SECTION 2.0

SECTION 2.0
IWWTF SITE AND STUDY AREA DESCRIPTION

The site of the proposed development is on the same site as and adjacent to the existing IWWTF site (Figure 2.1 - Site Plan). It is located on SW¼ 16-10-18 WPM excluding the most northerly 650 ft perpendicular and the most westerly 100 ft perpendicular; and a southern portion of the SE¼ 16-10-18 WPM, making a total area of approximately 102.81 hectares (254.04 acres). The site is located approximately 3.5 km (2.2 miles) east of the eastern built-up area of the City of Brandon, Manitoba. The property is located within the limits of the City of Brandon on the northeast corner of the intersection of P.T.H 110 (49th Street East) and Richmond Avenue and extends east to 65th Street East. A C.P.R.-C.N.R. transfer track borders the western edge of the property.

The site is located approximately 130 km (81 miles) east of the Manitoba-Saskatchewan border and approximately 106 km (66 miles) north of the Manitoba-United States international border. The nearest major settlements other than the City of Brandon include the Town of Virden (76 km west), Town of Carberry (33 km east), Town of Minnedosa (45 km north), Town of Wawanesa (28 km southeast), the City of Portage La Prairie (107 km east); and, the City of Winnipeg (185 km east). Shilo is located 16 km (10 miles) east and 1 km (0.6 miles) south of the proposed site.

A detailed site plan of the entire Maple Leaf Pork plant and the expanded IWWTF is included as Figure 2.2 of this licence application. An overall site plan of the expanded Industrial Waste Water Treatment Facility is also included in Figure 2.3. The site is located within the Assiniboine River Plain physiographic region. The topography can be described as gently sloping lacustrine and glaciofluvial plain.

Until 1998, the site had been owned by Simplot Canada Ltd. (Simplot). Prior to its acquisition by the City of Brandon for the purposes of accommodating the Maple Leaf Pork processing plant, the land was used by Simplot for fertigation; that is, disposal of effluent containing plant nutrients suitable for fertilization through an irrigation system. Adjoining land uses consist of the Simplot fertilizer plant (industrial) located about 2.5 km (1.5 miles) to the west; gravel pits to the north with the Assiniboine River 0.5 km (0.3 miles) beyond to the north; Nexen Chemicals Canada Limited Partnership 1.25 km (0.8 miles) to the east southeast; and, farmland with an east-west rail line to the south. Manitoba Hydro's Brandon Steam Generating Facility is located slightly less than 3 km (2 miles) northwest of the site. All the land immediately adjacent to and surrounding the site is currently used either as gravel pits, farmland, or scrap metal yards.

The proposed Developments will meet the requirements of local zoning and will be compatible with adjoining industrial areas. A zoning map can be referred to in Figure 2.4.

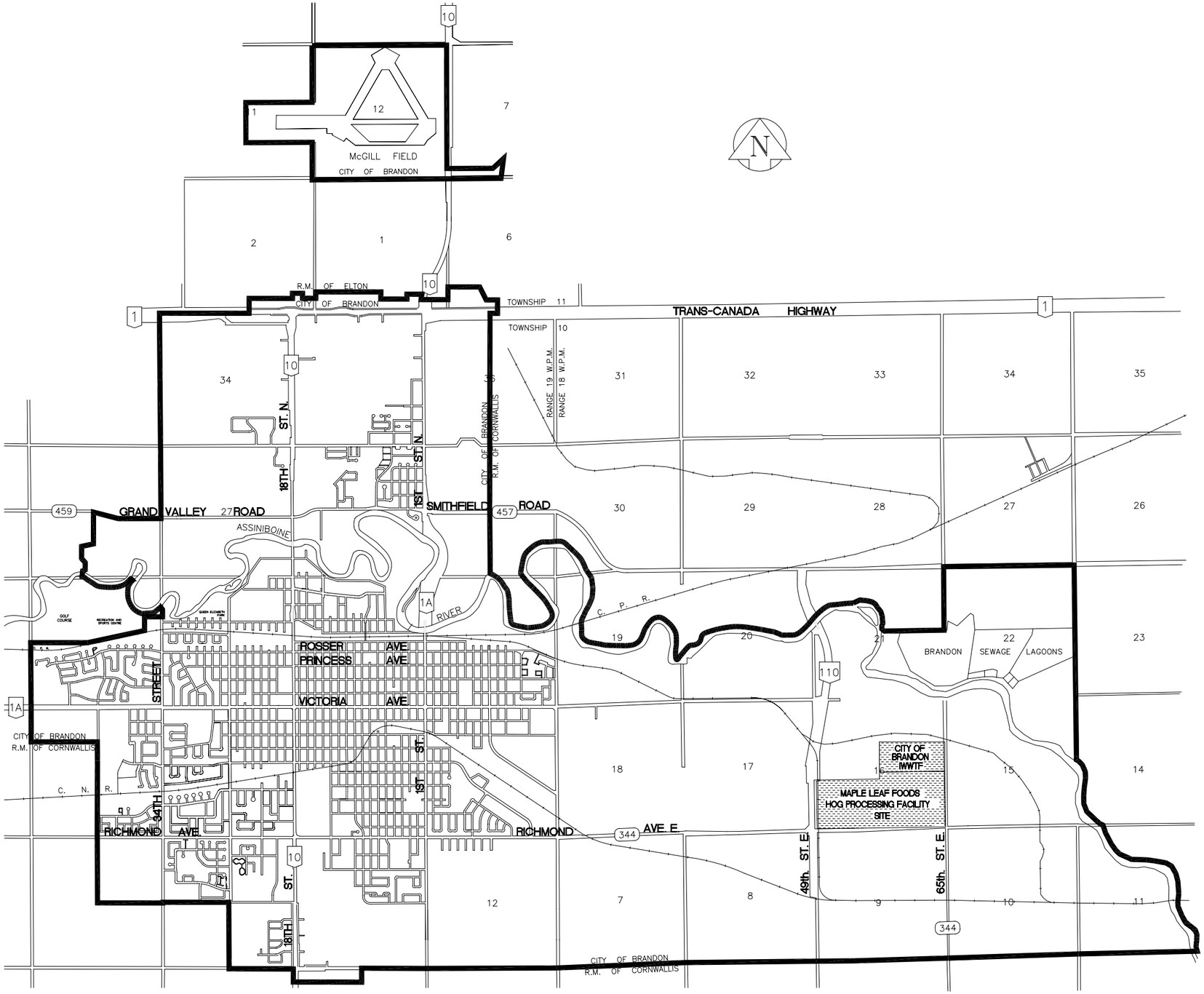
The western portion of the site itself was previously used as a sand and gravel pit. The nearest existing major residential area is over 3 km (2 miles) to the northwest, a suburban area of Brandon. Chater, a small residential area, is about the same distance to the northeast. The nearest known public facilities are in the eastern part of Brandon; the Assiniboine Community College on Victoria Avenue East and a park located on Garwood Drive between Inglewood and Hazelwood Crescent. Each of these public facilities is about 4.5 km (2.8 miles) from the plant site. The closest residents to the existing and proposed facility are Mr. Carmen Denbow and Mr. James Terhune (same residence), located immediately northeast of the east road allowance of the proposed site. Their residence is 0.25 km (0.15 miles) from the northeast corner of the site.

2.1 STUDY AREA

The study area comprises all areas within a 10 km (6.2 mile) radius of the proposed site as shown in Figure 2.5. A greater detail of study has been conducted within a 3 km (2 mile) radius (Figure 2.6) where impacts from the proposed development are anticipated to be more significant. The larger study area extends to the Brandon Hills to the south; 3 km short of Shilo to the east; 4 km into the R.M. of Elton to the north; and, includes Riverheights, Waverley; and, Westview subdivision on the western boundary of Brandon. The 3 km radius area extends just beyond the Brandon City Municipal boundary to the south, about 0.5 km into the Municipality of Cornwallis, about 0.5 km beyond the Nexen Chemical plant to the east, to beyond the Brandon City Municipal boundary to the north, about 0.5 km into the Municipality of Cornwallis; and, to the east side of the Simplot plant to the west.

In addition to the site of the existing and proposed facilities, the study area has been extended to encompass the Assiniboine River between the City of Brandon and the City of Portage la Prairie. The City of Brandon has monitored and studied this portion of the Assiniboine River since the fall of 1998; that is, nearly a year prior to the commissioning of the Maple Leaf Pork processing plant to the present time. The effects of past, present and future effluent inputs to the Assiniboine River forms an important part of this impact assessment.

The 2002 population within the 10 km (6.2 mile) radius of the proposed site is estimated to be about 42,242 (City of Brandon Website, June 2002), the same as that currently given for the City of Brandon. Within the 3 km (2 mile) radius, we estimate a residential population of about 13 persons within this 28.3 km^2 area, giving a population density of about 0.5 people per square kilometre (1.2 people per square mile).



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Site Plan of The City of Brandon
Expanded IWWTF

designed CB	scale N.T.S.	yyyy/mm/dd 2003/03/12
drawn CB	project no. 57730	
checked SJB	drawing no. 2.1	rev.
approved KMA		

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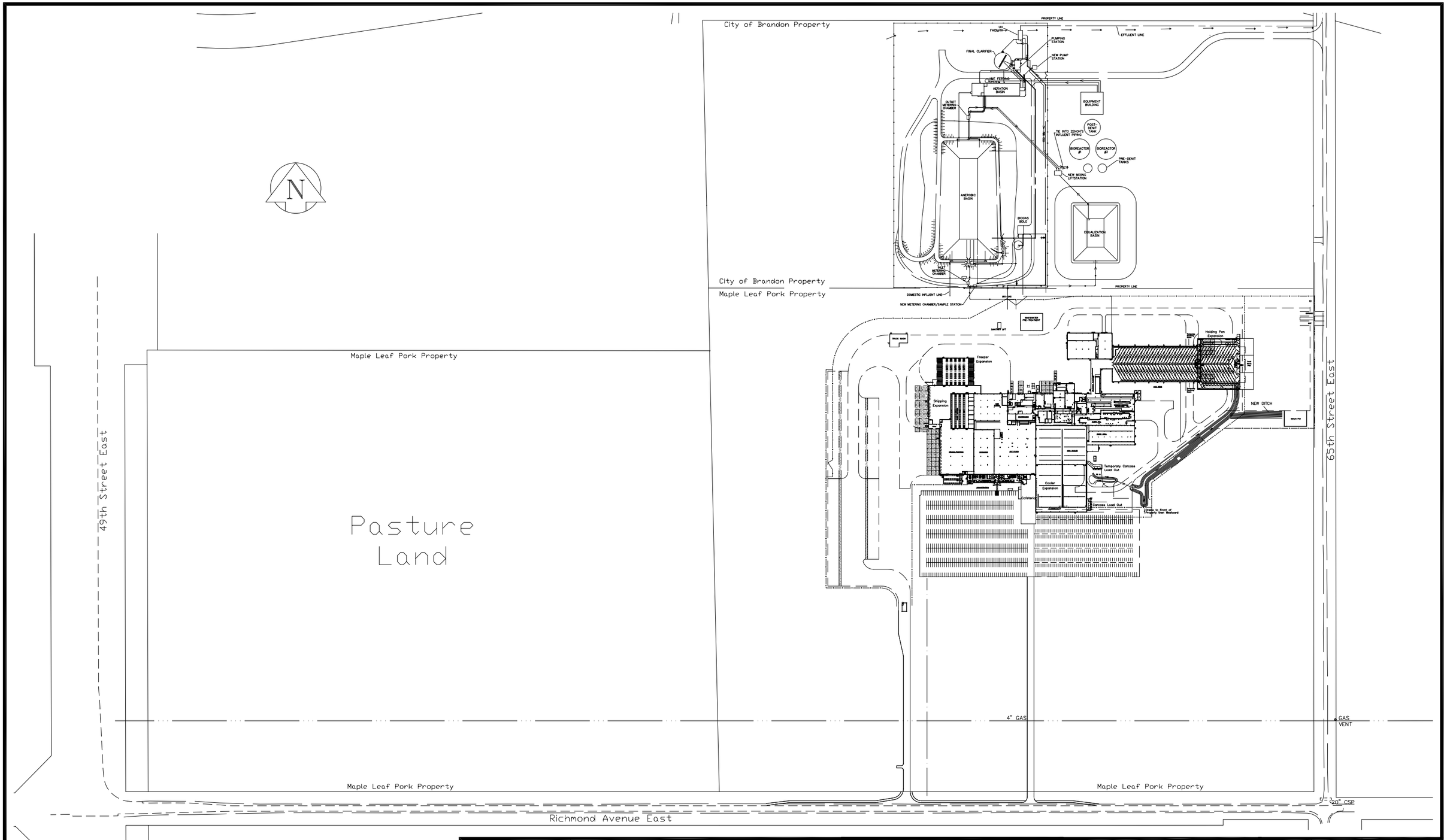

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Site Plan of the Expanded Maple Leaf Pork Plant and The Expanded City of Brandon IWWTF

designed CB	scale N.T.S.	yyyy/mm/dd 2003/03/14
drawn CB	project no. 57730	
checked SJB	drawing no. 2.2	rev.
approved KMA		

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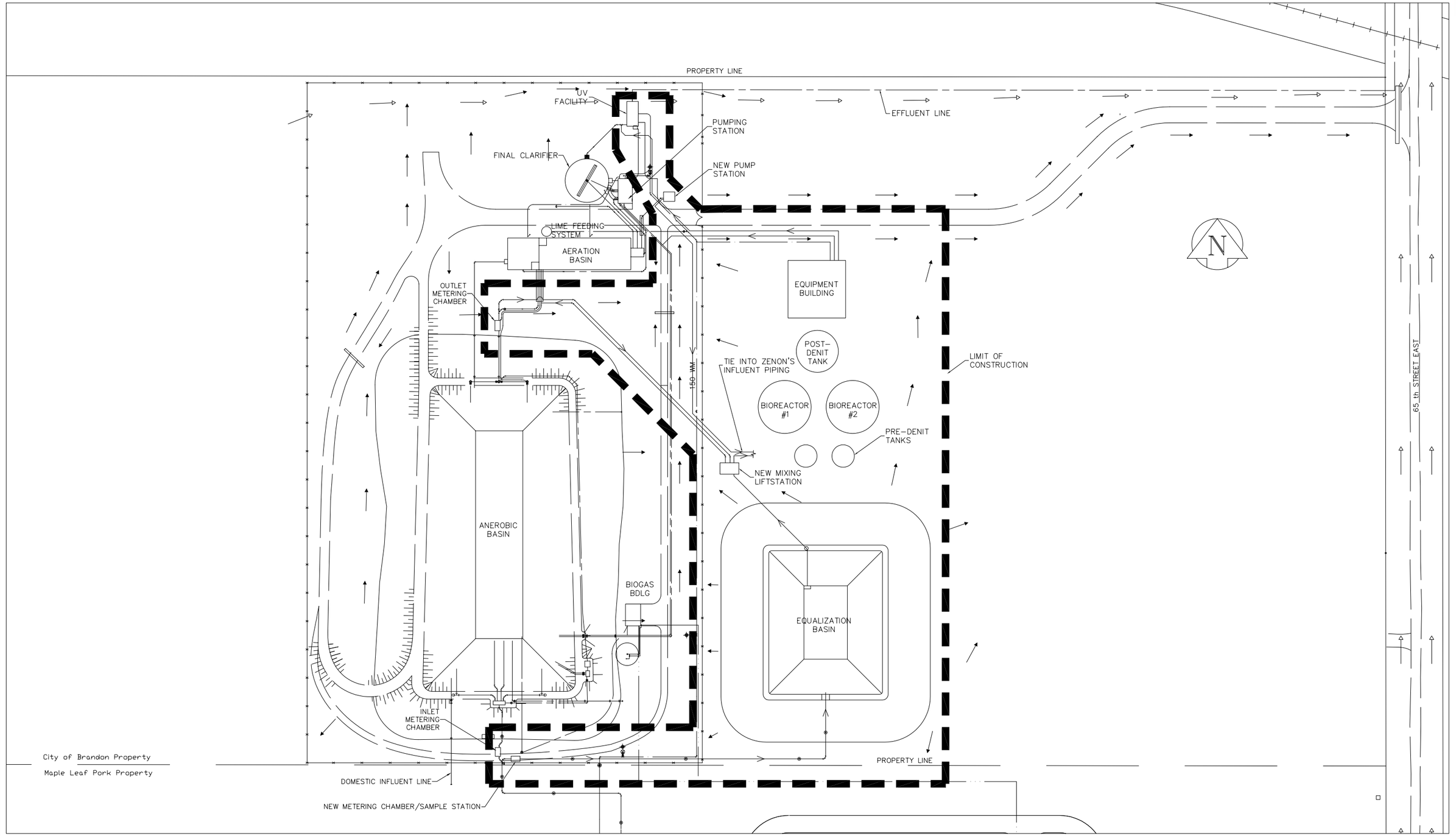

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Detailed Site Plan of The City of Brandon Expanded IWWTF

designed CB	scale N.T.S.	yyyy/mm/dd 2003/03/15
drawn CB	project no. 57730	
checked SJB	drawing no. 2.3	rev.
approved KMA		

