 4) through gray for Water Availability Index 4 (Table 4). Water availability indices for each tract are listed in Appendix 1. About 143 forty-acre tracts, or 5,700 acres likely overlay aquifers having broad local area coverage and high pumpage. Another 297 tracts, or 11,880 acres overlay aquifers having more limited pumpage, but broad areal extent. Fifty-four additional tracts, or about 2,000 acres, were located in sections having some possible water supplies, but where either low potential pumpage, or low aquifer extent might limit water availability. Local water would thus likely be available for irrigation of about 17,500 acres, under the designated tracts. If about 30% of local areas would be excluded for lack of suitable quality water, this would leave a net of about 12,000 acres in irrigable land having an adequate water supply of suitable quality.

Table 4.

<b>Water Availability Index</b>	
<b>INDEX</b>	<b>Area and Location of Limitation</b>
1	500 to 1,500 gpm, broad area
2	50 to 500 gpm, broad area
3	500 to 1,500 gpm, limited area
4.	50 to 500 gpm, limited area

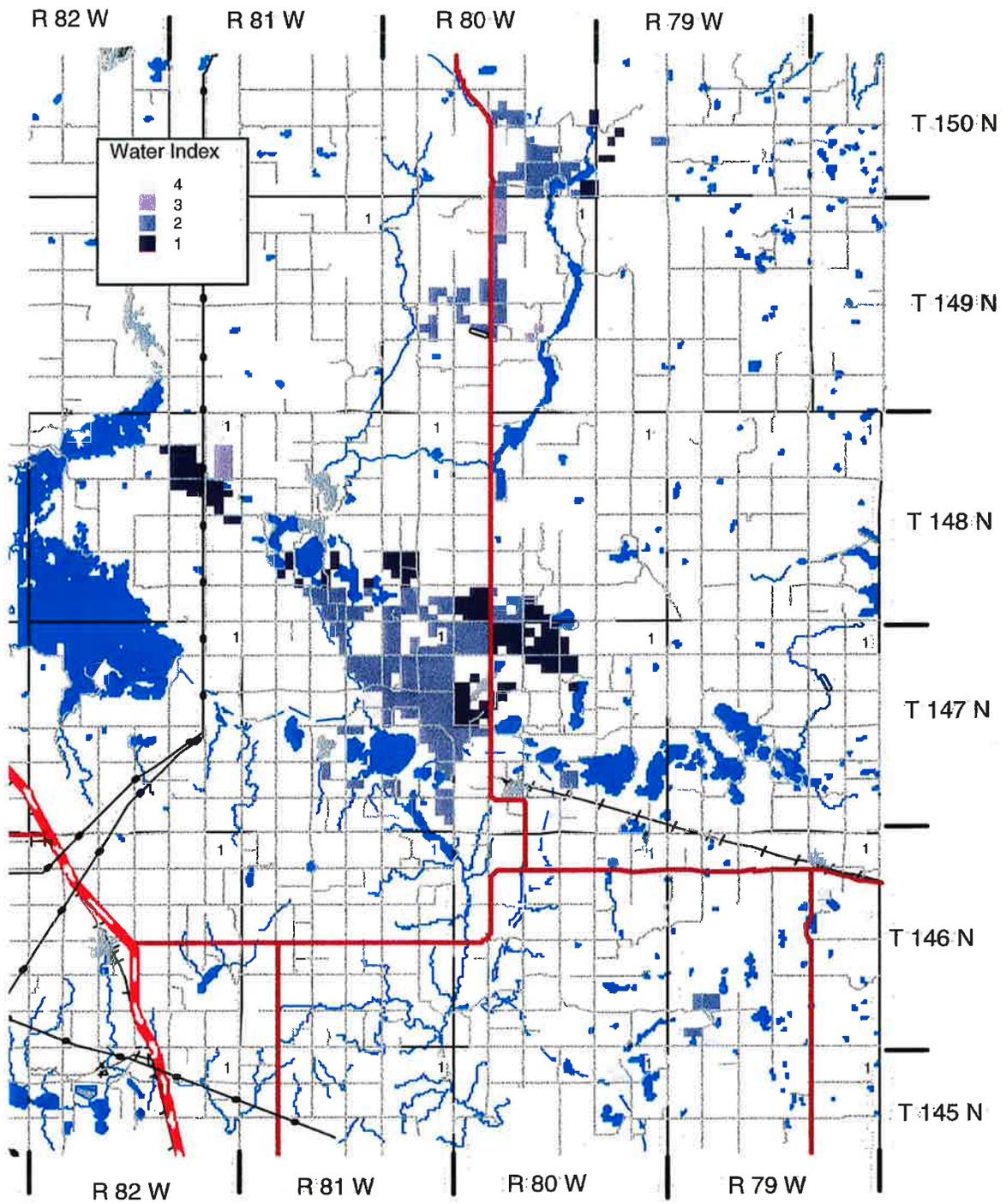


Figure 3. Water Availability Index. Lowest numbers (and darkest colors) indicate the highest probability of obtaining sufficient water suitable for irrigation at some location on the section containing the mapped 40 acre tract.

## THE COMBINED SOIL AND WATER INDEX

A Combined Index of soil suitability and water availability was derived by multiplying the Composite Soil Irrigability Index (three levels, Table 3) by the Water Availability Index (four levels, Table 4). The Combined Index is thus scaled from 1 through 12. A Combined Index of one or two indicates tracts with high probability of good water supply and also excellent soils for irrigation. A Combined Index of three or four indicates a reasonably high probability of having good local soils and adequate water. An index larger than four indicates that either the soil will have some limitations, with parts of the tract having limitations such as shallow gravel, or wetness, or water supplies might be limiting. A Combined Index of 12 would indicate a soil with a substantial portion (25 to 50%) of the land having irrigation limitations within the tract, and a high probability of a shallow aquifer with low pumpage and limited areal extent. However, even some tracts with an index of 12 may prove to be productive as irrigable land.

Combined Indices are mapped on Figure 4, and are listed in Appendix 1. There are 117 tracts, or 4,680 acres listed as having indices of 1 or 2 (high probability of suitability for irrigation). An additional 230 tracts, or 9,200 acres are listed as having indices of 3 or 4 (reasonably high probability of suitability for irrigation.) **Thus, a total of about 14,000 acres have reasonably high to high probability of having good conditions for irrigation using ground water in eastern McLean County. If about 30% of the local areas would be excluded for lack of suitable water, about 10,000 acres would be likely to be available for irrigation development and use.** A substantial portion of an additional 488 tracts (19,500 acres) represented by higher (5 to 12) combined index numbers would also likely prove to be good land for irrigation.