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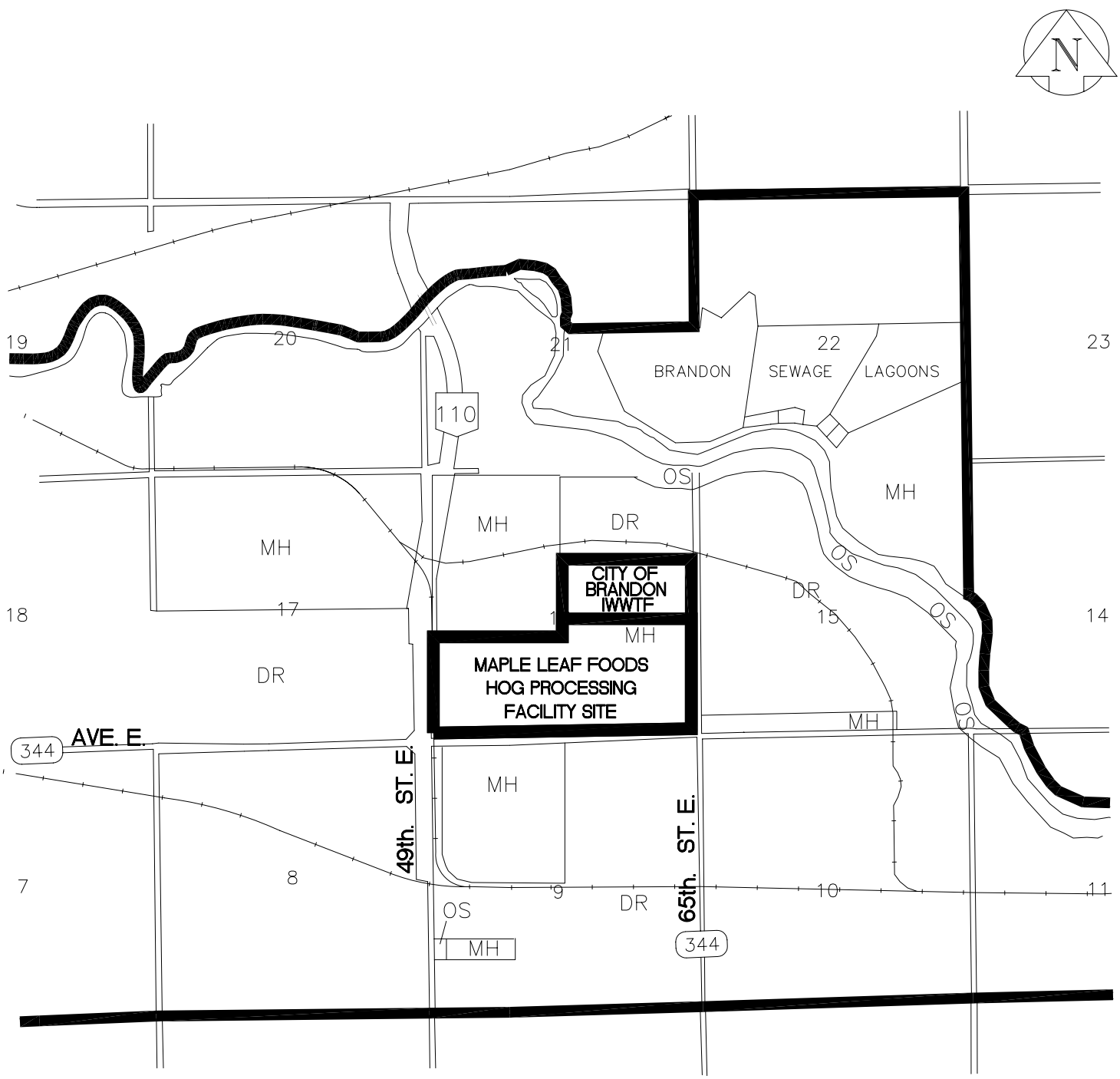

LEGEND

MH – INDUSTRIAL HEAVY ZONE
DR – DEVELOPMENT RESERVE ZONE
OS – OPEN SPACE ZONE

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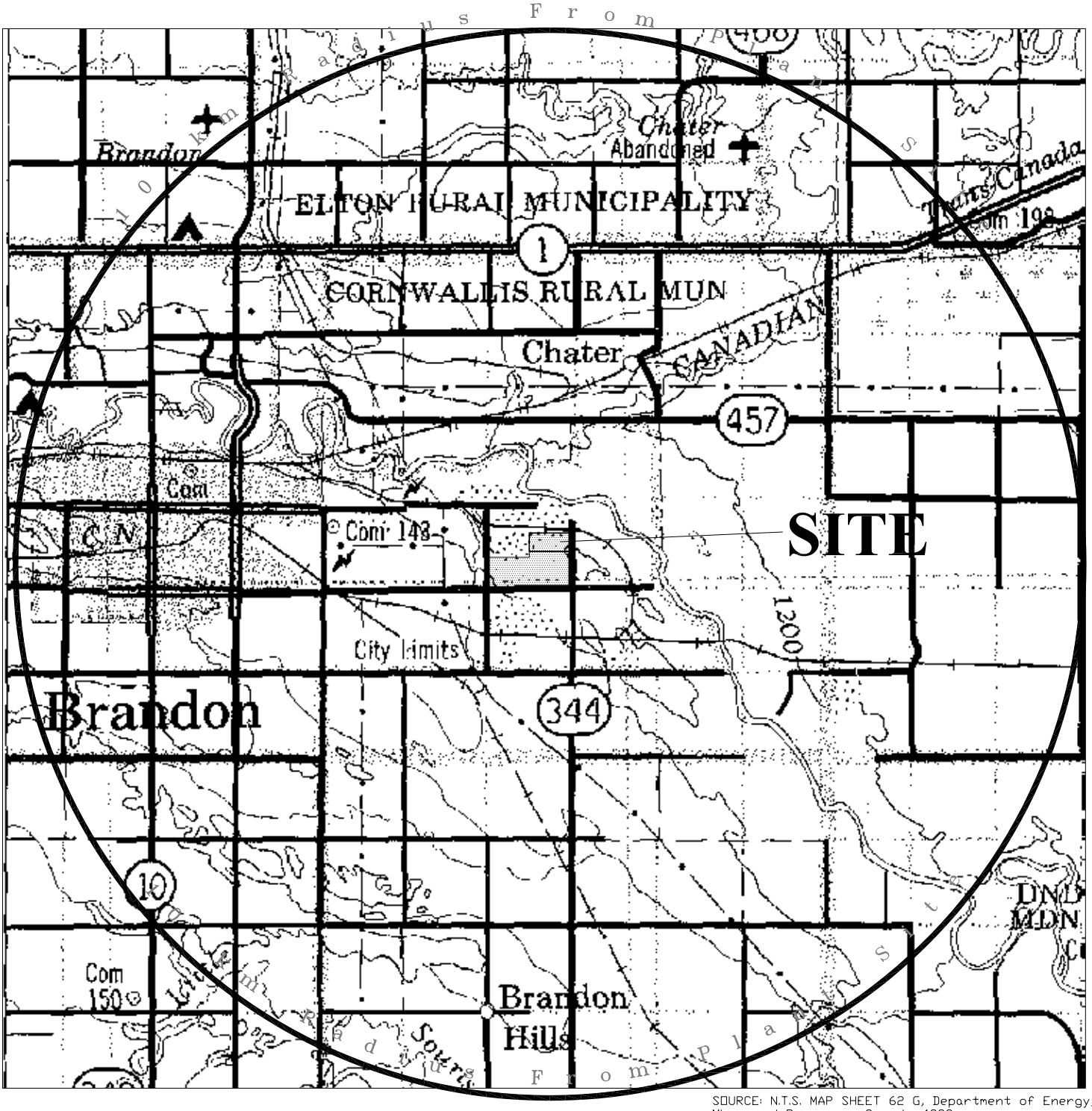
Zoning of Properties Neighbouring The City of Brandon Expanded IWWTF

designed	scale	yyyy/mm/dd
CB	N.T.S.	2003/03/12
drawn	project no.	
CB	57730	
checked	drawing no.	rev.
SJB	2.4	
approved		
KMA		



SOURCE: N.T.S. MAP SHEET 62 G, Department of Energy, Mines and Resources Canada, 1983

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10km Radius From The City of Brandon
Expanded IWWTF

designed	scale	yyyy/mm/dd
CB	N.T.S.	2003/03/12
drawn	project no.	
CB	57730	
checked	drawing no.	rev.
SJB	2.5	
approved		
KMA		

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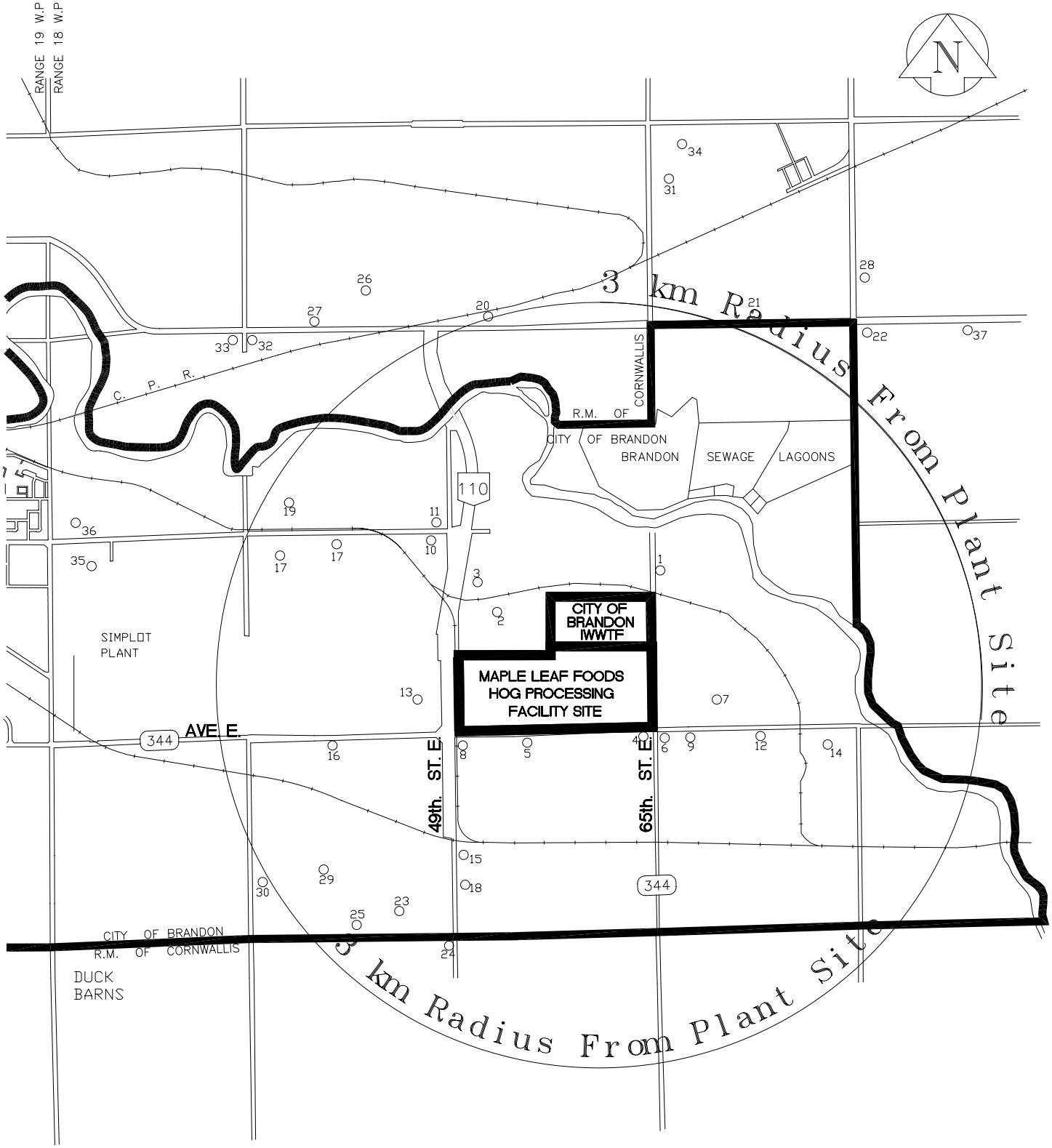

LEGEND

○ APPROXIMATE LOCATION
37 I.D. NUMBER

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Residents Situtated Within 3km of The City of Brandon Expanded IWWTF

designed	scale	yyyy/mm/dd
CB	N.T.S.	2003/03/12
drawn	project no.	
CB	57730	
checked	drawing no.	rev.
SJB	2.6	
approved		
KMA		

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FORM 8.5x11
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2.2 GENERAL PHYSICAL AND ENVIRONMENTAL SETTING

The proposed Industrial Waste Water Treatment Plant expansion and associated operationally improved pretreatment facility are located within the limits of the City of Brandon, Manitoba near the eastern boundary between the City of Brandon and the R.M. of Cornwallis (see Figures 5 and 6).

The topography of the immediate region varies from approximately 358 m above sea level (masl) along the Assiniboine River to 400 masl to the southwest of the City of Brandon. The site itself varies in elevation from 364 masl (1,195 ft) in the southwest corner, falling to 359.75 masl (1,180 ft) in the centre and northward; and, rising again to 367.4 masl (1,205 ft) along the north property line. Figure 2.7 shows the topography of this region to be relatively flat, with a general increase in elevation towards the west.

The environmental setting of most of the easterly portion of the site has been altered considerably to accommodate the Maple Leaf Pork processing plant and the original IWWTF. While the most westerly portion of the property has not been altered significantly other than for the construction of a couple of drainage ditches and the installation of numerous ground water monitoring wells, the eastern portion of the site has been re-graded almost in its entirety. The exception to this is primarily the grassy meadow in the southeast corner of the property. Noise from the plant and additional traffic noise associated with the plant have undoubtedly affected the use of the area by deer and other mammals; and, by most species of birds. Most, if not all, of the disturbance from the original construction and operation of the processing plant and the IWWTF has already occurred; and, as a result, additional disturbance from construction and operation of the expanded IWWTF will have already occurred. All operational improvements to the pretreatment plant occur indoors.

2.3 GEOLOGICAL BACKGROUND

Glacial action followed by deposition processes has created a variety of surface materials. The study area is characterized by reworked till, glaciofluvial; and, glaciolacustrine deposits mainly of sand and gravel (Figure 2.8). This material has been reworked along the Assiniboine River Valley to form floodplains and alluvial fans. The processing facility will be located on sand and gravel glaciofluvial and glaciolacustrine deposits.

The underlying bedrock geology in the immediate vicinity of the proposed site is composed of Cretaceous shales of the Vermilion River formation (Geological Highway Map of Manitoba, 1987). These include carbonaceous shale (Morden Member); speckled calcareous and carbonaceous shale (Boyne Member); thin bentonite beds, carbonaceous shale; and, bentonitic shale (Pembina Member). Bedrock in the vicinity of IWWTF site is about 305 masl (60 m or 200 ft below the surface) (Personal Communication – Mr. Eric Carlson, Manitoba Ground

water Division). More information on soils and geology follow in Section 2.5.3 Soils of the Brandon/Assiniboine Valley Region and Section 2.9 Hydrogeology.

2.4 CLIMATE

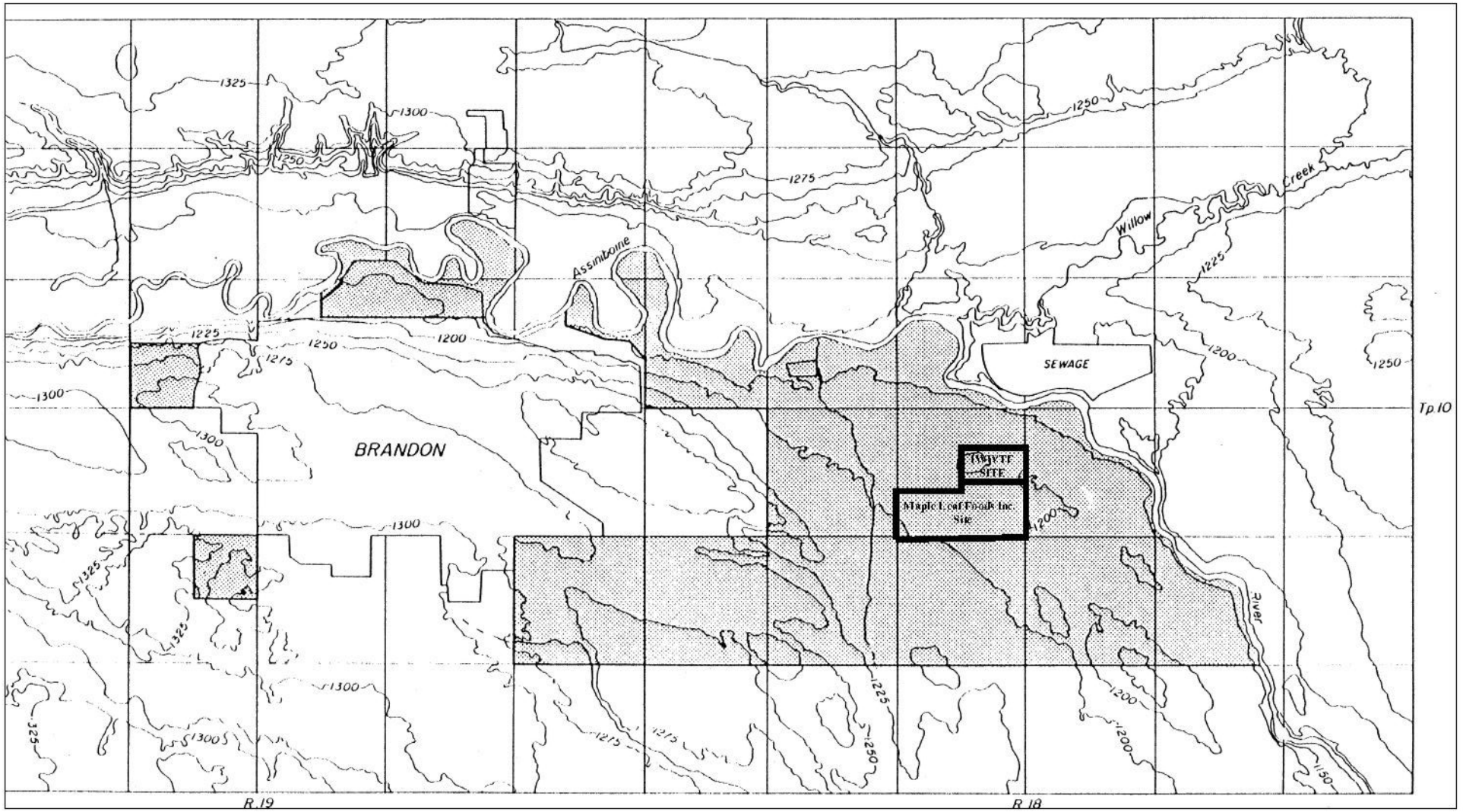
The proposed plant site is located in a subhumid continental climate, which produces winters (November through April) with average temperatures of –9.3°C and summers with average temperatures of 13.2°C. The mean annual daily minimum temperature is –4.3°C and the mean annual daily maximum temperature is 8.1°C. The extreme minimum temperature is –46.7°C and the extreme maximum temperature is 43.3°C (Environment Canada, 1984). The average annual precipitation is approximately 472.0 mm, which is made up of 112.0 cm of snow from generally October through April and 373.1 mm of rain generally from March through October.

The mean monthly temperature and precipitation (Canadian Climate Normals 1971-2000) is shown in Table 2.1. The mean annual number of frost-free days in the area of the site is between 80 and 120 days (Canada Land Inventory, 1966). The location of the meteorological station (Brandon Airport) where the data was recorded is indicated in Figure 2.5.

Table 2.1: Monthly Temperatures and Precipitation – Brandon

Month	Temperature °C	Precipitation mm
January	-18.0	18.0
February	-13.8	14.1
March	-6.4	22.2
April	3.5	31.0
May	11.4	52.7
June	16.1	74.4
July	18.4	75.8
August	17.5	69.2
September	11.4	50.1
October	4.4	27.7
November	-6.1	17.7
December	-14.9	19.2
Annual	**1.9**	**472.0**

Annual, winter and summer wind roses are presented later as Figures 2.9 through 2.11, respectively.



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Relief Map of The Brandon Region

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drawn CB	project no. 57730	
checked SJB	drawing no. 2.7	rev.
approved KMA		

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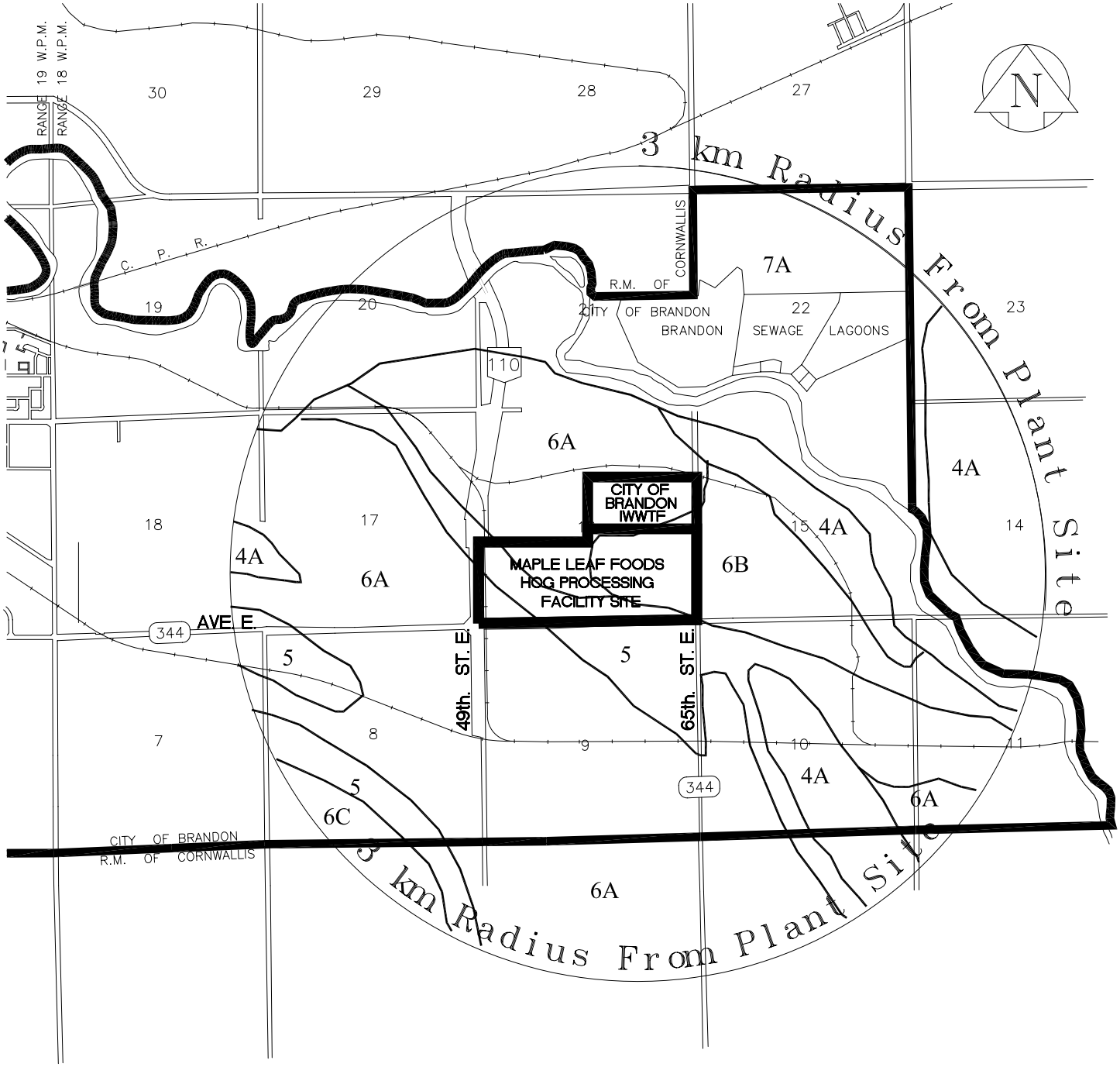

LEGEND

4A - Reworked Tills: Sand and gravel, sand; includes lag concentrates
5 - Glaciofluvial Deposits: Channel fill and terraces; sand with some gravel, poorly sorted sand, silt and clay
6A - Glaciolacustrine: Deltaic-coarse apex deposits; sand and gravel, sand; in some cases interbedded with silt
6B - Glaciolacustrine: deltaic-fine offshore deposits; fine sand, silt; in some cases interbedded with clay
6C - Glaciolacustrine: deep water deposits; clay, silt
7A - Alluvium: flood plains and alluvial fans: poorly sorted sand, silt and clay

Source : UMA 1977

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Surficial Geology Within 3km of The City of Brandon Expanded IWWTF

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CB	N.T.S.	2003/03/12
drawn	project no.	
CB	57730	
checked	drawing no.	rev.
SJB	2.8	
approved		
KMA		

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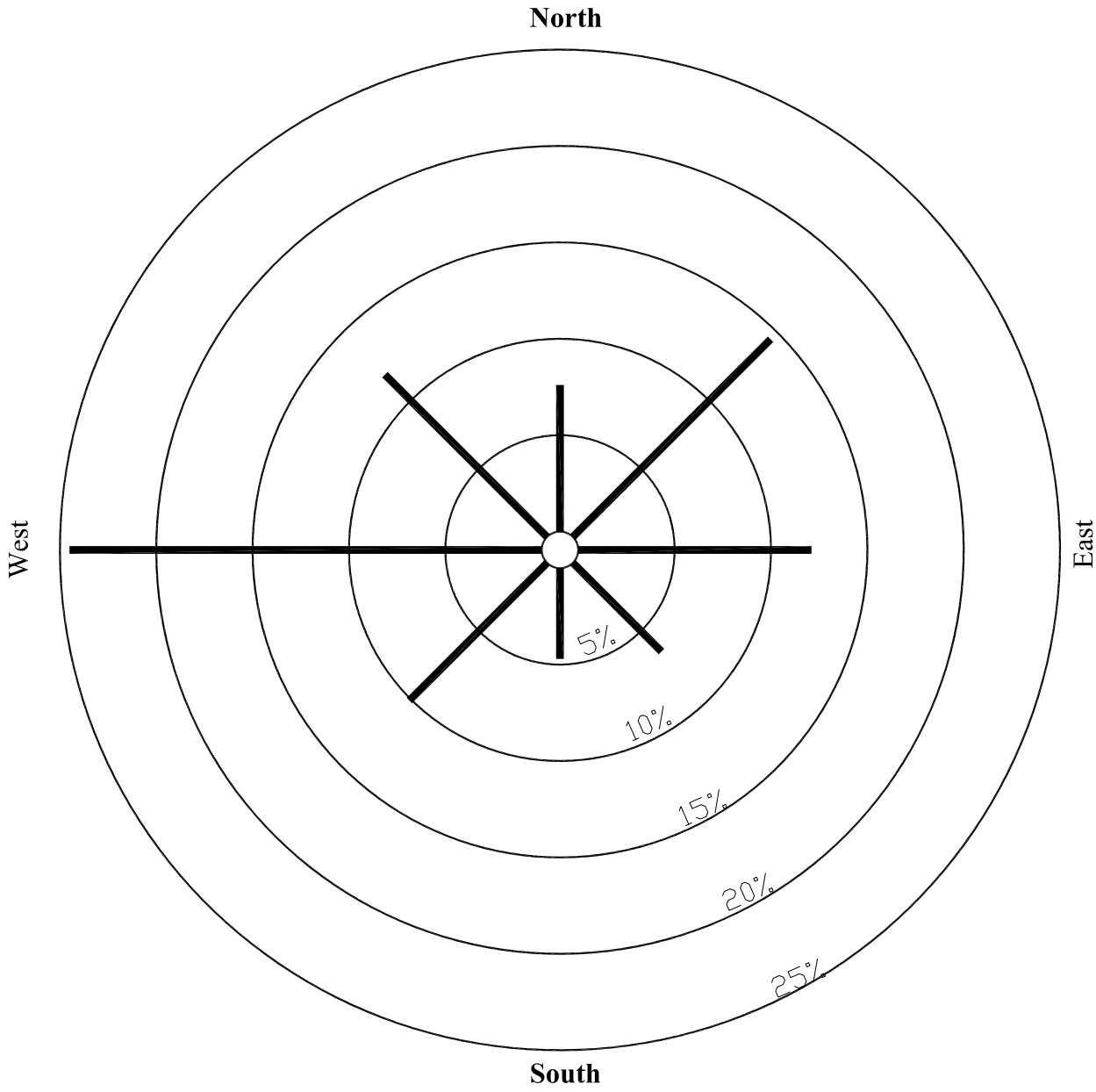
REV. 2002/12/11



DIRECTION	PERCENT FREQUENCY	AVG.SPEED (km/h)
CALM	8.1	
N.	7.6	17.0
N.E.	14.5	18.0
E.	12.1	15.1
S.E.	6.5	16.0
S.	4.7	14.9
S.W.	10.1	16.3
W.	24.5	18.8
N.W.	11.9	19.7

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Annual Wind Rose
Brandon, Manitoba - 1958 to 1982

designed	scale	yyyy/mm/dd
CB	N.T.S.	2003/03/12
drawn	project no.	
CB	57730	
checked	drawing no.	rev.
SJB	2.9	
approved		
KMA		

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FORM 8.5x11
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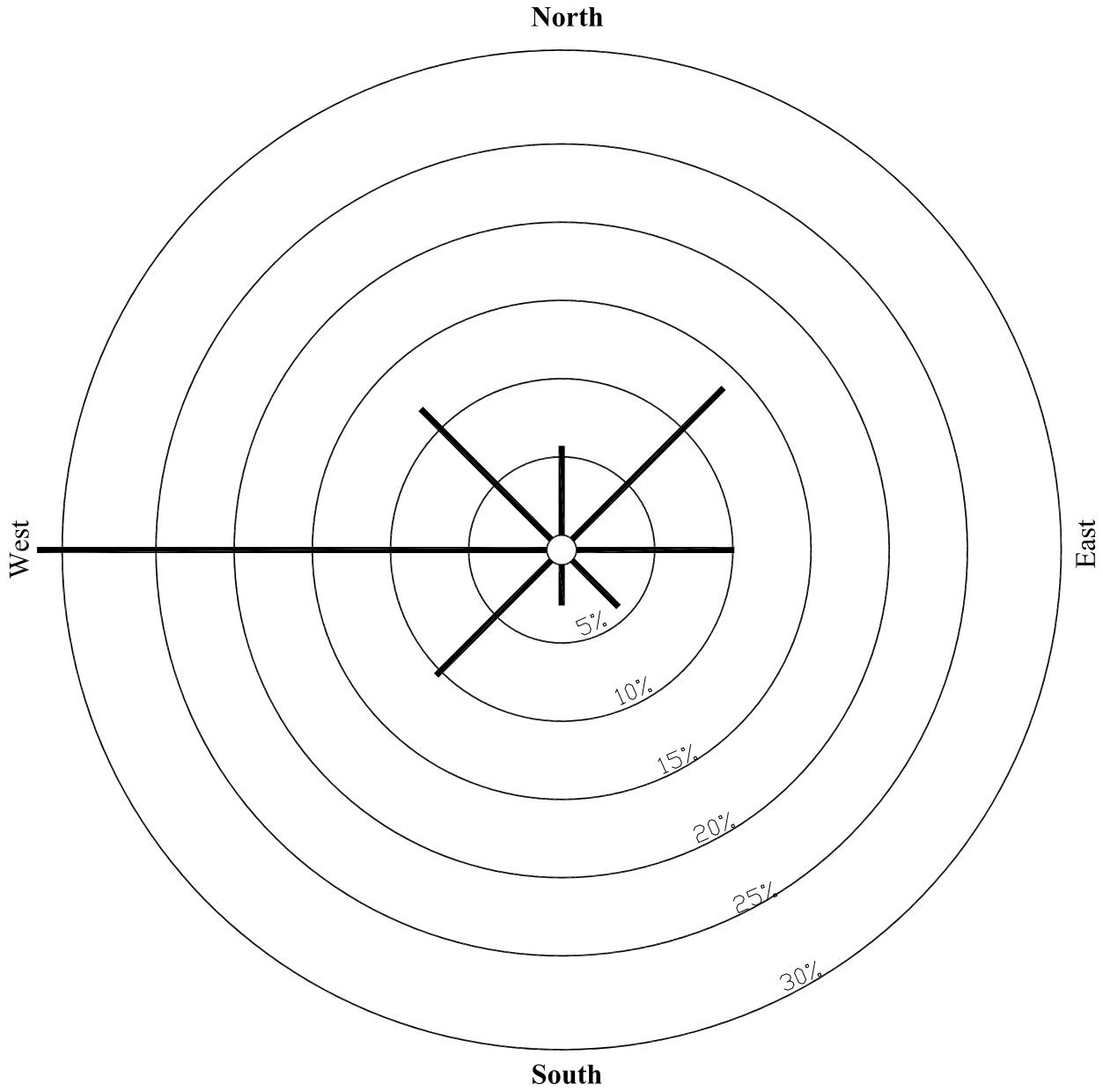

DIRECTION	PERCENT FREQUENCY	AVG.SPEED (km/h)
CALM	9.1	
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N.E.	13.7	15.6
E.	11.1	12.5
S.E.	4.2	12.5
S.	2.6	10.7
S.W.	10.4	13.3
W.	31.6	15.9
N.W.	11.8	16.8

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Winter Wind Rose (Nov - Apr)
Brandon, Manitoba - 1958 to 1982

designed	scale	yyyy/mm/dd
CB	N.T.S.	2003/03/12
drawn	project no.	
CB	57730	
checked	drawing no.	rev.
SJB	2.10	
approved		
KMA		

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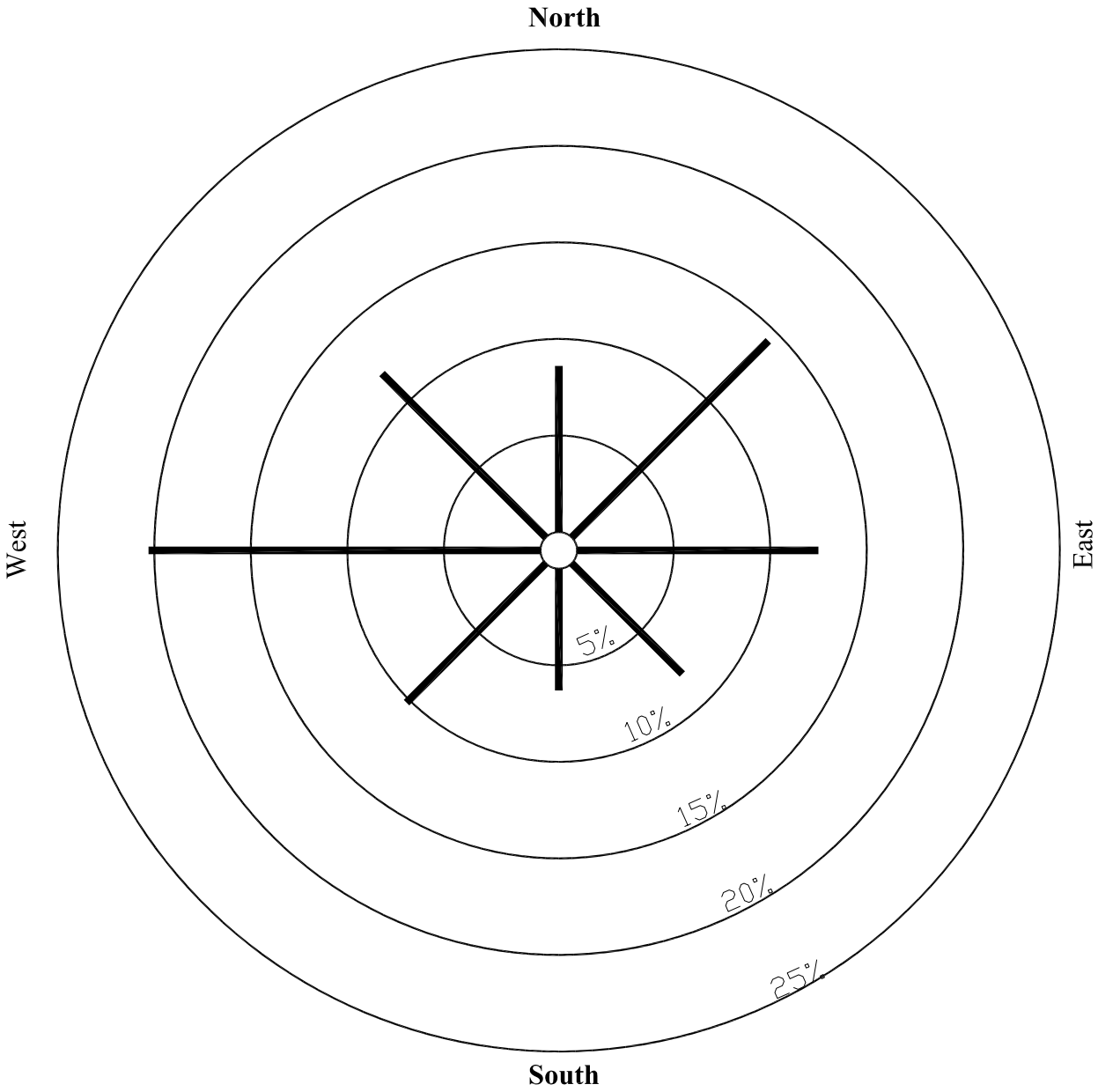

DIRECTION	PERCENT FREQUENCY	AVG.SPEED (km/h)
CALM	7.5	
N.	8.6	16.5
N.E.	14.4	17.0
E.	12.5	14.8
S.E.	8.1	16.4
S.	6.3	16.2
S.W.	10.2	16.6
W.	20.3	18.4
N.W.	12.0	19.0

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Summer Wind Rose (May - Oct)
Brandon, Manitoba - 1958 to 1982

designed	scale	yyyy/mm/dd
CB	N.T.S.	2003/03/12
drawn	project no.	
CB	57730	
checked	drawing no.	rev.
SJB	2.11	
approved		
KMA		

2.5 VEGETATION, SOILS; AND, WILDLIFE

2.5.1 Natural Vegetation: An Overview

The study area (3 km radius from the IWWTF plant site/Maple Leaf Pork) is located within the Aspen-Oak forest of the Boreal Forest Region (Rowe 1972). This area is characterized by groves of trees, interspersed with grasslands. The dominant tree species is aspen while balsam poplar is common in wet areas and bur oak will sporadically occur along rivers. Other common species include white elm, Manitoba maple, eastern cottonwood; and, possibly basswood and black ash. This classification is similar to the Prairie ecozone classification as defined by Zoladski *et al.* (1995). Within the prairie ecozone the study area is classified to be on the border of the prairie and aspen parkland vegetation zones.