## WATER SUITABILITY FOR IRRIGATION

Water that is highly saline or sodic, or that contains excessive boron is unsuitable for irrigation. High sodium in irrigation water causes dispersion of the soil, destroys soil structure, and causes crusting. Eventually accumulated sodium can reach levels that are toxic to many crops. High salt content in irrigation water, as indicated by a high electrical conductivity, can cause accumulation and concentration of salts in the soil, eventually impeding root uptake of water and nutrients and greatly decreasing yields. Even with reasonably good irrigation water, salts must be periodically leached from the soil zone to prevent buildup.

A substantial number of water samples have been taken from various ground-water locations in McLean County, and can be used to assess water suitability for irrigation. However, water chemistry data are less well represented than soil and aquifer data, and cannot, therefore, be presented as a part of the composite index discussed above. To aide the reader in evaluating where water might be most likely to be suitable for irrigation, we have devised and mapped a simple Water Suitability Index.

There is a wide variability in soil and crop tolerance for sodium and total salts. However, for sake of simplicity a limit of 1,500  $\mu\text{S}/\text{cm}$  was previously placed on the electrical conductivity (EC) of the applied water, as an indicator tolerable salinity for most soils and crops (Olson and Schuh, 1995). We have also previously placed a maximum sodium adsorption ration (SAR) of 6 as the limiting indicator of tolerable sodium content in applied water for most soils and crops. Although boron is important, previous studies have indicated that boron concentrations are invariably low in ground-water in central North Dakota, and can usually be ignored. For site evaluation, all locations having water samples with  $\text{EC} < 1,500 \mu\text{S}/\text{cm}$  and  $\text{SAR} < 6$  are designated as suitable for irrigation. All having  $\text{EC} > 1,500 \mu\text{S}/\text{cm}$  and  $\text{SAR} > 6$  are designated as unsuitable for irrigation.

All water chemistry data in the North Dakota State Water Commission data base from Strawberry Lake, Horseshoe Valley, Mercer, and Lake Nettie aquifers were classified as suitable or unsuitable for irrigation based on the above criteria, and mapped with the Combined Soil and Water Index (Figure 4). Water Suitability indices are also listed in Appendix A.2. While more sparse than the Combined Soil and Water Indices, mapped data for soil water suitability should provide some visual indication of areas most likely to provide water with appropriate chemical characteristics. Generally, water underlying tracts in the vicinity of the Strawberry Lake and Horseshoe Valley aquifers, and the central portions of the Lake Nettie aquifer system, seemed to be most suitable for irrigation. Locations approaching the southern boundaries of Lake Nettie, and the chain of lakes on the eastern edge of the Lake Nettie aquifer system, were often poorly suited for irrigation.

## DISCUSSION

A previous general screening (Olson and Schuh 1995) indicated that about 17,500 acres of land might be irrigated using ground water in McLean County, based primarily on water limitations. The actual total of potentially irrigable soils overlying aquifers, however, was about 32,000 acres. These soils were assessed using general soil association maps. The data set used in this report, however, is much more selective. The 10,000 acres of potential irrigation represent land tracts in eastern McLean County that have a high probability of obtaining suitable quantities of water, and which consist of soils mapped entirely to prime irrigable soils, with either no mapped inclusions that are limiting, or minor acreage having limitations on the margins of the designated tract. The previous assessment was based on general soil association maps. This assessment is based on soil series maps, evaluated at a 40-acre resolution. Mapped locations indicated on figures in this report should provide a reasonably good indicator of actual locations of tracts optimal for irrigation development. However, soil maps and aquifer maps are not exact. Within the indicated areas, final on field assessment is still necessary for final evaluation of soil suitability and water supply. In particular, water samples from potential development areas need to be taken and evaluated for chemical properties suitable for irrigation.

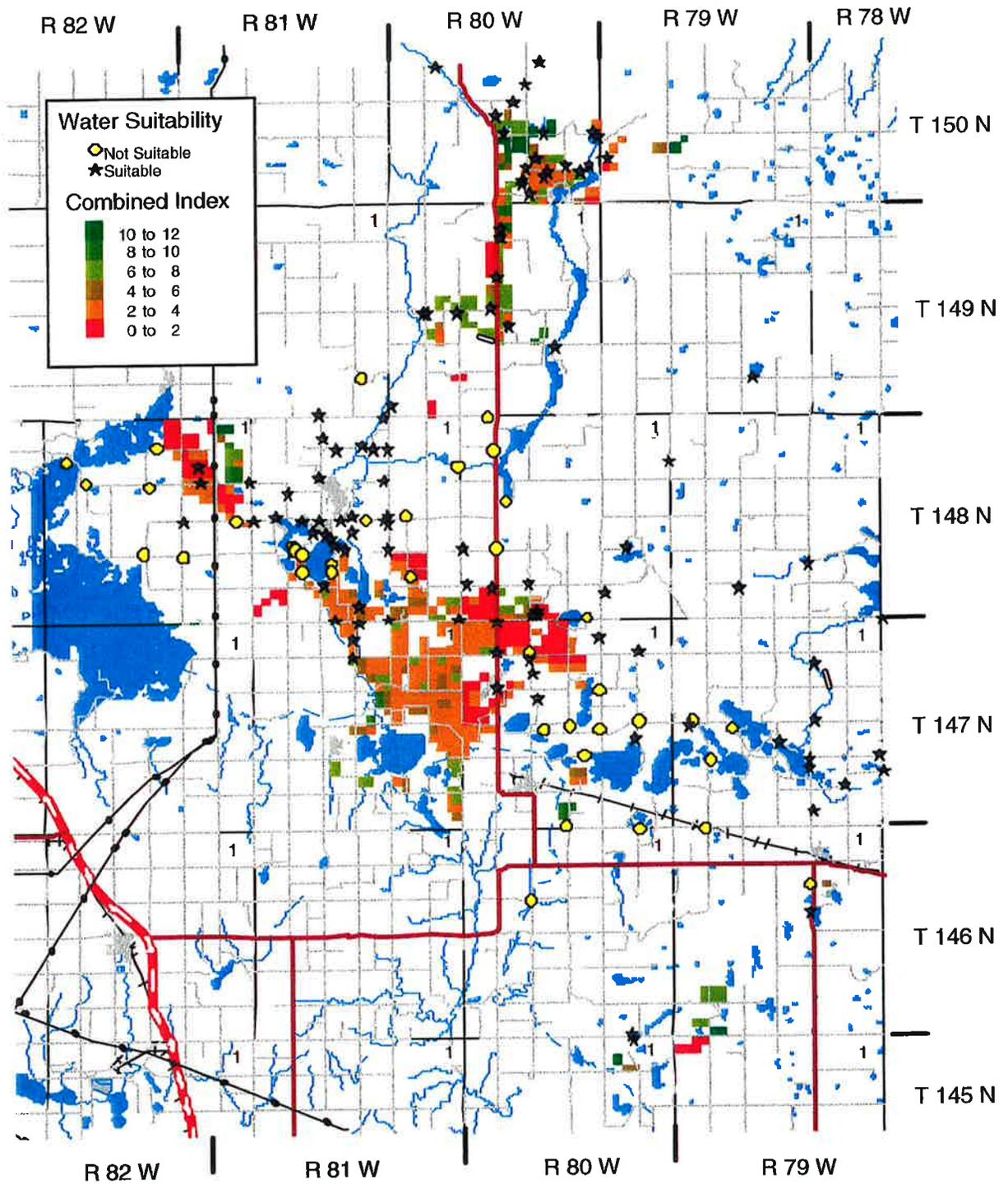


Figure 4. Combined Index of soil and water available for irrigation. Lower numbers indicate the highest probability of suitable soil and sufficient quantity of water. Water suitability marks indicate the chemical suitability, or lack of suitability for irrigation measured in water samples taken at the designated site.