The majority of the vegetation communities within the study area have been altered for agricultural or industrial practices (Figure 2.12). Few stands of aspen forest remain except for the Assiniboine River valley. Native grasslands have been cultivated or disturbed through grazing practices. Some areas of native vegetation exist, but these sites have been invaded by agronomic and weed species. Land use activities are dominated by hay and pasture land (1,083 ha, 2,676 acres), annual cropping on cultivated land (346 ha, 855 acres), rangeland dominated by a mixture of pasture and shrub vegetation communities (192 ha, 475 acres); and, open shrub land with low agricultural use (275 ha, 680 acres). The areas have been seeded to agronomic seed mixes, including alfalfa, rye, brome, wheat grass; and, some fescue. Three gravel operations are within the area (337 ha, 833 acres), most of which are inactive. These sites now form depressional areas that have wetland vegetation of bulrushes, sedge; and, aquatic grass species. Industrial sites, roads, railways; and, farmsteads occupy 200 ha (494 acres). Forests occur in a narrow band along the southern bank of the Assiniboine River and cover an area of 62 ha (153 acres). These forests are mainly aspen with a few Manitoba maple. On the northern bank of the Assiniboine River and along Willow Creek northwest of the Brandon Sewage Lagoon is an area dominated by a mixture of forest and shrub cover (104 ha, 257 acres). The sewage lagoon, the Assiniboine River; and, other water storage sites cover an area of 229 ha (566 acres).

The City of Brandon and Maple Leaf sites prior to development contained pasture, an inactive gravel pit and a small grove of aspen. The east field was vegetated with a mixture of brome, quack grass; and, a variety of hay species; and, this field was cut and baled for hay this past summer. The west field, which contains the small aspen stand and had been seeded with alfalfa, rye grass; and, intermediate wheat grass currently, is used as a horse pasture. The northern edge of the west field abuts an inactive gravel pit that is dominated by sedges, bulrushes; and, other aquatic vegetation species. Portions of this area have been reclaimed with fescue, brome; and, intermediate wheat grass. Native vegetation exists in small areas associated with the reclaimed gravel pit and these have been invaded by leafy spurge.

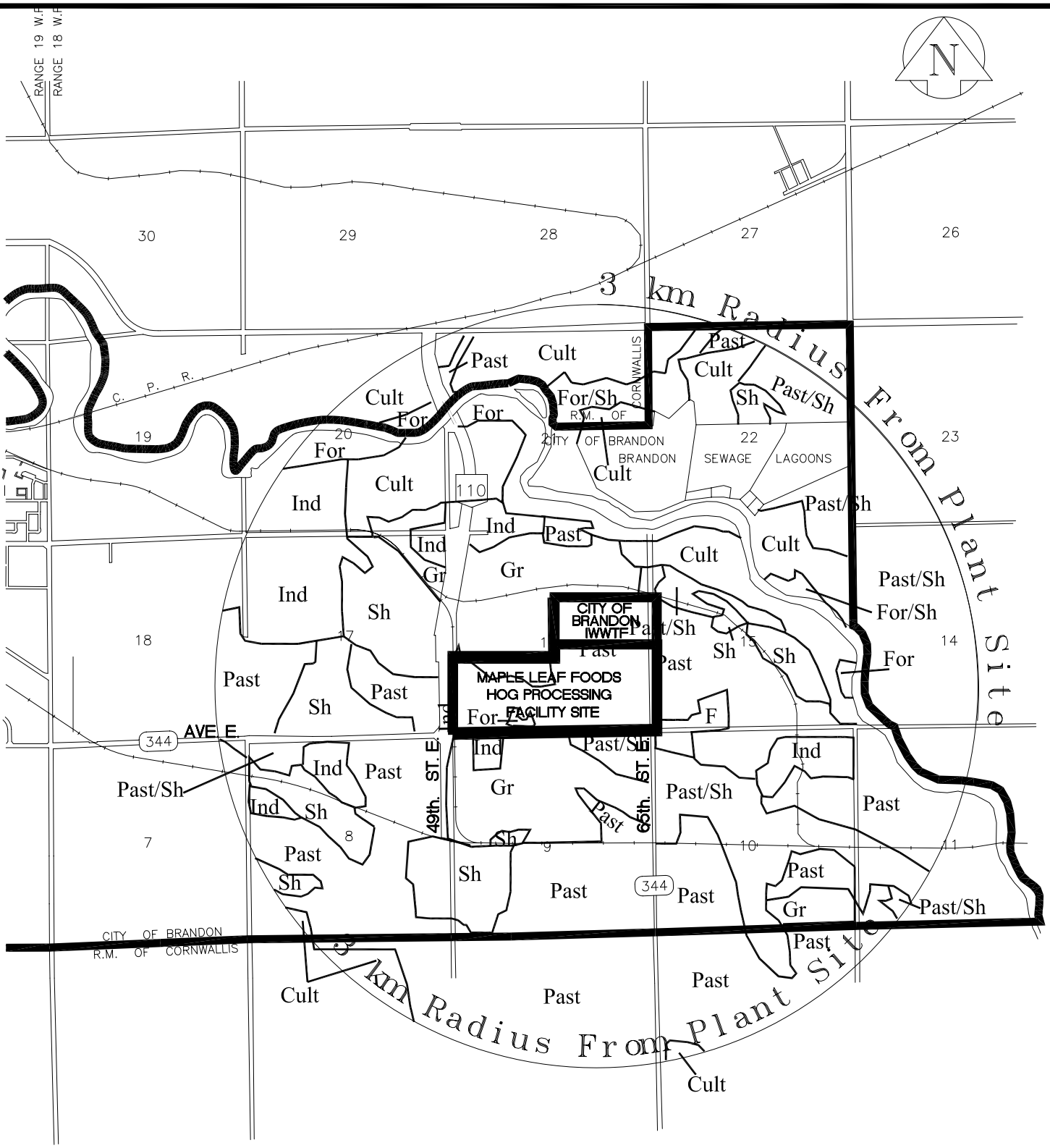
Previous vegetation and rare plant studies within the vicinity of the City of Brandon/Maple Leaf site had not identified any rare species to occur within the vegetation communities that would have been disturbed for the construction or operation of the IWWTF plant (Cochrane Environmental 1997). There are several rare plants that may occur within undisturbed vegetation communities within the region (Table 2.2).

Table 2.2: Rare Plants Within the Vicinity of the IWWTF Site

Scientific Name	Common Name	Habitat
Andropogon hallii	Sand bluestem	Dry prairies and sandhills
Aristida longiseta	Red three-awn	Dry plains and gravelly slopes
Arnica fulgens	Shining arnica	Moist meadows and gravelly prairies
Astragalus lotiflorus	Low milk vetch	Dry slopes and prairies
Carex hookerana	Hooker's sedge	Dry prairies and plains
Carex laxiflora var. blanda	Pleasing sedge	Meadows, thickets and woodlands
Clematis virginiana	Virgin's-bower	Thickets and forest edges
Lomatium orientale	White-flowered parsley	Dry plains and bluffs
Oryzopsis micrantha	Little-seed rice grass	Open woods, rocky ridges or slopes
Poa cusickii	Early bluegrass	Dry prairie and sandhills
Polansia dodecandra	Clammyweed	Sandy or gravelly soil
Polygala verticillata	Whorled milkwort	Prairie and dry hills
Potentilla plattensis	Low cinquefoil	Moist meadows and prairies
Thermopsis rhombifolia	Golden bean	Dry prairies

Source: White and Johnson (1980)

Notwithstanding the above, it is known that the small white lady slipper *(Cypripedium passerinum*) exists in the area; and, until recently it was the only plant species listed under the Manitoba Endangered Species List. On previous studies of the Eastern By-Pass for the Department of Highways, they were found in greater numbers than expected along the road allowance containing P.T.H. #110 located in the 1.6 km (1 mile) stretch south of the Maple Leaf site and along the old rail beds to the south (Personal Communication – David Hatch, Greenspaces Environmental Consulting). Earth Tech (Canada) Inc. personnel have visited the site numerous times since the summer of 1998 during ground water well installation and monitoring, specifically looking for the small white lady slipper. For example, the old rail bed on the western portion of the site was surveyed. No small white lady slippers have been cited on the property by Earth Tech (Canada) Inc. personnel; and, no sitings have been reported by others.



LEGEND

For - Forest	Gr - Gravel Pit
Sh - Shrubland	Ind - Industrial/Road/Railway
Past - Pasture	F - Farm
Cult - Cultivated	

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Vegetation Within 3km of The City of Brandon Expanded IWWTF

designed CB	scale N.T.S.	yyyy/mm/dd 2003/03/12
drawn CB	project no. 57730	
checked SJB	drawing no. 2.12	rev.
approved KMA		

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The site falls within a zone classified by the Canada Land Inventory as Class 5Sd, indicating the sites on this class are on gently sloping to level, moist clays, loams; and, sands. No factor other than climate limits tree growth.

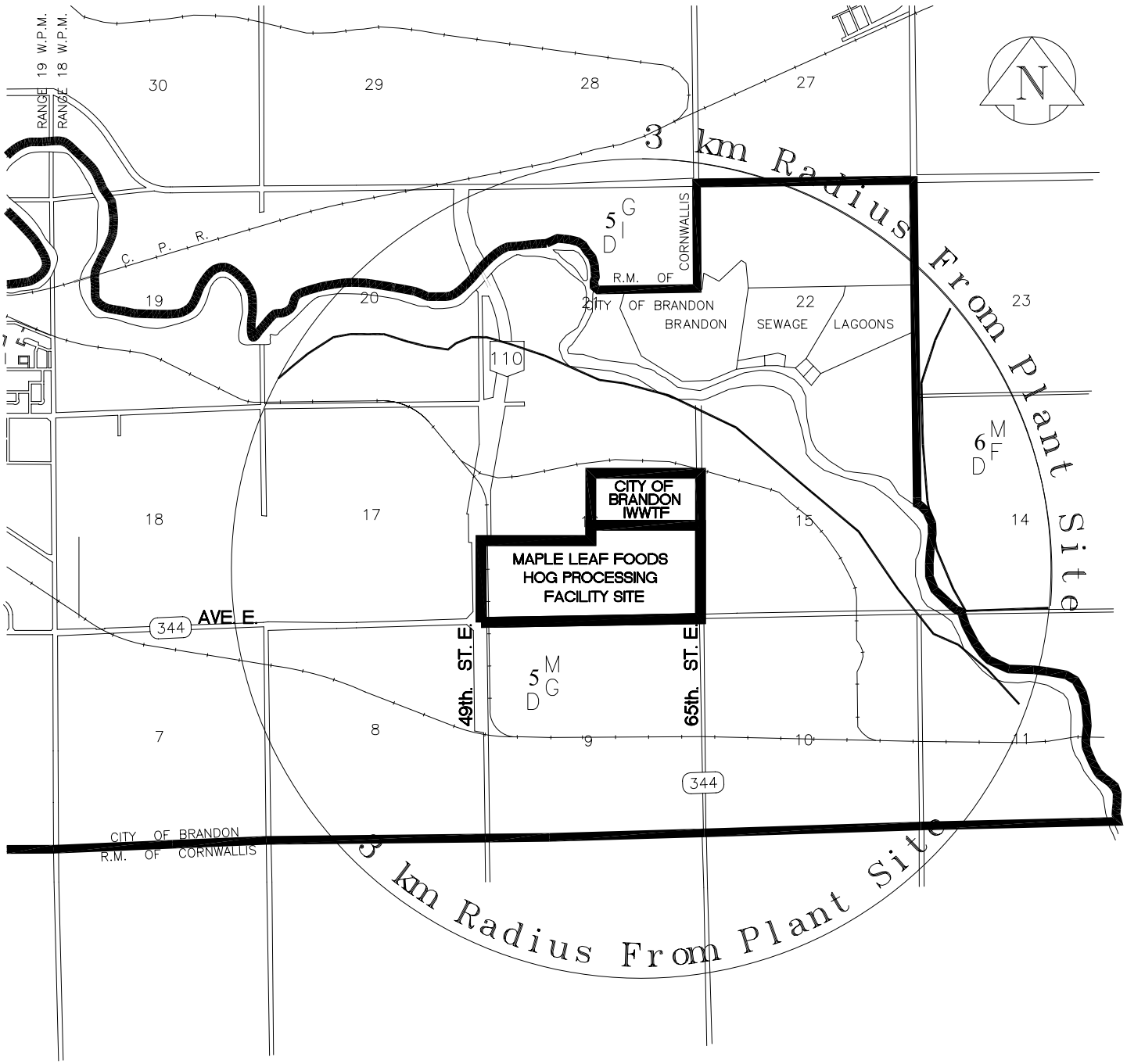
2.5.2 Wildlife: An Overview

The area is located in a transition zone between the prairie and aspen parkland with the result that wildlife habitat is limited to patches of grass, wetlands; and, woodlands along and beside the Assiniboine River. Much of the area has been cleared or disturbed through agricultural and industrial land use even prior to the development of the Maple Leaf Pork processing plant and the IWWTF. Existing habitat at the facility was predominately hayfield prior to development; and, large portions of both hayfield and pasture still exist on the site. Wildlife species commonly found in the area reflect the existing land use and are largely restricted to those species, which have adapted to human activities. Key wildlife species expected to occur near the facility include ungulates (deer), carnivores (coyote, fox; and, weasel), furbearers (beaver and muskrat) small mammals (jackrabbit, snowshoe hare; and, mice), songbirds; and, waterfowl. White tailed deer, crows, magpies and sharp tailed grouse were all identified on the site during site visits.

Due to poor quality habitat the capability for ungulates in the study area including the facility site is rated as having severe limitations (Class 5) from landform and adverse topography (Figure 2.13), (CLI 1974a). Better ungulate habitat covering about 25% of the study area occurs along the river valley.

Areas where deer travel patterns cross roadways can have high incidences of mortality due to collisions with vehicles. Deer mortality statistics can provide further evidence of crossing locations, as well as identifying potential road safety issues. Statistics from the RCMP (Brandon area) and Brandon Police Department prior to the Maple Leaf Pork processing plant indicated one to two deer deaths from vehicle collisions per year along Richmond Avenue and Highway 110 near the proposed facility site. In comparison, the area at the north end of Brandon (Highway 10) has four to eight deer deaths per year mostly during the winter months. A recent (July 2002) telephone call to the Brandon Police Department indicated there has been a noticeable increase in deer kills on Richmond Avenue since Maple Leaf start-up. (Personal Communication – Kelly Pettinger, Animal Control Office, Brandon Police Service). He also indicated there are normally between 50 to 70 deer kills within the City of Brandon annually, with many occurring between October and the end of December.

Waterfowl capability in the study area also has moderate to severe limitations (Classes 5 and 6) due to the flat topography and the lack of wetlands (Figure 2.14), (CLI 1970). The better waterfowl habitat also occurs along the river valley.



LEGEND

Class 3 - Lands in this class have slight limitations to the production of ungulates

Class 5 - Lands in this class have moderately severe limitations to the production of ungulates

Class 6 - Lands in this class have severe limitations to the productions of ungulates

Subclass F - Fertility - Lack of nutrients in soil for optimum plant growth

Subclass G - Landform - Poor distribution or interspersion of landforms necessary for optimum ungulate habitat

Subclass I - Inundation - Excessive water level fluctuation or tidal action that adversely affects the habitat or survival of ungulates

Subclass M - Soil Moisture - Poor soil moisture, either excessive or deficient.

Subclass T - Adverse Topography - Either steepness or flatness of the land

Species D - Deer (white-tailed deer, mule deer)

Source : CLI 1974

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Land Ungulate Capability Within 3km of The City of Brandon Expanded IWWTF

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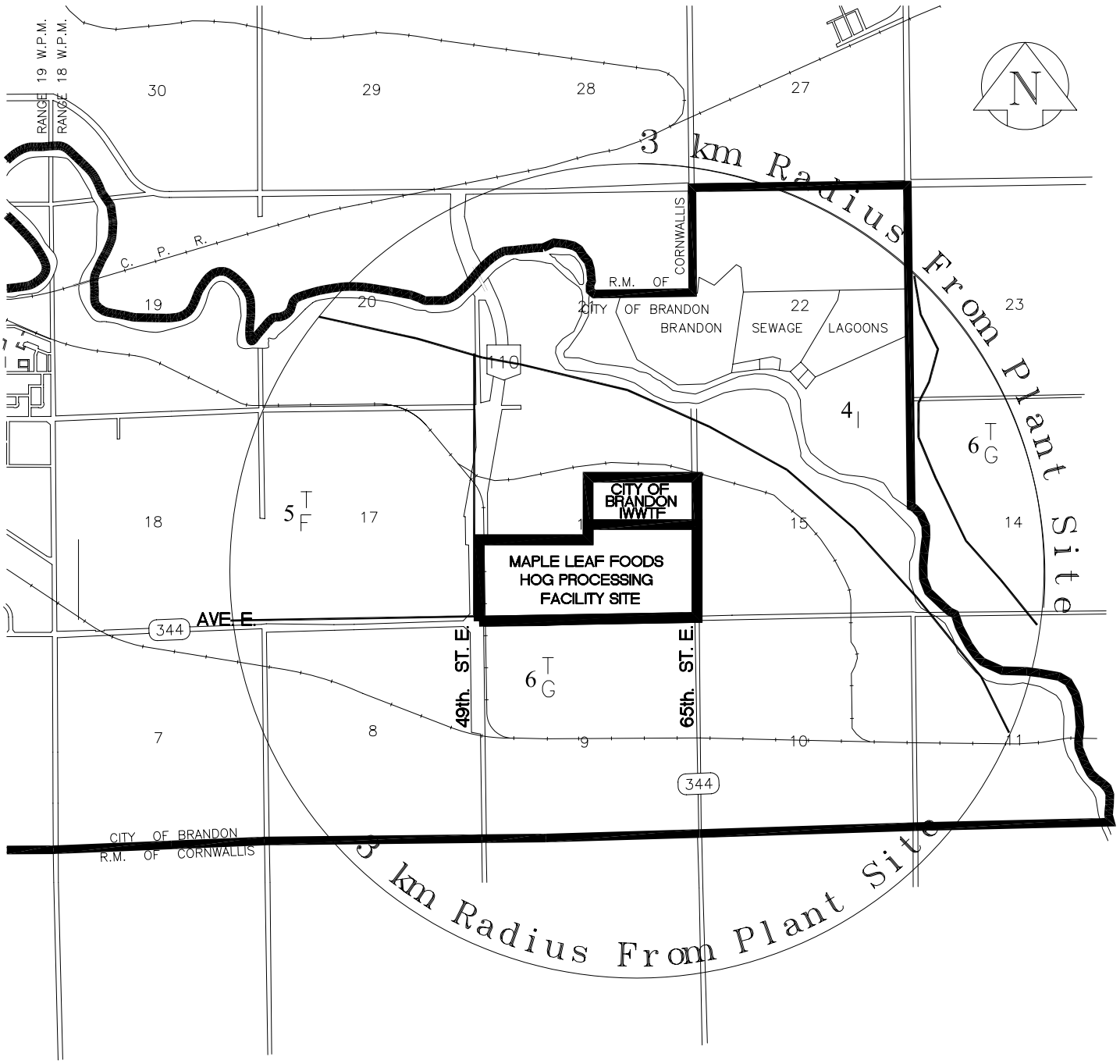