Table 5. Township (T), Range (R), Section (S), quarter section (1/4 S), number of 40-acre tracts in the quarter section having prime irrigable soil (N-1), letter location of N-1 tracts (LOC-1), number of 40-acre tracts having some minor limitation (N-2), letter location of N-2 tracts, Limitation Code describing soil limitations in N-2 tracts, as described on Table 2, and index indicating the ability to combine with neighboring 40-acre tracts for form a minimum unit of 80 contiguous acres (I-80)

Table 5 Key

T	R	S	1/4 S	N-1	LOC-1 1/4, 1/4 S 40-acre tracts	N-2	LOC-2 1/4, 1/4 S 40-acre tracts	Limitation Code	I-80
T o w n s h i p	R a n g e	S e c t i o n	1/4 S e c t i o n	No. of 40-acre tracts with prime irrigable soil and without limits	Letter location of 40- acre tracts in N-1	No. of 40-acre tracts with prime irrigable soil and with some limits	Letter location of 40- acre tracts in N-2	Code designating soil limitations in N-2 tracts, as described on Table 2	Ability to form 80-acre tracts  Y (Yes) or N (No)

Table 5 continued for the next 7 pages

How to Use Table 5

Table 5 provides for each quarter section, the number and letter locations of 40-acre tracts having only prime irrigable soils, without limitations, and the number and letter locations of 40-acre tracts having predominantly prime irrigable soils, with some minor areas of soil having limitations. Table 5 also provides code descriptions of specific soil limitations, and an assessment of whether or not tracts in a quarter section can be combined to form combined land units of 80 acres or more.

An example of the use of Table 5 is as follows. The 6th entry from the top in Table 5 on page 15 is the southeast quarter of Township 148 N, Range 82 W, Section 3 (148-082-3D). **This entry is darkened in the table to aid in its location.** In this quarter section one (1) 40-acre tract contains only soils mapped as irrigable without limitation (column N-1), and it is located in the southeast quarter of the southeast quarter section (letter D in column LOC-1). Three (3) 40-acre tracts contain mostly soils that are irrigable without limitation (column N-2). These three tracts are located in the northeast, northwest, and southwest quarters of the southeast quarter section (letters ABC in column LOC-2). The soil limitations found in the minor inclusions are listed as SL4 and FS1 (column Limitation Code). These codes are taken from Tables 1 and 2, and indicate that tracts with soil limitations have the following limitations: slope greater than 6% (SL from Table 2) occupying between 25 to 50% of the tract surface in the center of the tract (4 from table 1), and some minor (less than 25% of the tract surface) inclusions of fine soil (FS from Table 2) located near the edge of the tracts (1 from Table 1). The letter Y in the last column indicates that the single 40-acre tract not having any limitations can be combined with other contiguous tracts, to form a combined land unit of 80 acres or more without soil limitations.

Table 5. Township (T), Range (R), Section (S), quarter section (1/4 S), number of 40-acre tracts in the quarter section having prime irrigable soil (N-1), letter location of N-1 tracts (LOC-1), number of 40-acre tracts having some minor limitation (N-2), letter location of N-2 tracts, Limitation Code describing soil limitations in N-2 tracts, as described on Table 2, and index indicating the ability to combine with neighboring 40-acre tracts for form a minimum unit of 80 contiguous acres (I-80)

T	R	S	1/4 S	N-1	LOC-1 1/4, 1/4 S 40-acre tracts	N-2	LOC-2 1/4, 1/4 S 40-acre tracts	Limitation Code	I-80  Y/N
148	82	1	B			2	CD	SF4, FS3	Y
		1	C	1	B	1	D	FS1	Y
		2	A			2	AD	SF4	Y
		2	C	3	ABC	1	D	W1	Y
		3	A	1	D	3	ABC	SL4	Y
		3	D	1	D	3	ABC	SL4, FS1	Y
		10	A			1	A	SL1	N
		11	A	1	C	1	B	FS3	Y
		11	B	3	BCD	1	A	W2	Y
		11	C	2	AB	2	CD	W4, SL4	Y
		11	D	2	AB	2	CD	SG3, SL3	Y
		12	A	1	C	1	B	FS1	Y
		12	B			2	AD	SG1	Y
		12	C			2	AD	SF4	Y
		12	D			2	BC	SF4	Y
		13	A	1	C				Y
		13	B	2	CD				Y
		13	C	1	A	2	BD	FS3	Y
		13	D	3	BCD	1	A	SG1, W1	Y
		14	A			4	ABCD	FS1(14), W1, SL1,	Y
		14	B			2	AB	W1(12), S1	N
		24	A			2	AB	S4, SG1, FS1	Y
150	80	22	B			1	D	FS1, SG1	N
			C			3	ABC	SL4, SG3, FS1	N
			D			4	ABCD	SL4, SG4	N
		23	C			1	C	SG3, SL3	Y
			D			2	BC	SG4, SL3	Y
		24	D			2	AD	SG1, SL1	Y
		26	B			1	C	SG1	Y
			C	2	CD	2	AB	SL1, SG1	Y
			D	1	C	2	AB	SL4, SG4	Y

Table 5. Township (T), Range (R), Section (S), quarter section (1/4 S), number of 40-acre tracts in the quarter section having prime irrigable soil (N-1), letter location of N-1 tracts (LOC-1), number of 40-acre tracts having some minor limitation (N-2), letter location of N-2 tracts (LOC-2), Limitation Code describing soil limitations in N-2 tracts, as described on Table 2, and index indicating the ability to combine with neighboring 40-acre tracts for form a minimum unit of 80 contiguous acres (I-80)