LEGEND

Class 4 - Lands in this class have moderate limitations to the production of waterfowl

Class 5 - Lands in this class have moderately severe limitations to the production of waterfowl

Class 6 - Lands in this class have severe limitations to the productions of waterfowl

Subclass F - Fertility - The limiting factor is Insufficient nutrients in the soil and water for plant growth

Subclass G - Landform - Poor distribution or interspersion of marshes or basins may be a limiting factor of the land and may prevent the development of optimum waterfowl habitat

Subclass I - Inundation - The limiting factor is excessive water level fluctuation or tidal action, which adversely affects the habitat or nesting success of waterfowl

Subclass T - Adverse Topography - Either steepness or flatness of the land may limit the development or permanency of wetlands

Source : CLI 1970

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Waterfowl Capability Within 3km of The City of Brandon Expanded IWWTF

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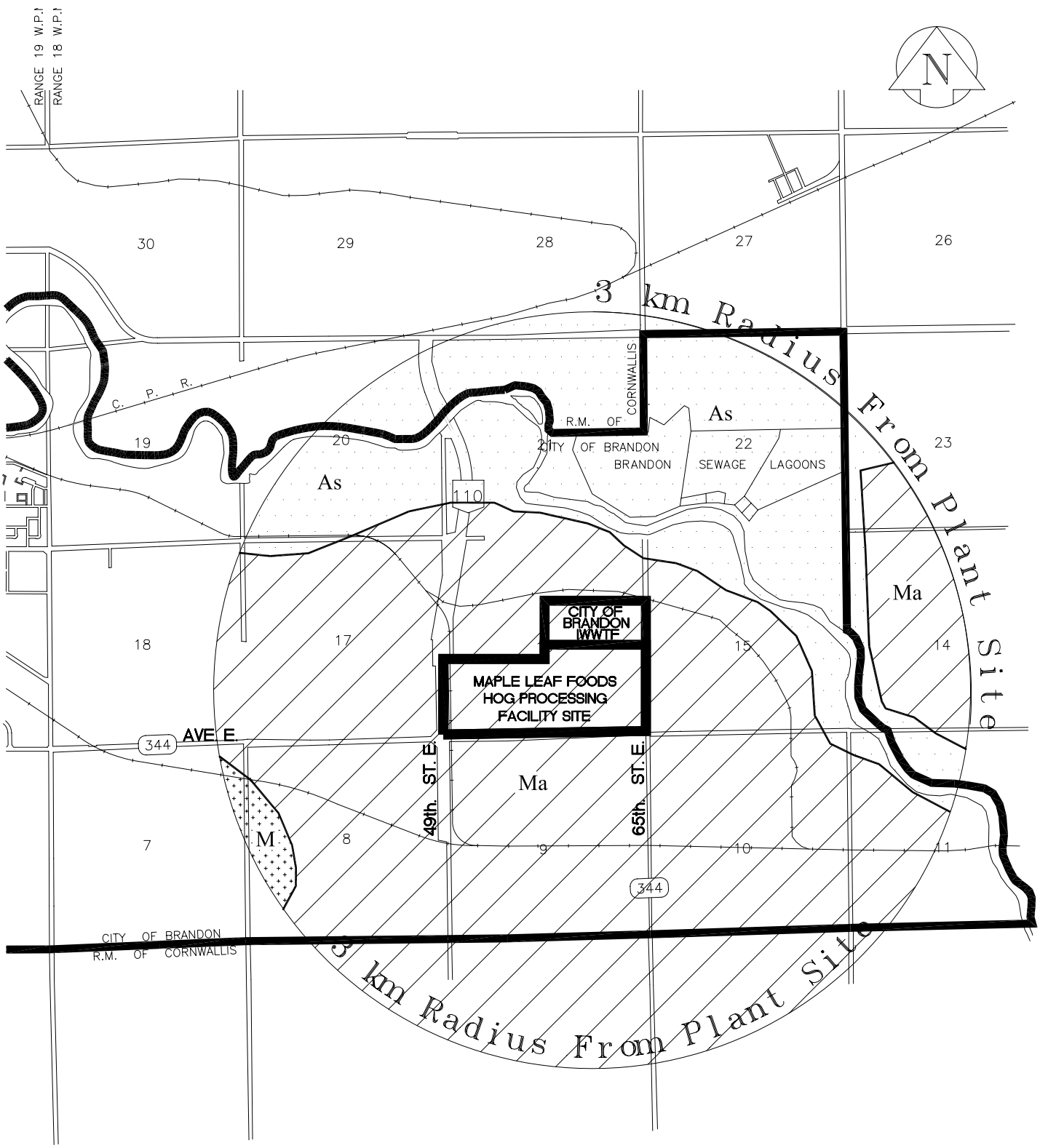

LEGEND

- As - Assiniboine Association
- M - Miniota Association
- Ma - Maringhurst Association

Source : Ehrlich et al 1957

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Soil Associations Within 3km of The City of Brandon Expanded IWWTF

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2.5.3.3 Miniota Association

The Miniota soils occupy a minor portion of the southwest fringe of the study area. These soils occur on undulating to level terrain. Soil drainage is very rapid due to the sand to sandy loam surface texture. The soils are developed on sandy and coarse sandy outwash deposits that may be gravelly with increasing depth. Within the study area, the soils are within the sandy loam textural type that has a characteristic Ah horizon between 18 and 33 cm in thickness. This layer is very friable and has a neutral pH. The B layer has a loamy sand texture with a weak subangular blocky structure. The pH varies from neutral to slightly acidic. The parent material is a calcareous, loamy sand that is moderately alkaline.

The fertility of these soils varies with surface texture although there is generally limited natural fertility. The soils are prone to severe wind erosion and are best utilized for pasture. Limited grain production is possible.

2.5.3.4 Land Capability for Agriculture

According to the Canada Land Inventory (CLI), mineral soils are grouped into seven classes according to soil survey information. Classes 1, 2; and, 3 are considered to be suitable for sustained production of field crops; Class 4 is considered to be marginal; Classes 5 and 6 are considered useable but not generally suitable for crop production. The area of the site is classified as Class 5; that is, soils in this class have severe limitations that restrict their capability of producing perennial forage crops, but improvement practices are feasible.

The land capability for agriculture within the study area varies from areas with moderate to very severe limitations (Figure 2.16), (CLI 1974b). The majority of the area, including the existing and proposed IWWTF plant sites and the existing Maple Leaf Pork plant site and the pretreatment site, is classed as soils with very severe limitations (Class 5) due to soil moisture limitations (1,681 ha, 4,154 acres). At the southeast fringe of the study area, the soils are classed as having severe limitations that restrict crops due to soil moisture (486 ha, 1,201 acres). The Assiniboine River valley has the best soils within the study area. These soils are classed as having moderate to moderately severe land capabilities for agriculture with some limitations to soil moisture and excess water (435 ha, 1,075 acres). The Assiniboine River and the Brandon Sewage Lagoons area located within this area (225 ha, 556 acres).

The limitations of land capability within the study area limit most agriculture to hay production. Most of the annual crop areas identified in this study area are located in the Assiniboine River valley where the better soils are located.

2.5.3 Soils of the Brandon/Assiniboine Valley Region

The study area includes three soil associations (Figure 2.15) (Ehrlich *et al.* 1957). The predominant soil association is the Marringhurst, which occupies most of the upland area and includes the proposed Maple Leaf plant site (1,996 ha, 4,932 acres). The Assiniboine association covers an area of 577 ha (1,426 acres), which includes the Assiniboine River and the Brandon Sewage Lagoons, which have a combined area of 225 ha (556 acres). The Miniota soil association only occurs on the southwest fringe of the study area (30 ha, 74 acres). The Marringhurst and Miniota soil associations are Black Chernozems while the Assiniboine soils are classified as Regosolic.

2.5.3.1 Marringhurst Association

The Marringhurst soils occur on level to gently undulating topography and are the dominant soils outside of the Assiniboine River valley. The areas are well to rapidly drained except for remnant stream channels where drainage is poor due to seepage along adjacent gravel deposits. The soils have developed on outwash deposits of shale, limestone; and, granitic rock that includes gravel and sand. The surface textures are coarse, varying from loamy sand to sandy loam. With depth, the texture becomes coarser.

Common horizon features include an Ah horizon from 8 to 18 cm in thickness. This layer is generally loamy sand with a weak granular structure that is very friable. The pH is neutral to mildly alkaline. Underlying this layer is a transitional layer between the A and B horizon, classed as AB. This layer has an increasing amount of sand making it more friable. The pH is similar to the surface layer. The B horizon varies in texture from loamy sand to coarse sand. There is a weak blocky structure and the pH remains slightly alkaline. The parent material is calcareous and moderately alkaline.

These soils have low natural fertility and moisture retention capacity. The friable surface materials are prone to wind erosion and best retained in permanent vegetation cover.

2.5.3.2 Assiniboine Association

The soils of the Assiniboine Complex have a wide range of textures ranging from loamy sand to clay. The soils have developed on alluvial deposits along the broad valley floor of the Assiniboine River. Topography in the valley is complex and irregular, including, terraces, oxbows; and, remnant stream channels. Drainage varies based on the texture of the parent material. Soil development is weak and many soils are considered to be juvenile. These soils are moderately to very fertile and provide excellent agricultural opportunities if drainage is adequate. Much of the valley has irregular topography, which precludes intensive agricultural practices, but the area is generally suitable for pasture.

2.5.3.3 Miniota Association

The Miniota soils occupy a minor portion of the southwest fringe of the study area. These soils occur on undulating to level terrain. Soil drainage is very rapid due to the sand to sandy loam surface texture. The soils are developed on sandy and coarse sandy outwash deposits that may be gravelly with increasing depth. Within the study area, the soils are within the sandy loam textural type that has a characteristic Ah horizon between 18 and 33 cm in thickness. This layer is very friable and has a neutral pH. The B layer has a loamy sand texture with a weak subangular blocky structure. The pH varies from neutral to slightly acidic. The parent material is a calcareous, loamy sand that is moderately alkaline.

The fertility of these soils varies with surface texture although there is generally limited natural fertility. The soils are prone to severe wind erosion and are best utilized for pasture. Limited grain production is possible.

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The limitations of land capability within the study area limit most agriculture to hay production. Most of the annual crop areas identified in this study area are located in the Assiniboine River valley where the better soils are located.

2.6 PLANT SITE

Land use of the plant site prior to Maple Leaf Pork and the original IWWTF was pasture on the SW¼ 16 - 10 -18WPM and irrigated haylands on the remainder of the proposed site. The SW¼ contains a couple of small areas of bush towards the south boundary (Richmond Avenue) and a lone tree towards the west. An irrigation system originally sat on the eastern portion of the site prior to the Maple Leaf Pork development.

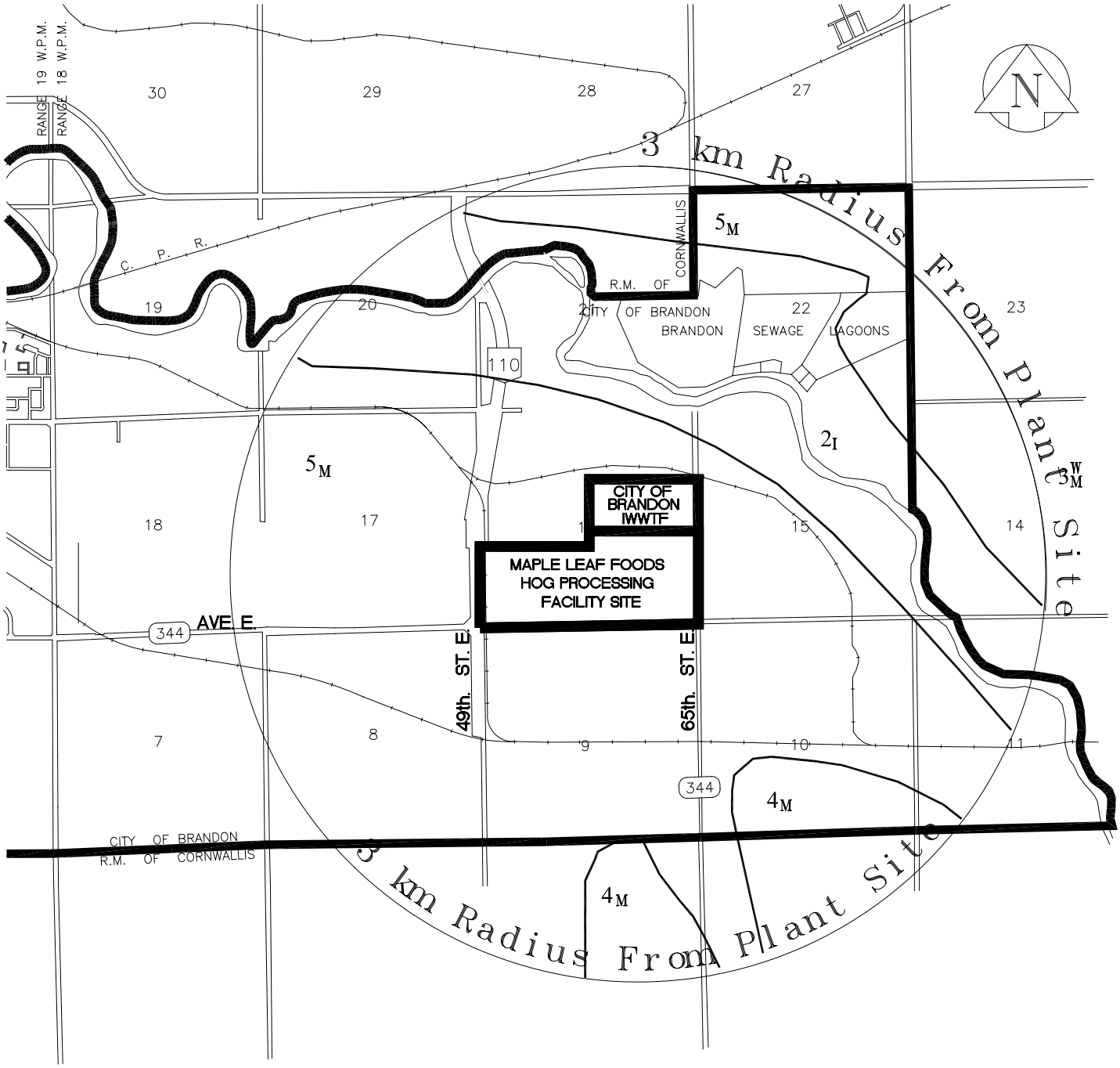
The surficial soils of the site are very mixed and comprise a total of at least seven types of soils over the site area. The site contains at least patches of Capell Series (CXT), Croyon Series (CYN), Dorset Series (DOT), Hummerston Series (HMO) Kilmury Series (KUY), Melland Series (MXT); and, Stockton Series (SCK) soils (Podolsky, 1984). The common characteristic of these soils is that they have developed over lacustrine and/or fluvial sediments and are often less than 1 m (3.28 ft) in thickness.

2.7 HYDROLOGY

The subject site is located in the Assiniboine River drainage basin and within 1 km (0.6 miles.) of the Assiniboine River. At Brandon, 55.8% of the Assiniboine River basin area is contributing. The average daily flow in Brandon (Personal Communication – M. Kowalchuk, Environment Canada) is 32.9 m^3/s (1,160 cfs); the maximum daily flow is 651 m^3/s (22,970 cfs); and, the lowest $_7Q_{10}$ flow (4.237 m^3/s; or, 150 cfs) occurs in late September (Personal Communication - C. Moche, Manitoba Conservation.). A $_7Q_{10}$ flow is defined as the average flow over a 7-day period with a return frequency of once every 10 years. Flows have recently (July 25, 2002) been very low (240 c.f.s or 6.8 m^3/s) on the Assiniboine River at Brandon.

2.7.1 Site Drainage

There is only one (1) second order provincial drain in the vicinity of the proposed plant and it is located on the adjacent sections to the west of the City of Brandon/Maple Leaf site (Section 16, Twp. 10, Range 18W); namely, Sections 9 and 20. The location of this drain is shown in Figure 2.17; and, this drain is used largely by Simplot to discharge its effluent to the Assiniboine River. Natural drainage on the City of Brandon/Maple Leaf site flows from the northeast and from the southwest towards the middle of the site, then northwesterly towards a marshy area just beyond the northern property line. Similarly, along Richmond Avenue, ditch flow presently carries water to near the centre of the site, where it flows overland also towards the marshy area to the northwest. This marshy area drains to the northwest to the secondary drain or along highway ditches and into the Assiniboine River. A very small area in the northeast corner of the site and along the north boundary of the site on the east side, also drains directly overland in a northeasterly direction to the Assiniboine River.



LEGEND

Class 2 - Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices

Class 3 - Soils in these class have moderately severe limitations that restrict the range of crops or require special conservation practices

Class 4 - Soils in this class have severe limitations that restrict the range of crops or require special conservation practices, or both

Class 5 - Soils in this class have very severe limitations that restrict their capability to produce perennial forage crops, and improvement practices are feasible

Subclass I - Inundation - Flooding by streams or lakes limits agriculatural use

Subclass M - Moisture - A low moisture holding capacity, caused by adverse inherent soil characteristics, limts crop growth (not to be confused with climatic drought)

Subclass W - Excess Water - Excess water other than from flooding limts use for agriculture. The excess water may be due to poor drainage, a high water table, seepage or runoff from surrounding areas.

Source : CLI 1974

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Land Agricultural Capability Within 3km of The City of Brandon Expanded IWWTF

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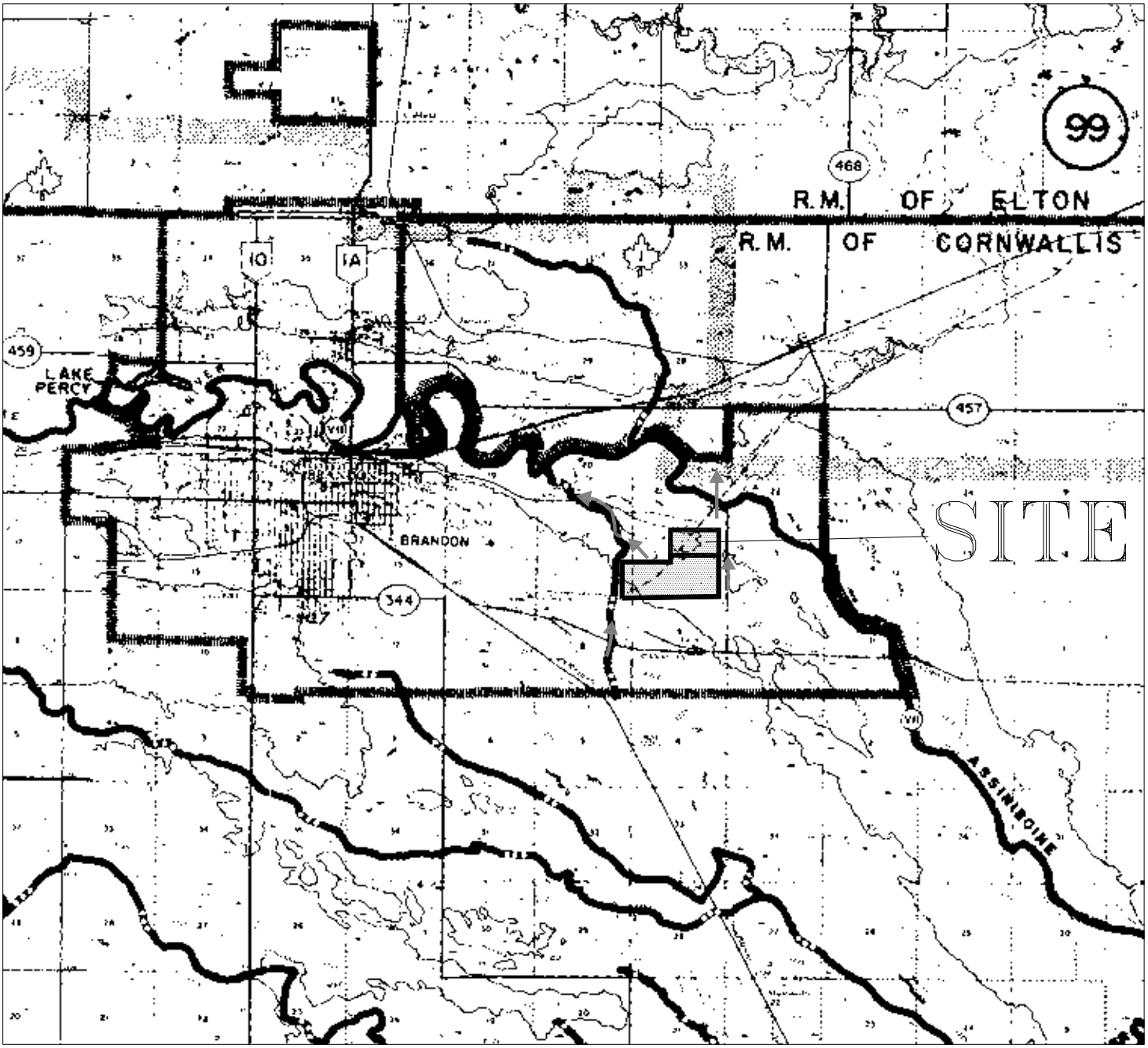

↖ Approximate Drainage Pattern

Source: Plan of Little Souris and Adjacent Area Watersheds
Province of Manitoba Department of Mines, Natural Resources
and Environment: Water Resources Division

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Typical Drainage Patterns Near The City of Brandon Expanded IWWTF

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The Stellar Group, the original prime consultant for the plant, designed a drainage plan in 1998 for the site as shown in Figures 2.18 and 2.19. The gravel pits on the site are also used as stormwater retention basins, so that peak post-development discharge is equal to or less than the pre-development peak discharge. Therefore, the impact of the proposed original development on downstream drainage was predicted to be extremely minor and insignificant. No changes to the existing drainage system will occur to accommodate the improved pretreatment plant or the expanded IWWTF. Some disturbance of vegetation near the existing drainage ditch may occur as a result of construction, but such areas will be re-vegetated immediately after construction. Therefore, the impact of the expanded IWWTF and improved pretreatment facility on the drainage system will be minor and insignificant.

2.7.2 Assiniboine River

The Assiniboine River originates in south-central Saskatchewan and flows southeastward draining about 91,300 km^2 of Saskatchewan (17,900 km^2 via mainstem, 51,000 km^2 via the Qu'Appelle River; and, 22,400 km^2 via the Souris River), about 21,600 km^2 of North Dakota and 41,100 km^2 of Manitoba at its confluence with the Red River. The Souris River with a total drainage area of over 61,100 km^2 joins the Assiniboine River just downstream of Wawanesa, Manitoba. The Qu'Appelle River confluence with the Assinboine River is located just inside the Manitoba-Saskatchewan border west of St. Lazare, Manitoba. The Qu'Appelle River is the second largest tributary with a drainage area of 51,000 km^2. At Brandon, the total drainage area of the Assiniboine River is 86,000 km^2. A sketch of the Assiniboine River Basin is shown in Figure 2.20.

At Brandon, the main contributors of water to the Assiniboine River are controlled releases from the Lake of the Prairies via the Shellmouth Dam followed by the Qu'Appelle River. Other significant tributaries of the Assiniboine River upstream of Brandon are the Shell, Birdtail and Little Saskatchewan rivers. Downstream of Brandon the significant tributaries to Portage la Prairie are the Souris River, ground water from the Carberry Aquifer, which exists from Brandon to approximately the community of Lavenham, the Little Souris River, Epinette Creek and the Cypress River. The ground water from the aquifer enters the river via springs, which may discharge either above or below the surface of the river. The Little Souris River, Epinette Creek and the Cypress River do not provide significant flow during the winter.

The river study area for the purposes of this proposal is the Assiniboine River from Brandon to Portage la Prairie a river distance of about 300 km. Flows in the Assiniboine River in this reach naturally would be quite varied, but have been moderated in Manitoba by the construction of the Shellmouth Dam and creation of the Lake of the Prairies reservoir. The Shellmouth Dam is located about 450 river km upstream of Brandon and is currently operated to assure the City of Brandon a minimum flow of 2.83 m^3/s (100 cfs) and a minimum flow at Headingly of 5.67 m^3/s (200 cfs).

Flows at Brandon now range in general from a controlled daily minimum flow of 2.83 m^3/s (100.0 cfs) to the maximum peak flow at Brandon of 651 m^3/s (22,967 cfs) recorded on May 7th, 1923. A similar high flow of 617 m^3/s (21,768 cfs) was recorded on April 18th, 1976. Recorded flow data exists at Brandon since 1906. Analysis of the flow data by Water Branch, Manitoba Conservation describes the low flow characteristics of the Assiniboine River in terms of the flow data required for the assessment under the Manitoba Water Quality Standards, Objectives; and, Guideline (MWQSOG) models to be described later. The relevant low flow data is characterized by ${}_aQ_b$ flows where "a" is the number of days used in the average flow calculation and "b" is the interval of years over which the average is expected to occur. In this case, it was agreed the study would be based on the following low flows:

- ${}_1Q_{10}$: The lowest average flow rate over a one-day period that would be expected to occur within a ten-year period. (Daily minimum flow)
- ${}_7Q_{10}$: The lowest average flow rate over a seven-day period that would be expected to occur within a ten-year period. (Weekly minimum flow)
- ${}_{30}Q_{10}$: The lowest average flow over a 30-day period that would be expected to occur within a ten-year period. (Monthly minimum flow)

For the Assiniboine River near Brandon the above-defined discharges for the regulated flows adjusted for current operating methods used at Shellmouth Dam are given in Table 2.3 as provided by the Water Resources Branch.

Table 2.3: Minimum and Median Flows for Assiniboine River based on Present Regulated Flows at Brandon

Period	${}_1Q_{10}$ (cms)	${}_7Q_{10}$ (cms)	${}_{30}Q_{10}$ (cms)
January	6.03	6.14	6.44
February	6.11	6.18	5.60
March	2.83	3.11	5.74
April	3.96	6.04	9.65
May	5.27	5.78	6.55
June	4.51	4.92	5.78
July	4.02	4.43	5.56
August	3.83	3.92	3.79
September	2.83	3.00	3.34
October	2.83	3.00	4.32
November	3.65	4.60	5.77
December	5.29	5.60	6.27
Open Water	2.83	2.87	3.35
Winter	2.83	3.06	4.64
Water Year	2.83	2.86	3.22

LIMIT OF CONSTRUCTION

DITCH RELOCATED

EFFLUENT LINE

FROM 65TH STREET TO EAST LINE OF FENCING C-BASE, A-BASE, DITCHING, TOPSOIL, AND SEEDED ADJACENT ROADWAY DITCHES

16m x 600 CSP

LIMIT OF CONSTRUCTION

LIMIT OF CONSTRUCTION

LIMIT OF CONSTRUCTION

LIMIT OF CONSTRUCTION

12 13 14 21 22 23 24 25 26

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REID CROWTHER & PARTNERS LIMITED
WINNIPEG

AS-BUILT

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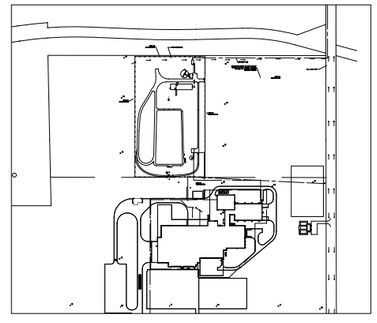

150 mm WM	WATERMAIN	150 mm WM		LIGHT STANDARDS			CULVERTS	
	TELEPHONE		500#	TREE		⊗	VALVE	⊗
300mm LDS	LAND DRAINAGE SEWER	300mm LDS		FENCE		◇	HYDRANT	✦
300mm WWS	WASTEWATER SEWER	300mm WWS	←	ANCHOR		69.000	ELEVATION	69.000
	SUB-DRAIN		•	POLE			TEST HOLE, MONITORING WELL	
	HYDRO (ELECTRICAL)		○	MANHOLE	●		SURVEY BAR	
	PROPERTY LINE		□	CATCH BASIN	■		ASPHALT	
	GAS		▽	CATCH PIT	▼		CONCRETE	
existing	plan – legend	proposed	existing	plan – legend	proposed	existing	plan – legend	proposed

revision	by	app.

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City of Brandon IWWTF
Existing Site Drainage

MAPLE LEAF FOODS INC.

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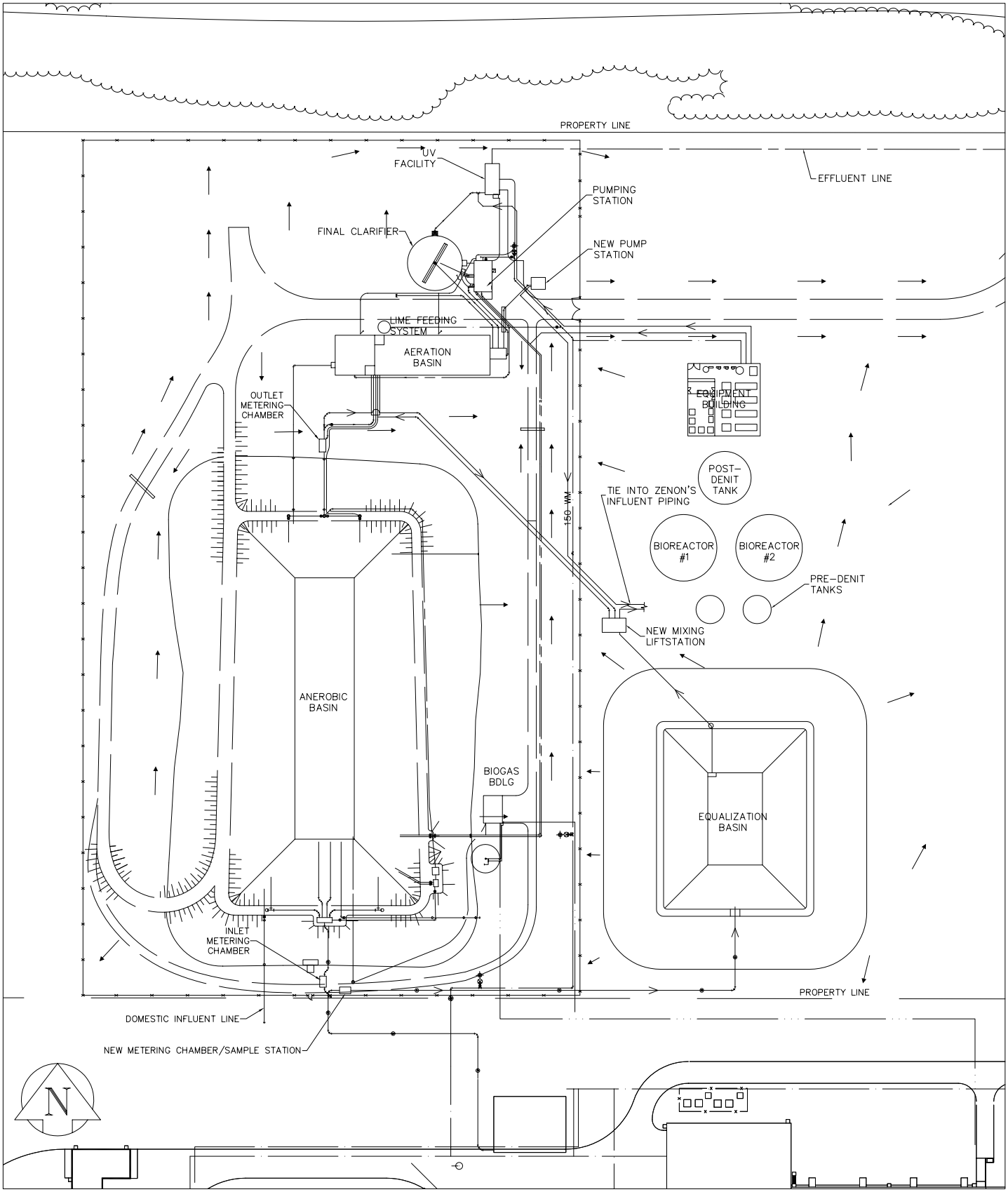

MAPLE LEAF FOODS INC.

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General Site Drainage at The City of Brandon Expanded IWWTF

designed CB	scale N.T.S.	yyyy/mm/dd 2003/03/11
drawn CB	project no. 57730	
checked SJB	drawing no. 2.19	rev.
approved KMA		

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Source: Upper Assiniboine River Basin Study Summary and recommendations; Environment Canada, Sask Water, Manitoba Conservation

no.	yyyy/mm/dd	revision	app.

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Assiniboine River Drainage Basin

designed CB	scale N.T.S.	yyyy/mm/dd 2003/03/13
drawn CB	project no. 57730	
checked SJB	drawing no. 2.20	rev.
approved KMA		

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The above flows have been adjusted from those flows actually recorded at Brandon to reflect the present-day operating methods being used for the Shellmouth Dam. Therefore, the above numbers are derived from the computer-adjusted data set by the Water Branch, Manitoba Conservation.

2.7.2.1 Point and Non-Point Sources

The three largest point sources of ammonia and oxygen-consuming substances (i.e., biochemical oxygen demand, BOD) within the study area during the winter are the waste water discharges from the Brandon Municipal Waste Water Treatment Facility (WWTF), the Industrial Waste Water Treatment Facility (IWWTF) that currently serves Maple Leaf Pork's one-shift operation and the municipal drainage ditch that receives discharge from the Simplot Canada fertilizer plant and Manitoba Hydro's Brandon Thermal Generating Station ash lagoon. Within the City of Brandon, four combined sewer overflows (CSOs) discharge to the river, the furthest upstream of which is located just downstream of the 18th Street Bridge.

The municipal drainage ditch that receives discharge from the Simplot Canada fertilizer plant and Manitoba Hydro's Brandon Thermal Generating Station ash lagoon enters from the south bank of the river approximately 1 km downstream of the thermal generating station weir, or about 13 km downstream of the 18th Street Bridge.

Approximately 16 km downstream of the 18th Street Bridge, along the north bank is the outfall from Cell 5 of Brandon's municipal lagoon system, which is the normal discharge point from the City of Brandon Municipal WWTF. The outfall from the IWWTF is located approximately 500 m farther downstream, on the south bank of the river. Approximately 700 m downstream of the IWWTF outfall, on the north bank, is the outfall from Cell 3 of the municipal lagoon system, which is normally only used when volumes of waste water are very high, such as during prolonged heavy rainfall events.

Other point sources can be considered to be the creeks, rivers and streams that enter the Assiniboine River between Brandon and Portage la Prairie. Non-point sources exist all along the Assiniboine River primarily wherever agricultural land borders the river. Significant non-point sources would most likely occur during the spring freshet or after heavy rainfalls at which time the river flow is more likely to be higher and the effect of non-point contributions would likely be reduced.

2.7.2.2 Withdrawals from the Assiniboine River

Significant withdrawals of water from the Assiniboine River from Brandon to Portage la Prairie consist primarily of municipal supplies and irrigation. Municipal withdrawals take place at Brandon, Portage la Prairie and R.M. of Cartier year round for their primary water supply (24,000 acre-ft per year as of 2001) and over the summer months during the growing

season numerous licenced irrigation users share a total allocation of 19,000 acre-feet per year as 2001. An additional 24,000 acre-ft per year is allocated to diversions (22,000 La Salle River and 2,000 Cresent Lake in Portage). Industrial use allocated as of 2001 is 3,000 acre-ft (mostly Manitoba Hydro, Brandon at 2,800 acre-ft). The total allocation as of 2001 was 70,000 acre-ft (Personal Comm. – Ray Bodnaryk, Manager, Water Licensing, Water Branch).

It is important to understand the system of water allocation with respect to withdrawals along the Assiniboine River. Each licence has a use associated with it (irrigation, industrial, municipal), as well as a Total Quantity Diverted; a Cutoff Flow in cubic feet per second (c.f.s) at which the licensee would be expected to curtail use, an expiry date and a maximum pumping rate. Often the full allocation is not used and as is the case with the City of Brandon, a backup system using wells could be implemented in times of extreme low flows on the Assiniboine River. If the City of Brandon and City of Portage municipal allocations as well as the industrial and diversion flows are distributed over the year; and, the irrigation allocation is distributed over four months, the total allocated withdrawals at full use quantities amount to a maximum average withdrawal rate of 149 c.f.s. (4.22 m^3/s) This indicates withdrawals from the Assiniboine River between Brandon and Portage are significant in comparison to the controlled daily minimum flow of 2.83 m^3/s (100.0 cfs) at Brandon.

2.7.2.3 Physicochemical Properties of Surface Water

Water samples are routinely collected by Manitoba Conservation (Water Quality Management Section) along numerous waterways throughout the Province. In the following section, water quality data collected at Brandon, Treesbank; and, Portage la Prairie between 1992 and 2002 are summarized to provide an overview of water quality in the study area. During 1998 to 2002, the City of Brandon, as part of the Assiniboine River Monitoring Study, conducted intensive water quality sampling during discrete periods in the ice-cover and open-water seasons. Results are reported in Cooley et al. (2001a, 2001b, 2003), Schneider-Vieira et al. (1999, 2000), Toews and Schneider-Vieira (2000); and, Toews et al. (1999, 2000, 2001, 2002). Results from these studies as they pertain to the current assessment are presented in Section 5.5.2 Assiniboine River.

2.7.2.4 Surface Water Chemistry

Selected water quality parameters measured by Manitoba Conservation at the three locations are provided in Tables 1 to 3 (Appendix A).