T	R	S	1/4 S	N-1	LOC-1 1/4, 1/4 S 40-acre tracts	N-2	LOC-2 1/4, 1/4 S 40-acre tracts	Limitation Code	I-80		
150	80	27	A			4	ABCD	SG4, SL4	N		
			B			3	ABD	SG3, FS2	N		
			D	2	BD	2	AC	SG1, SL1, FS1	Y		
				34	A	2	AD	1	C	SG4	Y
			B			1	D		FS3	Y	
			C		2	BC	2	AD	SG4	N	
				35	A	3	ABC	1	D	W1	Y
			B		4	ABCD					
			C		2	BD	2	AC	SL4, FS1	Y	
				36	B	1	B	2	AC	SG3, FS3	Y
			C				1	D	FS1	Y	
		149	80	3	B	2	CD	2	AB	SG4	Y
C	1				D	3	ABC	SG4	Y		
				9	A			2	AD	FS3, SL3, SG3	Y
	D						2	AD	FS3, SG3, SL4	Y	
				10	B	1	A	2	BC	SL2, SG2	Y
	C						2	BC	FS1	Y	
				15	B			3	BCD	SG2	
	C						4	ABCD	SG4	Y	
				16	A			1	D	SG1	
	C						4	ABCD	SG4, SL4		
	D						2	AD	SG4, SL4		
				17	C			2	AD	FS2, SL3, SG3	Y
	D						2	BD	SL3, SG3	Y	
				20	B			1	D	SG1	Y
	C				2	AD	1	B	SG3	Y	
				21	B			3	BCD	SG3, FS3, SL3	Y
	D						2	AB	SG1, SL1, FS3	Y	
				22	B	2	AD	2	BC	SG2, SL2	Y
	C				1	B	1	C	SL4	Y	

Table 5. Township (T), Range (R), Section (S), quarter section (1/4 S), number of 40-acre tracts in the quarter section having prime irrigable soil (N-1), letter location of N-1 tracts (LOC-1), number of 40-acre tracts having some minor limitation (N-2), letter location of N-2 tracts, Limitation Code describing soil limitations in N-2 tracts, as described on Table 2, and index indicating the ability to combine with neighboring 40-acre tracts for form a minimum unit of 80 contiguous acres (I-80)

T	R	S	1/4 S	N-1	LOC-1 1/4, 1/4 S 40-acre tracts	N-2	LOC-2 1/4, 1/4 S 40-acre tracts	Limitation Code	I-80
149	80	23	C			2	AC	SL4, SG4, FS1	Y
		28	C			1	C	FS3, W3	Y
		29	D	1	D				Y
		32	C	1	B	1	C	FS3	Y
148	81	26	A	4	ABCD				Y
			B	2	AB	2	CD	SG1, FS1	Y
			C			1	A	FS	Y
			D	2	AB	1	C	FS1	Y
		27	D			1	C	FS1	Y
		28	A			2	BC	W1	Y
			C			2	AD	W1	Y
		29	B			2	AD	W1, FS1	Y
			C			1	B	W1	Y
			D			1	C	FS2	Y
		31	A	1	B	2	AD	SG3	Y
			B			1	D	SG1	Y
			C			1	B	SG1	Y
		32	A	1	A				
		33	A	3	BCD	1	A	FS1	Y
			B	3	ACD	1	B	SL2, SG2	Y
			C	2	AD				Y
			D	4	ABCD				Y
		34	A			1	B	W1	Y
			C	2	AD	2	BC	W1	Y
			D	1	B				Y
		35	A	2	AB	2	CD	FS1	Y
			C			4	ABCD	FS1	Y
			D	2	AB				Y
		36	A			2	CD	FS2	Y
			B	1	D				Y
			C	1	B	2	CD	SG2, FS1	Y
			D	1	A	1	B	W1	Y

Table 5. Township (T), Range (R), Section (S), quarter section (1/4 S), number of 40-acre tracts in the quarter section having prime irrigable soil (N-1), letter location of N-1 tracts (LOC-1), number of 40-acre tracts having some minor limitation (N-2), letter location of N-2 tracts, Limitation Code describing soil limitations in N-2 tracts, as described on Table 2, and index indicating the ability to combine with neighboring 40-acre tracts for form a minimum unit of 80 contiguous acres (I-80)

T	R	S	1/4 S	N-1	LOC-1 1/4, 1/4 S 40-acre tracts	N-2	LOC-2 1/4, 1/4 S 40-acre tracts	Limitation Code	I-80
148	80	31	A	4	ABCD				Y
			B	1	D	1	C	SL2	Y
			C	3	ABD				Y
			D	4	ABCD				Y
		32	A			2	CD	SG3, SC1	Y
			B			1	B	SG3, FS1	Y
			C	2	CD	2	AB	FS4	Y
			D			32	ACD	SL1	Y
		33	B			1	C	SC1	Y
			C	4	ABCD				Y
			D	1	C				Y
147	80	3	C			2	BC	FS1	Y
		4	A	4	ABCD				Y
			B			1	C	FS1	N
			C	3	ACD				Y
			D	4	ABCD				Y
		5	A	4	ABCD				Y
			B	4	ABCD				Y
			C	3	ABC				Y
			D	2	AB	2	CD	SG1, SL3	Y
		6	A	4	ABCD				Y
			B	4	ABCD				Y
			C	4	ABCD				Y
			D	2	AB	2	CD	SG1, SL3	Y
147	81	1	A	4	ABCD				Y
			B	2	AD				Y
			C	2	CD				Y
			D	4	ABCD				Y
		2	B	3	ACD	1	B	FS3	Y
			C	4	ABCD				Y
			D	1	D	1	A	FS1	Y
		4	A	4	ABCD				Y
			D	2	AD				Y
		9	A			1	A	FS1	Y

Table 5. Township (T), Range (R), Section (S), quarter section (1/4 S), number of 40-acre tracts in the quarter section having prime irrigable soil (N-1), letter location of N-1 tracts (LOC-1), number of 40-acre tracts having some minor limitation (N-2), letter location of N-2 tracts, Limitation Code describing soil limitations in N-2 tracts, as described on Table 2, and index indicating the ability to combine with neighboring 40-acre tracts for form a minimum unit of 80 contiguous acres (I-80)

T	R	S	1/4 S	N-1	LOC-1 1/4, 1/4 S 40-acre tracts	N-2	LOC-2 1/4, 1/4 S 40-acre tracts	Limitation Code	I-80
147	81	10	A	4	ABCD				Y
			B	2	AD	2	BC	W1	Y
			C			1	A	W1	Y
			D	1	C	3	ABD	SG2	Y
		11	A	3	ACD	1	B	FS3	Y
			B	3	ABC	1	D	FS1	Y
			C	2	BC				Y
			D	3	ABC	1	D	SG4, SL4	Y
		12	A	3	ABC	1	D	FS1	Y
			B	3	BCD	1	A	FS4	Y
			C	2	BC	2	AD	SG1	Y
			D	3	BCD	1	A	SG3, SL3	Y
147	80	7	C	2	CD				
			D	1	B				
		8	C	1	D				
			D			1	C	SL3, SG3	Y
		9	A	2	AB	2	CD	FS1., SL1., SG1	Y
			B			2	AB	SG1	Y
		10	B	2	AB	2	CD	SL1, SG1	Y
			C			1	D	FS1, SL1	Y
		17	B	1	B	2	AC	SL3, SG3	Y
		18	A	1	D				
			B	2	BC	2	AD	W1	Y
			C	4	ABCD				
			D	2	BC	1	A	SL1, SG1	Y
147	81	13	A	3	ABD	1	C	FS1	Y
			B	3	ABC	1	D	FS1	Y
			C	4	ABCD				Y
			D	4	ABCD				Y
		14	A	4	ABCD				Y
			B	4	ABCD				Y
			C	2	BC				Y
			D			2	AB	FS1, W1	Y

Table 5. Township (T), Range (R), Section (S), quarter section (1/4 S), number of 40-acre tracts in the quarter section having prime irrigable soil (N-1), letter location of N-1 tracts (LOC-1), number of 40-acre tracts having some minor limitation (N-2), letter location of N-2 tracts, Limitation Code describing soil limitations in N-2 tracts, as described on Table 2, and index indicating the ability to combine with neighboring 40-acre tracts for form a minimum unit of 80 contiguous acres (I-80)

T	R	S	1/4 S	N-1	LOC-1 1/4, 1/4 S 40-acre tracts	N-2	LOC-2 1/4, 1/4 S 40-acre tracts	Limitation Code	I-80
147	81	15	A	2	AD	2	BC	W1	Y
			C			1	D	SG1	Y
			D	1	A				
		21	A			1	A	SG1	N
147	81	22	B	1	A	1	B	SG1	Y
		24	A	4	ABCD				
			B	3	ACD	1	B	FS1	
			C	1	A				
			D	3	ABD	1	C	FS1	
147	80	19	A	2	AB				
			B	4	ABCD				Y
			C	2	BC				Y
									Y
		27	B			2	CD	SL1, W1, SG1	Y
			C	2	AB				Y
147	81	25	A			3	ABD	FS3	Y
			D			2	CD	FS3, SL3	Y
		26	C	1	B	2	AD	SG1, SL1	Y
		27	C			2	AB	SG3	Y
		28	B			2	AD	FS3	Y
		36	A	2	BC	1	A	SG3	Y
			D	1	D	2	A	FS1	Y
147	80	33	A			1	D	FS1	Y
			D			1	A	SL1	Y
		34	B			1	C	SL1, W1	Y
146	79	11	C			1	A	SG1	Y
150	79	28	B			2	AC	FS3	?
		29	A			2	CD	SL1, W1	?

Table 5. Township (T), Range (R), Section (S), quarter section (1/4 S), number of 40-acre tracts in the quarter section having prime irrigable soil (N-1), letter location of N-1 tracts (LOC-1), number of 40-acre tracts having some minor limitation (N-2), letter location of N-2 tracts, Limitation Code describing soil limitations in N-2 tracts, as described on Table 2, and index indicating the ability to combine with neighboring 40-acre tracts for form a minimum unit of 80 contiguous acres (I-80)

T	R	S	1/4 S	N-1	LOC-1 1/4, 1/4 S 40-acre tracts	N-2	LOC-2 1/4, 1/4 S 40-acre tracts	Limitation Code	I-80
		30	A			1	B	FS3	?
			B			1	D	FS3	?
			C	1	A	2	CD	FS3	Y
150	80	36	D	2	CD	2	AB	SL1, FS1	Y
146	79	29	C			4	ABCD	SG4, SL4	Y
		30	D			2	AD	SG4, SL4, FS3	Y
		31	D			2	AB	SG4, SL4	Y
		32	C			2	CD	SG4, SF1	Y
145	79	6	A			3	ABC	FS4, SG3	Y
			B			2	CD	SG4	Y
145	80	2	D			2	CD	SL1, SG1	Y
			C			1	A	SL3	Y

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USDA. 1979. Soil Survey of McLean County, North Dakota. U.S. Department of Agriculture Soil Conservation Service.

## APPENDIX 1

List of locations, Soil Suitability Index (SOIL INDEX) , Water Availability Index (H2O INDEX), and Combined Index (COMBINED) for each of the 40-acre tracts evaluated. Tracts are listed in ascending order.



APPENDIX 1

LOCATION	SOIL INDEX	H2O INDEX	COMBINED	LOCATION	SOIL INDEX	H2O INDEX	COMBINED
14708101BA	1	2	2	14708112BB	1	2	2
14708101BD	1	2	2	14708112BC	1	2	2
14708101CC	1	2	2	14708112BD	1	2	2
14708101CD	1	2	2	14708112CA	2	2	4
14708101DA	1	2	2	14708112CB	1	2	2
14708101DB	1	2	2	14708112CC	1	2	2
14708101DC	1	2	2	14708112CD	2	2	4
14708101DD	1	2	2	14708112DA	3	2	6
14708102BA	1	2	2	14708112DB	1	2	2
14708102BB	3	2	6	14708112DC	1	2	2
14708102BC	1	2	2	14708112DD	1	2	2
14708102BD	1	2	2	14708113AA	1	2	2
14708102CA	1	2	2	14708113AB	1	2	2
14708102CB	1	2	2	14708113AC	2	2	4
14708102CC	1	2	2	14708113AD	1	2	2
14708102CD	1	2	2	14708113BA	1	2	2
14708102DA	1	2	2	14708113BB	1	2	2
14708102DD	1	2	2	14708113BC	1	2	2
14708104AA	1	2	2	14708113BD	2	2	4
14708104AB	1	2	2	14708113CA	1	2	2
14708104AC	1	2	2	14708113CB	1	2	2
14708104AD	1	2	2	14708113CC	1	2	2
14708104DA	1	2	2	14708113CD	1	2	2
14708104DD	1	2	2	14708113DA	1	2	2
14708109AA	2	4	8	14708113DB	1	2	2
14708110AA	1	2	2	14708113DC	1	2	2
14708110AB	1	2	2	14708113DD	1	2	2
14708110AC	1	2	2	14708114AA	1	2	2
14708110AD	1	2	2	14708114AB	1	2	2
14708110BA	1	2	2	14708114AC	1	2	2
14708110BB	2	2	4	14708114AD	1	2	2
14708110BC	2	2	4	14708114BA	1	2	2
14708110BD	1	2	2	14708114BB	1	2	2
14708110CA	2	2	4	14708114BC	1	2	2
14708110DA	3	2	6	14708114BD	1	2	2
14708110DB	3	2	6	14708114CB	1	2	2
14708110DC	1	2	2	14708114CC	1	2	2
14708110DD	3	2	6	14708114DA	2	2	4
14708111AA	1	2	2	14708114DB	2	2	4
14708111AB	3	2	6	14708115AA	1	4	4
14708111AC	1	2	2	14708115AB	2	4	8
14708111AD	1	2	2	14708115AC	2	4	8
14708111BA	1	2	2	14708115AD	1	4	4
14708111BB	1	2	2	14708115CD	2	4	8
14708111BC	1	2	2	14708115DA	1	4	4
14708111BD	2	2	4	14708121AA	2	2	4
14708111CB	1	2	2	14708122BA	1	2	2
14708111CC	1	2	2	14708122BB	2	2	4
14708111DA	1	2	2	14708124AA	1	2	2
14708111DB	1	2	2	14708124AB	1	2	2
14708111DC	1	2	2	14708124AC	1	2	2
14708111DD	3	2	6	14708124AD	1	2	2
14708112AA	1	2	2	14708124BA	1	2	2
14708112AB	1	2	2	14708124BB	2	2	4
14708112AC	1	2	2	14708124BC	1	2	2
14708112AD	2	2	4	14708124BD	1	2	2
14708112BA	3	2	6	14708124CA	1	2	2