Temperature, Conductivity; and, pH

Mean monthly water temperature in the Assiniboine River at Brandon ranges from 18.9 to 21.5^oC during June, July; and, August, with a maximum temperature of 24.0^oC. Similar values were recorded at Treesbank and Portage La Prairie, with mean monthly water

temperatures during June, July; and, August ranging from 18.0 to 21.1°C and 19.4 to 22.2°C, respectively. Water temperatures above 26°C have been recorded under low flow conditions in mid-summer (Toews et al. 2002).

Conductivity is a measure of the ability of aqueous solution to carry an electrical charge and is dependent upon the concentrations and types of dissolved ions present in the solution. Conductivity in the Assiniboine River at Brandon ranged from 403 to 1430 µS/cm (Table 1); and, exceeded 1,000 µS/cm in 43% of samples.

The pH value describes the equilibrium between hydroxide ions [OH^-] and hydrogen ions [H^+] in water and is equal to the negative logarithm of the hydrogen ion concentration. A pH value of 7.0 describes neutral conditions; values greater than 7.0 are indicative of basic conditions and less than 7.0 are indicative of acidic conditions. The pH range in the Assiniboine River (7.6 to 9.5) indicates alkaline conditions.

Nitrogen

Nitrogen occurs in water in organic and inorganic forms (nitrite, nitrate; and, ammonia); and, can be separated into dissolved and suspended fractions. Sources of nitrogen to surface waters include point sources such as municipal and industrial effluents and non-point sources such as atmospheric deposition and agricultural runoff.

Total Kjeldahl nitrogen (TKN), which is the sum of ammonia and organic nitrogen, levels along the Assiniboine River ranged from 0.1 mg/L to 8.0 mg/L (Tables 1-3).

Measured nitrite/nitrate concentrations at Brandon ranged from 0.005 to 1.5 mg/L, with a mean concentration of 0.196 mg/L (Table 1). Slightly higher values were recorded at Treesbank and Portage La Prairie, with mean concentrations of 0.363 mg/L and 0.295 mg/L respectively (Table 2 and Table 3).

Ammonia concentrations in the Assiniboine River ranged from 0.003 to 2.01 mg/L over the ten-year period evaluated (Tables 1-3). Ammonia concentrations at Brandon ranged from 0.003 to 0.310 mg/L, with a mean concentration of 0.05 mg/L. Slightly higher values were recorded at Treesbank and Portage La Prairie, with mean concentrations of 0.143 mg/L and 0.096 mg/L respectively (Table 2 and Table 3). Ammonia objectives (Williamson 2002) were calculated using both the median and maximum monthly temperature and pH data; objectives were met on all occasions for the period of consideration.

Phosphorus

Phosphorus occurs in numerous organic and inorganic forms and can be adsorbed to sediment particles, dissolved in the water, or contained within aquatic plants and animals.

Measurements of total phosphorus incorporate all forms. Phosphorus can enter surface waters via industrial and municipal effluents and agricultural runoff, among other pathways.

The narrative guidelines in the Manitoba Water Quality Standards, Objectives; and, Guidelines (MWQSOGs) set a guideline of 0.05 mg/L total phosphorus in rivers to avoid the nuisance growth of algae and aquatic plants (Williamson 2002). Phosphorus concentrations measured along the Assiniboine River exceeded this level in the majority of samples.

Total phosphorus levels at Brandon ranged from 0.045 to 0.649 mg/L (Table 1); and, are similar to concentrations at Treesbank (Table 2). Recorded phosphorus levels at Portage la Prairie are somewhat higher, ranging from 0.044 to 3.01 mg/L (Table 3).

Oxygen

Adequate concentrations of oxygen in water are essential for survival and production of most aquatic organisms. The tolerance of fish to low oxygen levels is species-specific and varies with life stage.

Oxygen concentrations in the Assiniboine River have ranged between 2.30 to 15.60 mg/L during the ten-year period of record 1992 - 2002 (Tables 1-3). The MWQSOGs set several criteria for oxygen, depending on water temperature, fish species; and, life stages present.

The chronic objective is 6 mg/L at temperatures above 5 ^{o}C (i.e., the open-water season), with larval stages of cool-water species present (Williamson 2002). Recorded oxygen levels were below this level in 7% of the samples at Brandon.

Total Suspended Solids

Total suspended solids provides a measure of the amount of materials suspended in water, which can include clay and silt, organic and inorganic chemicals and aquatic biota such as algae. The amount of suspended solids in the Assiniboine River is variable (2 to 1100 mg/L; Tables 1-3) with large increases occurring during spring runoff and after heavy rainfall.

2.8 AQUATIC ENVIRONMENT

2.8.1 Aquatic Biota

The Assiniboine River provides diverse habitat for aquatic biota. Habitat ranges from swiftly flowing water in glides and riffles to quiet shallows along shores and calm back eddies in the lee of islands. Bottom substrate ranges from mud/silt to rubble and boulder.

Algae and Rooted Plants

Aquatic primary production is, in general, carried out by three groups of organisms: phytoplankton, periphyton; and, aquatic macrophytes. Phytoplankton is microscopic algae entrained in the water column of rivers, lakes; and, other aquatic habitats. Periphyton or attached/benthic algae, grow in association with various types of substrata, including rocks, aquatic vegetation; and, sand. Aquatic macrophytes are large plants that grow either completely under water (submersed macrophytes) or partially under water (emergent macrophytes).

Phytoplankton

Little information was available for phytoplankton in the study reach prior to the Assiniboine River Monitoring Study (Lawrence and Bernhardt 1998).

Chlorophyll *a* concentrations, an indicator of primary production by phytoplankton, remained relatively low (<15 µg/L) in samples collected from the Assiniboine River throughout the summer of 1999 and during monitoring in May and June 2000 (Cooley et al. 2001b). In 1999, growth was likely limited by extremely high flows, which resulted in high turbidity and low water residence times. In May and June 2000 flows were low, but low water temperature, low seeding from upstream lakes, light availability; and, possibly nitrogen limitation due to rapid uptake by periphyton during the same period may have limited growth (Cooley et al. 2001b).

Discharge in the Assiniboine River approached 7Q10 flows in the spring and summer of 2002. Chlorophyll concentrations in June 2002 were markedly greater than in previous years, ranging from approximately 15 µg/L to over 40 µg/L throughout the study area (Cooley et al. 2003). Background chlorophyll concentrations at the site upstream of effluent inputs at Brandon in June 2002, were over three times greater than background concentrations observed in 1999 and 2000. Chlorophyll *a* concentrations measured in July and August 2002 were similar to those observed in July and August 1999, ranging from <5 to 15 µg/L at most sites (Cooley et al. 2003), with the exception of background chlorophyll *a* concentrations in August 2002 (20 µg/L).

Chlorophyll *a* concentrations in the Assiniboine River were generally similar to those reported for turbid water in Alberta (e.g., South Saskatchewan River, Carr and Chambers 1998). Concentrations of chlorophyll *a* in excess of 15 µg/L have been deemed the 'nuisance phytoplankton growth goal' by some jurisdictions (e.g., State of Oregon, Rounds and Wood 2001).

Phytoplankton communities typically change over the growing season, as a result of changing dominance among major groups. The algal community in early summer consisted of diatoms

and green algae, with variable amounts of other groups (Cooley et al. 2001b). The relative abundance of bluegreen algae tended to increase in late August and September, including some groups capable of fixing nitrogen.

Periphyton

Periphyton are characterized by a distinct growth habit that follows a succession from initial attached forms (small diatoms and bacteria) to larger species of diatoms followed by stalked forms and filamentous green algae. As growth conditions in the lower layers decline (i.e., the overstory causes light limitation and restricts nutrient diffusion), they die, detach and the periphyton mat is sloughed off. Abundant periphyton was observed in the cobble areas within the mixing zone downstream of the IWWTF outfall during the summer of 2002 (Toews 2002). Abundant periphyton were also observed on various substrates in August 2002 both in the mixing zone and at various points accessed downstream of the mixing zone (Cooley et al. 2003).

2.8.2 Invertebrates and Fish

2.8.2.1 Invertebrates

Little or no information pertaining to the zooplankton community of the Assiniboine River is available.

Although a systematic description of the invertebrate fauna of the Assiniboine River has not been undertaken, the river is colloquially known as having one of the most diverse invertebrate faunas in North America (Flannagan 1991). The most complete invertebrate collection was conducted by Hughes et al. (1992) in the Assiniboine River immediately downstream of the Manitoba Hydro's Brandon Thermal Generating Station. Chironomids (midges), simuliids (black flies); and, ephemeropterans (mayflies) were the most abundant invertebrates captured at Brandon (Hughes et al. 1992). Additional information on the invertebrate community is provided in Lawrence and Bernhardt (1998).

2.8.2.2 Fish Community

The diversity of habitat provided by the Assiniboine River is reflected by the diversity of fish species found in the river. A total of 56 species, representing 17 families, have been documented from the Assiniboine River watershed, of which at least 30 species (mooneye and goldeye and brown and black bullheads were often not differentiated in studies) have been captured at Brandon (Table 4). None of the species recorded are listed as rare or endangered, although the chestnut lamprey, bigmouth shiner, silver chub; and, bigmouth buffalo are listed as species of "Special Concern" (COSEWIC 2002). A species of special concern has

characteristics that render it particularly sensitive to anthropogenic disturbances or natural events.

Many species, such as northern pike, central mudminnow, common shiner, bigmouth shiner, longnose dace; and, yellow perch occur most frequently in tributaries, but occasionally enter the river mainstem. Other species such as golden shiner, blackchin shiner; and, brook stickleback are predominantly found in oxbow lakes. Introduced species include black crappie and carp. Lake sturgeon were historically found in the Assiniboine River, but were extirpated in the early 1900's. The Manitoba Department of Natural Resources, Fisheries Branch and the University of Manitoba have been re-introducing lake sturgeon into the Assiniboine River since 1996.

The majority of fish found in the Assiniboine River are considered "cool water" species, which are tolerant of water temperatures typically found in southern Manitoba during the summer months (20^{o} to 28^{o}C). Lake whitefish and lake cisco are considered to be "cold water" species, but are primarily found in lakes in the Qu'Appelle River watershed and are rarely captured in the Assiniboine River mainstem. Lake whitefish have been documented only once in the mainstem and it was thought that these originated in the Qu'Appelle River drainage and moved downstream during high flow conditions (Franzin, pers. comm. 1998).

Toews and Schneider-Vieira (1999) conducted a fisheries assessment of the Assiniboine River near Brandon in the fall of 1998. A total of 17 fish species were observed during the electrofishing survey: the most commonly captured species were shorthead redhorse (56.1%) and white sucker (7%); other species captured, in order of abundance were, silver redhorse, sauger, walleye, quillback; and, carp.

Additional information on habitat requirements of fish in the Assiniboine River is presented in Lawrence and Bernhardt (1998).

2.8.3 Aquatic Resource Utilization

2.8.3.1 Fisheries

The Assiniboine River provides residents of Brandon with recreational opportunities; and, is used extensively for sport fishing. Angling is conducted at most locations near the city where access to the river is provided. Creel census data were collected by the Manitoba Department of Natural Resources within the Brandon city limits during 1993 (Bruederlin, 1993). A total of 1,104 fish, including, rock bass, channel catfish, northern pike, walleye, carp, stonecat, bullheads, mooneye, yellow perch, sauger and sucker species were captured. Stocked lake sturgeon have recently appeared in recreational catches.

Commercial fishing is not currently conducted along the Assiniboine River within Manitoba.

Additional information is provided in Lawrence and Bernhardt (1998).

2.8.2.1 Recreation

The Assiniboine River provides recreational boating (mostly paddling) and swimming opportunities in addition to providing a pleasant setting for riverside recreation, camping and picnicking. Spruce Woods Provincial Park is located approximately 110 km downstream of Brandon.

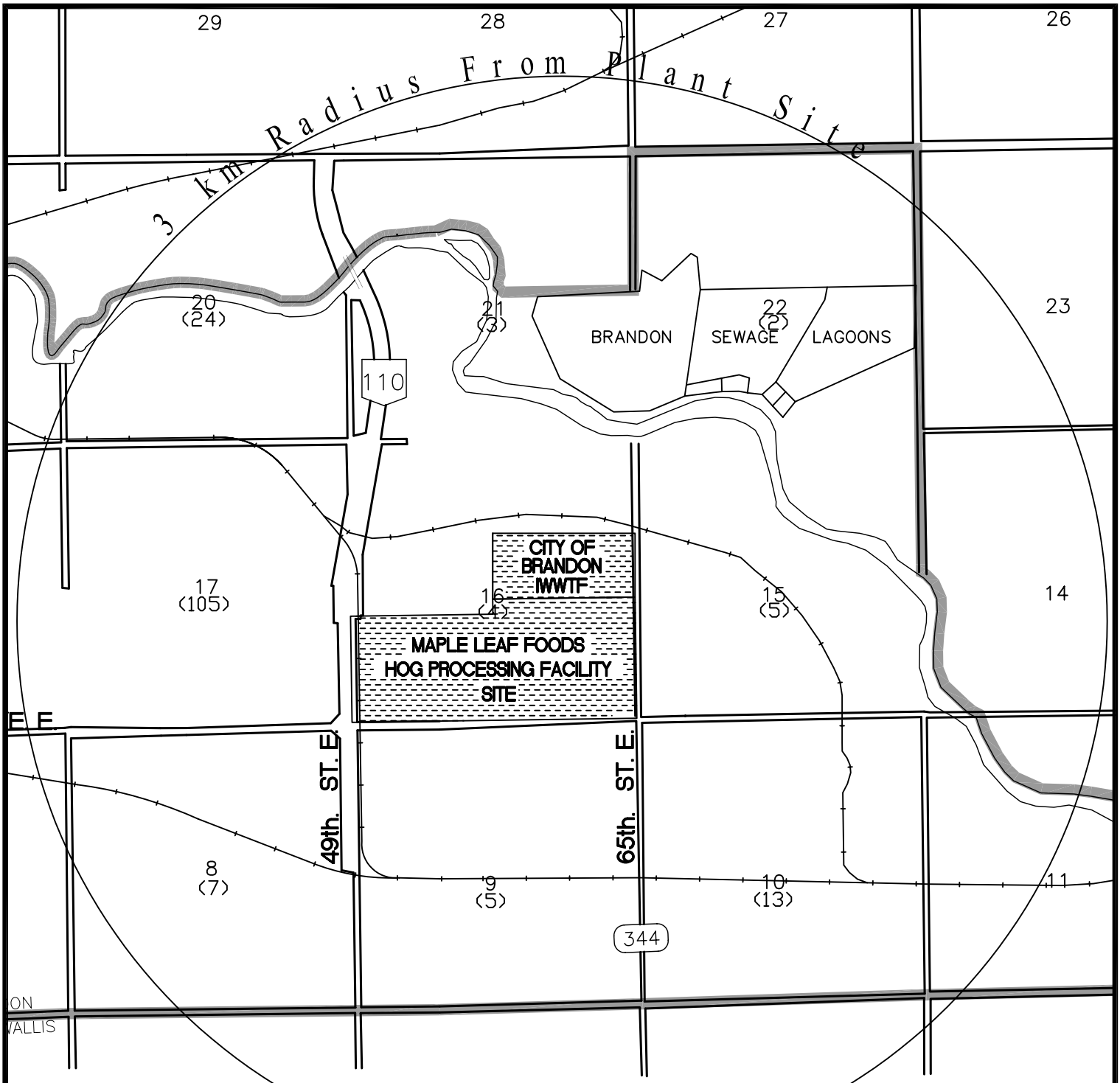
2.9 HYDROGEOLOGY

2.9.1 Site Hydrogeology

The industrial area of Brandon, Manitoba where the proposed site is located overlies a fairly extensive aquifer (Rutulis, 1976). Known registered wells within a 3-km radius of the site are shown by number per square mile (Section, Township and Range) in Figure 2-21a, excluding the ones on the City of Brandon/Maple Leaf Pork site that are shown later in this report. The general stratigraphy of the surficial deposits in the investigated area is described as consisting of deposits a couple of metres (about 6 ft) up to about 13.7 m (45 ft) in thickness of sand and gravel deposits in the upper layer. In fairly extensive areas, the sand and gravel have been removed by gravel pit operations. These deposits are underlain by thick glacial till deposits with layers of sand and gravel. An extensive, but generally thin layer of sand and gravel, occurs at 9.1 to 15.2 m (30 to 50 ft) below the till surface. A buried bedrock channel exists at the base of the till, which has been infilled with thick and extensive sand and gravel deposits. Outside this buried channel, the till is underlain by shale bedrock. Closer to the Assiniboine River and within its meander belt, the surficial deposits consist of silt and some sand and gravel. The total thickness of surficial deposits range from about 15 m (50 ft) near the Assiniboine River to more than 90 m (300 ft) on the Simplot site.

It is not the intention of the City of Brandon to construct supply wells on the property or to withdraw or utilize ground water from the underlying aquifer. All water utilized at the IWWTF or pretreatment facility will be supplied by the existing easterly extension of the City of Brandon water supply system to the project site.

As part of its Construction and Operating Licence requirements respecting ground water protection (Clause 8 of Licence No. 2311 S1 RR), Maple Leaf Foods Inc. submitted a detailed ground water monitoring strategy for the purposes of determining, on an ongoing basis, whether the construction activities and future operations activities have had an impact or are impacting the quality of the ground water beneath the property. This ground water monitoring program covered both the Maple Leaf Pork site and the City of Brandon's original IWWTF site. More specifically, the monitoring strategy was to describe:



LEGEND

8 Section
(7) Number of Registered Wells

N

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Wells Within Approximately 3 km
of the Expanded City of Brandon IWWTF

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SJB	N.T.S.	2003-03-18
drawn	project no.	
SJB	57730	
checked	drawing no.	rev.
SJB	2-21a	
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(a) The rationale and strategic purpose for the proposed number, locations and depth of any new and existing ground water monitoring wells proposed to be used relative to the site-specific upper aquifer ground water conditions for the property of the Development;

(b) The elevations of the well head and of the upper aquifer water table at each proposed monitoring well;

(c) The location of the four other abandoned monitoring wells reportedly located on the property of the Development along with the status of their sealed condition;

(d) A site plan showing the locations of all the proposed monitoring wells relative to the hog processing plant and the waste water treatment facility; and, showing the true direction of ground water flow of the upper aquifer based on the determined elevations of the water table at each of the proposed monitoring wells and any other temporary observation wells as may be installed on-site for this purpose;

(e) Information on the adequacy of the yield from each of the proposed monitoring wells;

(f) The water quality parameters proposed to be monitored; and,

(g) The frequency and elevations(s) at which the wells are proposed to be monitored.

To fulfill the above requirements, Maple Leaf Foods Inc. engaged Terraprobe Limited to undertake a detailed hydrogeologic evaluation of the site (Terraprobe, 1998). This work consisted of a review of available background information and a subsurface investigation involving 50 boreholes and monitoring well installations and is discussed in greater detail below.