APPENDIX 1

LOCATION	SOIL INDEX	H2O INDEX	COMBINED	LOCATION	SOIL INDEX	H2O INDEX	COMBINED
14708124DA	1	2	2	14808126BD	2	1	2
14708124DB	1	2	2	14808126CA	2	1	2
14708124DC	2	2	4	14808126DA	1	1	1
14708124DD	1	2	2	14808126DB	1	1	1
14708125AA	3	2	6	14808126DC	2	1	2
14708125AB	3	2	6	14808127DC	2	1	2
14708125AD	3	2	6	14808128AB	2	1	2
14708125DC	3	2	6	14808128AC	2	1	2
14708125DD	3	2	6	14808128CA	2	1	2
14708126CA	2	2	4	14808128CD	2	1	2
14708126CB	1	2	2	14808129BA	2	1	2
14708126CD	2	2	4	14808129BD	2	1	2
14708127CA	3	2	6	14808129CB	2	1	2
14708127CB	3	2	6	14808129DC	3	1	3
14708128BA	3	2	6	14808131AA	3		
14708128BD	3	2	6	14808131AB	1		
14708136AA	3	2	6	14808131AD	3		
14708136AB	1	2	2	14808131BD	2		
14708136AC	1	2	2	14808131CB	2		
14708136AD	1	2	2	14808132AA	1	2	2
14708136DA	2	2	4	14808133AA	2	2	4
14808031AA	1	1	1	14808133AB	1	2	2
14808031AB	1	1	1	14808133AC	1	2	2
14808031AC	1	1	1	14808133AD	1	2	2
14808031AD	1	1	1	14808133BA	1	2	2
14808031BC	1	1	1	14808133BB	3	2	6
14808031BD	3	1	3	14808133BC	1	2	2
14808031CA	1	1	1	14808133BD	1	2	2
14808031CB	1	1	1	14808133CA	1	2	2
14808031CD	1	1	1	14808133CD	1	2	2
14808031DA	1	1	1	14808133DA	1	2	2
14808031DB	1	1	1	14808133DB	1	2	2
14808031DC	1	1	1	14808133DC	1	2	2
14808031DD	1	1	1	14808133DD	1	2	2
14808032AC	3	2	6	14808134AB	2	2	4
14808032AD	3	2	6	14808134CA	1	2	2
14808032BB	3	2	6	14808134CB	2	2	4
14808032CA	3	2	6	14808134CC	2	2	4
14808032CB	3	2	6	14808134CD	1	2	2
14808032CC	1	2	2	14808134DBB	1	2	2
14808032CD	1	2	2	14808135AA	1	2	2
14808032DA	2	2	4	14808135AB	1	2	2
14808032DC	2	2	4	14808135AC	2	2	4
14808032DD	2	2	4	14808135AD	2	2	4
14808033BC	2	1	2	14808135CA	2	2	4
14808033CA	1	1	1	14808135CB	2	2	4
14808033CB	1	1	1	14808135CC	2	2	4
14808033CC	1	1	1	14808135CD	2	2	4
14808033CD	1	1	1	14808135DA	1	2	2
14808033DC	1	1	1	14808135DB	1	2	2
14808126AA	1	1	1	14808136AC	3	2	6
14808126AB	1	1	1	14808136AD	3	2	6
14808126AC	1	1	1	14808136BD	1	2	2
14808126AD	1	1	1	14808136CB	1	2	2
14808126BA	1	1	1	14808136CC	3	2	6
14808126BB	1	1	1	14808136CD	3	2	6
14808126BC	2	1	2	14808136DA	1	2	2

APPENDIX 1

LOCATION	SOIL INDEX	H2O INDEX	COMBINED	LOCATION	SOIL INDEX	H2O INDEX	COMBINED
14808136DB	2	2	4	14808214BB	2	1	2
14808201BC	3	4	12	14808224AA	3	1	3
14808201BD	3	4	12	14808224AB	3	1	3
14808201CB	1	4	4	14908003BA	3	3	9
14808201CD	2	4	8	14908003BB	3	3	9
14808202AA	3			14908003BC	1	3	3
14808202AD	3			14908003BD	1	3	3
14808202CA	1			14908003CA	3	3	9
14808202CB	1			14908003CB	3	3	9
14808202CC	1			14908003CC	3	3	9
14808202CD	2			14908003CD	1	3	3
14808203AA	3			14908009AA	3		
14808203AB	3			14908009AD	3		
14808203AC	3			14908009DA	3		
14808203AD	1			14908009DD	3		
14808203DA	3			14908010BA	1	2	2
14808203DB	3			14908010BB	3	2	6
14808203DC	3			14908010BC	3	2	6
14808203DD	1			14908010CB	2	2	4
14808210AA	2	1	2	14908010CC	2	2	4
14808211AB	3	1	3	14908015BB	3	2	6
14808211AC	1	1	1	14908015BC	3	2	6
14808211BA	3	1	3	14908015BD	3	2	6
14808211BB	1	1	1	14908015CA	3	2	6
14808211BC	1	1	1	14908015CB	3	2	6
14808211BD	1	1	1	14908015CC	3	2	6
14808211CA	1	1	1	14908015CD	3	2	6
14808211CB	1	1	1	14908016AD	2	2	4
14808211CC	3	1	3	14908016CA	3	2	6
14808211CD	3	1	3	14908016CB	3	2	6
14808211DA	1	1	1	14908016CC	3	2	6
14808211DB	1	1	1	14908016CD	3	2	6
14808211DC	3	1	3	14908016DA	3	2	6
14808211DD	3	1	3	14908016DD	3	2	6
14808212AB	2	3	6	14908017CA	3	2	6
14808212AC	1	3	3	14908017CD	3	2	6
14808212BA	2	3	6	14908017DB	3	2	6
14808212BD	2	3	6	14908017DD	3	2	6
14808212CA	3	3	9	14908020BD	2	2	4
14808212CD	3	3	9	14908020CA	1	2	2
14808212DB	3	3	9	14908020CB	3	2	6
14808212DC	3	3	9	14908020CD	1	2	2
14808213AC	1	1	1	14908021BB	3	2	6
14808213BA	2	1	2	14908021BC	3	2	6
14808213BB	1	1	1	14908021BD	3	2	6
14808213BC	1	1	1	14908021DA	3	2	6
14808213BC	1	1	1	14908021DB	3	2	6
14808213BD	1	1	1	14908022BA	1	2	2
14808213BD	1	1	1	14908022BB	3	2	6
14808213CA	1	1	1	14908022BC	3	2	6
14808213CB	3	1	3	14908022BD	1	2	2
14808213CD	3	1	3	14908022CB	1	2	2
14808214AA	2	1	2	14908022CC	3	2	6
14808214AB	2	1	2	14908023CA	3	3	9
14808214AC	2	1	2	14908023CC	3	3	9
14808214AD	2	1	2	14908028CC	3		
14808214BA	2	1	2	14908029DD	1		

APPENDIX 1

LOCATION	SOIL INDEX	H2O INDEX	COMBINED	LOCATION	SOIL INDEX	H2O INDEX	COMBINED
14908032CB	1			15008035BC	1	2	2
14908032CC	3			15008035BD	1	2	2
15007928BA	3	4	12	15008035CA	3	2	6
15007928BC	3	4	12	15008035CB	1	2	2
15007929AC	2	2	4	15008035CC	3	2	6
15007929AD	2	2	4	15008035CD	1	2	2
15007930AB	3	1	3	15008036BA	3	2	6
15007930BD	3	1	3	15008036BB	1	2	2
15007930CC	1	1	1	15008036BC	3	2	6
15007930CD	3	1	3	15008036CD	2	2	4
15008022BD	2	2	4	15008036DA	2	1	2
15008022CA	3	2	6	15008036DB	2	1	2
15008022CB	3	2	6	15008036DC	1	1	1
15008022CC	3	2	6	15008036DD	1	1	1
15008022DA	3	2	6				
15008022DB	3	2	6				
15008022DC	3	2	6				
15008022DD	3	2	6				
15008023CC	3	4	12				
15008023DB	3	4	12				
15008023DC	3	4	12				
15008024DA	2	1	2				
15008024DD	2	1	2				
15008026BC	2	2	4				
15008026CA	2	2	4				
15008026CB	2	2	4				
15008026CC	1	2	2				
15008026CD	1	2	2				
15008026DA	3	2	6				
15008026DB	3	2	6				
15008026DC	1	2	2				
15008027AA	3	4	12				
15008027AB	3	4	12				
15008027AC	3	4	12				
15008027AD	3	4	12				
15008027BA	3	4	12				
15008027BB	3	4	12				
15008027BD	3	4	12				
15008027CA	2	4	8				
15008027CB	1	4	4				
15008027CC	2	4	8				
15008027CD	1	4	4				
15008034AA	1	2	2				
15008034AC	3	2	6				
15008034AD	1	2	2				
15008034BD	3	2	6				
15008034CA	3	2	6				
15008034CB	1	2	2				
15008034CC	1	2	2				
15008034CD	3	2	6				
15008035AA	1	2	2				
15008035AB	1	2	2				
15008035AC	1	2	2				
15008035AD	2	2	4				
15008035BAA	1	2	2				
15008035BB	1	2	2				

## APPENDIX 2

List of dates, sodium adsorption ratios (SAR), field and laboratory electrical conductivities, and the water suitability (QW) Index, by location, for water samples taken from wells in the Horseshoe Valley, Lake Nettie, Mercer, and Strawberry Lake aquifers in eastern McLean County.

## APPENDIX 2

Location	Date_Sampled	SAR	Field_Conduct	Lab_Conduct	QW Index
14808211	1/1/68			1040	1
14508002AAB	5/2/68	0.2	800	857	1
14607808BBB	5/29/86	6.1	1020	993	0
14607830DDD	5/14/71	1.9	1850	1540	0
14607906AAA2	6/29/94	5.7	1818	1910	0
14607910DAD	9/15/98	3.4	1689	1810	0
14607915ADD	9/15/98	0.2	509	537	1
14608001BBB	6/29/94	9.5	2160	2210	0
14608017AAA	6/29/94	3.7	1466	1510	0
14608035DDC	5/3/68	0.6	850	876	1
14707803DAD	9/13/96	1.9	1175	1280	1
14707806BBB	8/18/95	0.8	839	853	1
14707810BBD	8/3/76	1	1200	1100	1
14707814CCC2	6/27/78	0.1	360	343	1
14707827DDD	9/16/96	1.8	870	1010	1
14707830BCC2	5/27/86	0.1	400	443	1
14707911BCB	8/18/95	0.9	638	668	1
14707914CCC	6/10/94	1.2	779	811	1
14707918DCC	6/28/94	16	1640	1810	0
14707919BAA3	9/22/95	1.6	785	851	1
14707920ABD	6/29/94	15	1995	2120	0
14707922CBB	6/10/94	2.5	848	877	1
14707924DDD	5/29/86	0.2	260	249	1
14707926DDA	6/10/94	0.7	952	977	1
14707927AAA	8/12/70	1	570	655	1
14707927ADA2	8/18/95	0.7	656	637	1
14707929BBB	9/15/98	8.3	1723	1820	0
14707935CBB	6/10/94	2	1253	1290	1
14708001CCC2	6/11/86	1.5	1200	1120	1
14708003DAA	6/28/94	0.3	706	727	1
14708005BBB	9/15/98	2.4	1093	1130	1
14708005CCC	9/15/98	2.6	1121	1170	1
14708005DDD	6/30/94	2.1	1588	1700	0
14708008AAD8	8/25/94	0.2	505	519	1
14708008CCC	6/30/94	3.2	1079	1150	1
14708009CBB	6/30/94	0.1	898	480	1
14708013CCC	8/18/95	6.2	1234	1280	0
14708015AAA2	5/30/86	0.5	1650	1550	0
14708016BCA	8/25/94	0.5	790	822	1
14708021BAC	6/29/94	3.8	2710	2900	0
14708022AAD	6/29/94	2.2	2680	2830	0
14708022BBB	12/3/69	4.1		1580	0
14708022CDD2	6/15/92	5.4	6500	4340	0
14708023ADD	9/17/85	5.5	1500	1340	1
14708033DDD	8/25/94	2.5	2230	2660	0
14708103BBB	9/22/95	0.5	563	611	1
14708104DAA	9/22/95	0.5	665	731	1
14708109AAA2	9/6/85	2	580	729	1
14807810CBC	9/13/78	1.5	850	921	1
14807820BBA	9/1/95	3.4	714	762	1
14807927ADD2	6/10/94	0.4	1140	1200	1
14807932AAA	6/28/94	0.6	919	976	1
14808006AAB	8/24/94	8.2	1222	1360	0
14808007AAA	11/20/84	7.6	2800	3180	0
14808007AAA	8/24/94	4.5	2870	3290	0
14808012ADD	6/28/94	0.1	579	597	1
14808017CAB2	8/24/94	9.9	1826	2040	0

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14808019CCC2	9/1/95	0.2	764	789	1
14808020CCC	8/24/94	8.6	2080	2310	0
14808023DCD	6/28/94	0.2	673	726	1
14808029DDD2	8/24/94	2.1	1038	1140	1
14808030CCD2	4/23/68	3.5	1270	1300	1
14808031AAA3	9/22/95	0.4	703	714	1
14808033CBD	11/9/70	0.9		951	1
14808033CCA2	8/27/70	1.3	1200	1260	1
14808033CCB	8/27/70	1	900	874	1
14808034DCC	9/1/95	9.5	1387	1520	0
14808035BBC	6/28/94	0.2	576	626	1
14808103AAB	9/21/87	0.2	890	766	1
14808103CCD	8/20/96	0.9	945	976	1
14808104CBC	8/11/95	0.9	983	977	1
14808108DDA	8/20/96	0.7	940	961	1
14808109BAA	9/15/98	0.9	877	939	1
14808110AAA	9/15/98	0.2	559	628	1
14808110ABB	9/15/98	1.4	836	893	1
14808110DDC	8/20/96	2.1	754	810	1
14808112DAA	8/24/94	0.8	1579	1780	0
14808114CDD	8/24/94	8.3	1165	1230	0
14808115DDD2	7/27/62	0.4		644	1
14808116DDD	7/14/94	1.9	798	840	1
14808117BCB3	7/14/94	0.1	966	1010	1
14808118DCD2	10/31/95	1.3	1322	1480	1
14808119BBB	8/23/94	0.2	1376	628	1
14808120AAA3	8/11/95	0.4	660	707	1
14808120ADC	8/14/70	6	990	1090	1
14808120BAA	7/28/86	3	1100	1040	1
14808120CCA	1/1/77	8.4	1200	1160	0
14808120CCD5	10/3/70	4.9	1260	1280	1
14808120CDC1	8/26/70	4.4	1280	1190	1
14808120CDC2	8/26/70	3.8	1610	1670	0
14808121ABB	10/8/87	1.7		899	1
14808121ADD	9/15/98	0.2	556	603	1
14808121BCC	6/16/87	1.5		1078	1
14808121BCC	10/8/87	1.6		1050	1
14808121CAB	9/23/98	1.2	941	927	1
14808121CDA	10/1/98	1.4	971	997	1
14808121DCD	9/23/98	1.6	940	966	1
14808122AAB	8/23/94	0.1	442	470	1
14808122AAD	8/23/94	1.8	634	677	1
14808122BAB	8/23/94	6.4	904	985	0
14808122DDD3	8/23/94	0.3	637	592	1
14808126DBC	8/25/94	4.4	1511	1740	0
14808128BDB3	10/1/98	8.4	2220	2430	0
14808128CAB	9/23/98	8.1	3200	3220	0
14808128CCC	7/1/94	2.9	1138	1200	1
14808129BAA2	10/31/95	18	2300	2650	0
14808129CAA	7/1/94	9.7	3110	3520	0
14808133CDD	7/12/96	0.6	834	964	1
14808134CBB	7/1/94	0.9	889	831	1
14808134DDD	9/22/95	0.2	575	622	1
14808136DDD	8/17/67	5		1330	1
14808203CDC	6/11/86	2.4	1700	1600	0
14808207ACA2	1/1/65	4.8		1550	0
14808208CDC2	8/29/85	5.9		1910	0
14808211DCC2	7/28/86	0.7	880	737	1

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14808212DDD2	9/15/98	1	1293	1390	1
14808215BBB	8/11/95	12	1986	2100	0
14808221DDD	7/13/94	6.9	1157	1250	0
14808223BBB	8/11/95	5	1236	1200	1
14808224ABB2	8/23/94	0.8	2840	3560	0
14808226BBB	7/13/94	7.2		1510	0
14907926CDC	5/19/70	0.2	420	508	1
14908003CBD	6/27/75	0.2		550	1
14908003CCD	9/14/94	0.2	584	619	1
14908015BBB	9/14/94	0.1	529	566	1
14908016DDD2	9/14/94	0.3	567	605	1
14908019AAA	9/7/67	2.7	1100	1220	1
14908020AAA2	9/14/94	0.1	484	502	1
14908020BBB	9/14/94	2.7	1157	1300	1
14908022BDD	8/28/81	0.8	710	642	1
14908026ABA	12/5/69	2.9		1270	1
14908031CBC	6/25/76	0.7	720	523	1
14908125CCD	9/14/94	2.4	1687	2010	0
14908134DDD	7/14/94	0.8	892	961	1
15007930CBD	11/24/97	0.2	652	648	1
15008002DCC	8/23/96	1.3	1106	1110	1
15008008BBB	8/6/98	0.3	792	338	1
15008011CDC	9/15/94	0.8	1244	1360	1
15008015DAA	9/15/94	0.8	1084	1230	1
15008017BAB	8/23/96	0.1	580	472	1
15008022ABB	8/23/96	0.5	949	1170	1
15008022BCC	8/23/96	0.1	480	323	1
15008022CDC	8/23/96	0.2	560	469	1
15008023CDD	9/15/94	0.3	630	604	1
15008024DDC	9/15/94	0.7	1084	1060	1
15008025AAA2	9/15/94	0.4	1062	1200	1
15008025CCC	8/23/96	0.1	570	502	1
15008025DCD	8/23/96	0.7	585	413	1
15008026CBD	8/6/98	0.1	532	542	1
15008027DDD	8/6/98	0.3	630	649	1
15008034ADB3	11/16/73	0.4	685	617	1
15008034ADC1	11/27/73	0.8		640	1
15008035ABB	8/6/98	0.2	592	616	1
15008035BAD	8/6/98	0.1	546	566	1
15008035CBC	9/14/94	0.3	640	694	1
15008036BAA	8/6/98	1.2	295	308	1
15008036CBD2	9/14/94	0.2	492	517	1