Ground water flow directions in both units are variable, but are generally directed to the north towards the Assiniboine River or to the north and west toward ponds that are situated on the property.

Copies of the Terraprobe Draft Ground water Monitoring Program were submitted to Manitoba Conservation for review and we understand Manitoba Conservation made copies available in the Public Registry for review. Out of the above, a monitoring program was initiated by Terraprobe Limited and semi-annual monitoring has subsequently been carried out in the years 1999, 2000, 2001; and, 2002 with annual reports being issued to Manitoba Conservation. A summary of the Ground water Monitoring Program and the annual reports follows.

2.9.2 Ground water Monitoring Program

Terraprobe completed a detailed hydrogeologic evaluation of the City of Brandon/Maple Leaf site in the spring of 1998 prior to the construction of the Maple Leaf Pork processing plant and

the IWWTF. The subsurface investigation consisted of 50 boreholes and monitoring wells together with chemical analysis of soil and ground water. Soils were characterized by a thin surficial layer of sand and gravel overlying glacial till. A further confined layer of sand and gravel was found beneath the glacial till. There is an unconfined perched or shallow ground water system found in the upper sand unit and a confined ground water system in the lower sand unit beneath the glacial till.

The chemical analysis of soil and ground water indicated that the site had been impacted by surrounding agricultural operations. Elevated levels of nitrogen species, including nitrate, were found in the soil and ground water beneath the site. The locations of the elevated nitrate levels are variable. Based on site conditions, the ultimate receptors of shallow ground water flow from the site were determined to be the existing ponds in the northwest corner of the site, the adjacent properties to the north and east of the site; and, ultimately the Assiniboine River. A ground water monitoring program was developed based on the nature of existing ground water impacts or contamination present in the area, the nature of potential contaminants from the proposed pork processing facility and waste management ponds; the expected ground water flow directions and pathways; and, the natural variability of ground water quality and ground water flow directions beneath the site.

From the above criteria, the monitoring program proposed consisted of the following:

- An initial short-term program of monitoring ground water levels and ground water quality in all wells (approximately 50) on the processing site and in the vicinity of the waste water facility.
- A short-term program for one year that included quarterly sampling of ground water quality and monthly measurement of ground water levels.
- Provision for a long-term monitoring program based on a review of short-term program results. At that time, it was expected the long-term program would include monitoring of approximately 25 on-site wells on a semi-annual basis.

2.9.2.1 1999 Ground Water Monitoring Program (Terraprobe, 1999)

The ground water monitoring program in 1999 was conducted in accordance with the requirements of the Stage 2 Environment Act Licence Number 2311S2 issued to Maple Leaf Pork and the Stage 2 Environment Act Licence Number 2367S2 issued to the City of Brandon. The program included monitoring ground water levels on a monthly basis and ground water quality on a monthly basis at over 50 locations throughout the site. The locations of boreholes and monitoring wells are shown in Figure 2-21b. The ground water quality parameters monitored included bacteria, nutrients (nitrogen species and phosphorous) and basic inorganic chemistry including anions and metals.

LEGEND

7 MONITORING WELL LOCATION

17 FORMER LOCATION OF MONITORING WELL

EASTERN ACCESS

65TH STREET E.

RICHMOND AVENUE E.

City of Brandon Property

Maple Leaf Pork Property

MW1 MW2 MW3 MW4 MW5 MW6 MW7

EMW1 EMW2 EMW3

EB 4 + 5

5 INCH

SIMPLOT

1D 2D 3D 4D 5 6 6D 7 7D 8 8D 9D 10D 11D 12D 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 39

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Ground Water Monitoring Wells Located at Maple Leaf Pork and The City of Brandon IWWTF

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drawn CB	project no. 57730	
checked SJB	drawing no. 2.21b	rev.
approved KMA		

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The 1999 results indicated no significant changes in the ground water flow directions, although rising ground water levels in the fall were noted. The results of the ground water quality monitoring showed no significant change in concentration of parameters; and, in particular no change in concentration of parameters around key facilities (holding pens, plant; and, waste water treatment facilities). Although after commissioning of the pork processing plant in August 1999, four leakage events occurred in October and November 1999 in pipe connecting the plant to the waste water treatment facility, no impact on ground water quality was noted. Cleanup and monitoring immediately after the spills occurred was initiated. Based on the results of the monitoring program, it was concluded that there had been no significant impacts to ground water conditions at the site as a result of commissioning or operation of the holding pens, plant and waste water treatment facility or the pipe leaks.

2.9.2.2 2000 Ground Water Monitoring Program (Terraprobe, 2000)

The 2000 monitoring program included 56 on-site wells and one off-site private well (Denbow). Thirty-five wells were monitored for both water levels and quality; and, the Denbow well was monitored for quality only. Nitrate levels continued to be variable throughout the property. One borehole (BH 27) showed nitrate levels increasing from 5.4 mg/l in November, 1998 and rose throughout the monitoring period to 90.4 mg/l in April 2000. By December 2000 it was back down to 36.8 mg/l. Terraprobe concluded the most likely cause of the elevated nitrate levels was the former land application of nitrogen wastes (fertilizer by-products) at the ground surface prior to Maple Leaf's use of the site. Eight other monitoring wells showed fluctuating nitrate levels, but Terraprobe noted that this was not likely due to current operations on the site. It was noted that the ground water flow direction has remained the same for these two hydrostratigraphic units throughout the monitoring program and that difference in ground water levels throughout the monitoring period are generally in the order of several tenths of a metre.

A pipe break caused by construction equipment occurred between the pretreatment building and the lagoon in February 2000. The leak was generally minor in nature and appropriate cleanup measures were instituted at the time of discovery. An investigation was undertaken immediately after pipe leak to determine potential impacts on local ground water quality. No significant impact to ground water quality arising from the leak was noted. However, an increase in nitrate was observed at BH18 (3.1 mg/l) and BH 28 (13.3 mg/l) located on either side (east and west) of the leak in the December 2000 monitoring. This increase may have been due to the leak or may be natural variation as noted in other wells.

Terraprobe concluded there was no significant change in ground water levels and no significant change in the concentration of parameters monitored at most locations. Some fluctuation in nitrate levels were noted in wells at random locations around the plant site. Terraprobe recommended monitoring ground water levels in the 2001 program on a semi-

annual basis; and, monitoring the ground water quality on a semi-annual basis for the same parameters as monitored to date.

2.9.2.3 2001 Ground Water Monitoring Program (Terraprobe, 2001)

Thirty-six monitoring wells and one off-site well (Denbow) were included in the 2001 ground water monitoring program. Nitrate levels in BH 27 continued to fall to 22.0 mg/l as of May 2001. Similar elevated and fluctuating nitrate levels were noted at other areas of the site including BH's 16, 18, 20, 24, 27, 28, 30, 33 and 36. These elevated and fluctuating nitrate levels occur throughout the site, in areas both up-gradient and down-gradient of site operations. The elevated and fluctuating levels of nitrates were noted prior to the construction of the Maple Leaf Pork and City of Brandon facilities.

With few exceptions, the nitrate levels in wells have remained relatively stable when compared to previous monitoring events. There was no defined trend (increase or decrease) in nitrate levels or other inorganic parameters (remaining nitrogen cycle, phosphorous, chloride and bacteria) according to Terraprobe. No off-site impact was observed in the Denbow private well. The nitrate concentration in the Denbow well has remained stable since September 1999.

Elevated levels of E. coli (230 Most Probable Number (MPN)), fecal (430 MPN) and total coliform (430 MPN) were observed in BH 32 in December 2000. Results of previous monitoring events indicated no E. coli or fecal coliform were present. Lower levels of total coliform were observed previously in June and September 1999 (9 and 75 MPN, respectively). BH 32 is directly south of the hog pens and is approximately 3.0 m deep. A program to assess the causes ensued involving further sampling and inspection of the well casing and surrounding area for potential sources. Following inspection, the well was disinfected, purged; and, re-sampled. Subsequent bacteriological analysis conducted showed total coliform detected in May 2001 (9 MPN) and that no bacteria were detected in December 2001.

Terraprobe reviewed the bacteriological analysis conducted during 1999, 2000 and 2001 monitoring programs and noted sporadic detection of total coliform, E. coli and/or fecal coliform bacteria in 53 of the 61 on-site wells throughout the site. The most common occurrence was total coliform. Generally, evidence of E. coli and/or fecal coliform was observed only once at random times, after which the levels returned to non-detectable levels. Generally, these wells were completed in the upper sand unit. The locations of the fluctuating levels were random; and, not associated with any defined sources of spills or other site activities. Terraprobe indicated in their experience it is common to encounter low and fluctuating levels of bacteria in shallow monitoring wells. There were no bacteria noted in the off-site private well (Denbow).

In summary, Terraprobe concluded that the 2001 results of the ground water level monitoring indicated no changes in ground water flow directions in either of the stratigraphic units monitored. Also, there was no significant change in the concentration of the parameters monitored at most locations. Some fluctuation in nitrate and total coliform levels was noted in wells at random locations around the site. Terraprobe recommended for the 2002 monitoring program that the monitoring frequency be reduced from semi-annual to annual and that BH23 no longer should be monitored since its nitrate levels have been stable and it is up-gradient of the plant area.

2.9.2.4 2002 Ground Water Monitoring Program (Terraprobe, 2002)

Thirty-five wells on the site (including previously installed wells by others) and the Denbow well were monitored for both water levels and quality including boreholes 1 to 3, 12, 13, 15, 16, 18 to 20, 22, 24, 26 to 34, 36, 37 and 39; 1D to 4D, 7D, 9D, 11D and 12D and RC-2, RC-3 and RC-6. Borehole 15 was dry during the October 15 monitoring event. Each was monitored annually including the off-site Denbow well. Parameters monitored include in 2002 included bacteria, nutrients (nitrogen and phosphorous) and basic inorganic chemistry including anions and metals. Nitrate is used as a primary indicator of possible impacts associated with the plant or waste water lagoon. Data from the monitoring conducted prior to the construction of the facilities indicates that nitrate levels in the ground water are often elevated and variable throughout the property. Elevated levels of nitrate (i.e., greater than 5 mg/l) are noted consistently at most borehole locations in the upper sand unit at the eastern portion of the property. While the nitrate levels fluctuate, there has generally been no distinct trend to increasing concentrations of nitrate at any of the borehole locations.

Nitrate levels in the southwestern corner of the property have been decreasing as seen in borehole BH3 in the upper sand unit. The highest nitrate level was observed in June of 1999 (26.6 mg/l) that have gradually decreased and was observed to be lower than the detection limit in both December 2001 and October 2002. It is concluded that the most likely cause of the elevated nitrate levels is the land application of nitrogen wastes (fertilizer by-product) at the ground surface prior to Maple Leaf's use of the site. (Terraprobe, February 2003). Similar elevated and fluctuating nitrate levels are noted at other areas of the site such as BH16, BH18, BH12, BH13, BH20, BH24, BH27, BH28, BH29, BH30, BH33, BH36 and BH4D. Boreholes 18 and BH30 had elevated nitrate levels in October 2002 compared to previous levels. These elevated and fluctuating nitrate levels do not appear to be related to site operations. The elevated and fluctuating levels were noted prior to construction of the Maple Leaf Pork and City of Brandon facilities (Terraprobe, February 2003).

Generally, the concentration of nitrate in the till and low sand unit is significantly lower, with exceptions being BH1 and BH2 in the till unit of the western portion of the property. The nitrate concentration of BH4D in the lower sand unit of the north-central portion of the

property was formerly elevated, but has reduced in recent monitoring events. Elevated and fluctuating levels of nitrate have been noted in boreholes BH1 and BH2 in the past. The values appear to be diminishing. Other than these exceptions, the nitrate levels have remained relatively stable when compared to previous monitoring events. There is no defined trend (increase or decrease) in nitrate levels or other inorganic parameters (remaining nitrogen cycle, phosphorous, chloride and bacteria). Also, no off-site impact has been observed in the Denbow private well. The nitrate concentration in the Denbow well has remained stable since September 1999 (Terraprobe February 2003).

Elevated levels of bacteria were observed in five wells during the October 2002 program: with elevated Total Coliforms only in BH1 (7), BH27 (230) and BH29 (9) and elevated levels of Total Coliforms, Fecal and E coli, respectively in BH12 (230, 23, 9) and BH32 (43, 4, 4). Borehole BH1 is located in the northwestern part of the site; BH12 in the south-central, BH 27 in the northeastern (up-gradient of the hog pens and waste water lagoons), BH 29 in the northeastern (adjacent to the access road from the hog pens and up-gradient of the waste water lagoons) and BH32 in the east-central portion of the site, immediately down-gradient of the hog pens. Review of previous results indicates bacteria have been encountered previously in all these wells. Historic levels of bacteria in each of the wells are highly variable, ranging from zero to total bacteria counts of several hundred. With the exception of coliform levels in BH12, all of the bacteria levels are within the historic range of results. A program to assess the causes of the elevated fecal bacteria at BH12 and BH32 is currently being implemented. The program will include further sampling at these wells and an inspection of the casing of the wells and surrounding area for potential sources. Following inspection, the wells will be disinfected, purged and resampled. The results of subsequent bacteriological analysis will be reported in the 2003 monitoring report.

Results of the monitoring events indicated that total coliform, E. coli and/or fecal coliform have been noted on sporadic occasions in 53 of the 59 on-site wells; only boreholes BH14, BH31, BH36, BH4D, BH7D, BH10D have never had recorded coliforms of one type or another.

Terraprobe's observations as given above, strongly suggests that few, if any, of the elevated coliform levels can be attributed to the Maple Leaf Pork operations, because the majority of wells affected are in locations up-gradient of any Maple Leaf Pork or City of Brandon activity that on the site that might be suspect. There has been no bacteria noted in the off-site well of Denbow.

The ground water flow in the till and lower sand units is generally directed in a northwesterly direction towards the former gravel pit and has generally remained the same for these two hydrostratigraphic units throughout the monitoring program.

2.9.3 Ground water Flow to the Assiniboine River

Inflows from ground water to the Assiniboine River are significant, particularly where the river passes through the Carberry Aquifer and Spruce Woods Provincial Park during times of low flow. When the Assiniboine River is high ground water inflow although relatively constant with time becomes insignificant; whereas when the Assiniboine River is low ground water inflow provides a significant contribution to the base flow.

2.10 INDUSTRIAL BASE

The most important industry types in the Brandon regional area at the present time are agriculture, trade, agricultural chemical companies and health/social services and others. There are approximately 1,600 businesses within the City of Brandon. Currently within the City of Brandon, Maple Leaf Pork is the single largest private employer at just over 1375 people and Simplot is second with a staff of just over 260 people.

Although the main industry in the region is agriculture, the main industry in the City of Brandon until Maple Leaf Pork arrived has been trade followed by "others" and health/social services.

2.11 HISTORY, GEOGRAPHY AND SERVICES

The City of Brandon was incorporated on May 30, 1882. Chosen as a location for a major division of the Canadian Pacific Railway, the area received its name for the Brandon Hills from General Thomas Rosser. The area was abundant with farmland and was quickly settled as people took advantage of the rail location and the agricultural opportunities that were offered, (Brandon Economic Development Board (BEDB), 1997). Brandon has the distinction of having grown so rapidly near its beginning, that it was originally incorporated as a city. Currently the city has approximately 42,242 residents (July 2002), making it the second largest city in Manitoba. The City of Brandon covers an area of approximately 43 km^2 (26 mi^2 or 10,625 acres) in the southwestern portion of Manitoba approximately 106 km north of the Canada-United States Border.

Geographically the majority of the City of Brandon is situated on the south side of the Assiniboine River Valley. The average elevation is 390 metres (1,280 feet) above mean sea level in the city and 409 metres (1,342 feet) at the airport that lies on the north side of the Assiniboine Valley.

Services provided in the City of Brandon include those typically found in urban centres including its own fire, police; and, ambulance services. The fire department employs 48 fire fighters/EMA-DS, four fire prevention officers, ten fire vehicles, four ambulances, one rescue

unit; and, five administrative personnel as of July 2002 (Personal Communication – Capt. Edwards). The police service employs 65 sworn members and 25 civilians assisted by 16 volunteers as of January 2002 (Personal Communication – Terry Nelson). The Royal Canadian Mounted Police serves the rural areas surrounding the city. These services are augmented through a 911 operation that employs ten full-time and two part-time personnel.

Health care in the City of Brandon is served by the Brandon General Hospital, the Assiniboine Centre; and, the Brandon Mental Health Centre.

The City of Brandon services most of its residents with its own sewage treatment and water treatment plant. The water is mainly supplied from the Assiniboine River that is balanced during low-flow periods by discharges from the Shellmouth Reservoir located on the Assiniboine River near the Saskatchewan border. The water treatment plant currently operates in the range of 45% to 75% of its 12 million gpd capacity. In cases of extreme low-flow periods, the City of Brandon has the capability to supplement its water supply through two ground water well fields. This backup system is capable of supplying approximately 315.3 L/s (6 million gallons per day). The City of Brandon currently has an application submitted for licencing of this back-up well system (Personal Communication – Ian Christiansen, Asst. City Engineer).

The City of Brandon is served by the City of Brandon landfill located on N.E ¼ Sec. 17-10-18 WPM. This landfill has a conservatively estimated life span of at least 35 years (Personal Communication - Ted Snure, P.Eng., City Engineer, City of Brandon).

Existing services at the proposed site include hydro, gas and road service (Richmond Avenue); and, the hydro service in the area was upgraded to accommodate Maple Leaf Pork. Prior to Maple Leaf Pork, no City of Brandon water or sewer lines existed in the area of the site; however, a water line had been constructed to the proposed plant site as part of the original construction on the site. A 400 mm (16-inch) H.D.P.E. water line constructed during the winter of 1998-99 now parallels Richmond Avenue. Domestic sewage from the Maple Leaf Pork Processing plant is currently being treated on-site at the City of Brandon's IWWTF..

There were reportedly at least 85 residential lots available (July 2002) in Brandon for sale (Personal Communication - Mr. Will Majcher, Real Estate Officer, City of Brandon). The City only has about 5 lots available while developers have about 80 lots currently available. Developers currently active in Brandon include Mr. Bill Fotheringham, Riverheights Developments Ltd.; Mr. John Burgess, Waverley Developments; Mr. Jack Jacobson, Cottenridge Developments; Mr. Tony Torres, T & T Enterprises and Brookwood Farms. Services generally include sewer and water and gas. There are 1131 hotel rooms available (July 2002) and 12 bed and breakfast rooms within the City of Brandon (Personal Communication – Sandy Trudel, BEDB). Up to 160 new hotel rooms are currently planned.

Also, Brandon and Area Planning (Personal Communication – Merv Pedlow) indicates that there were 145 sites built upon in Brandon from March 1998 to March, 1999. The number of single-family residential units built were 45 in 2000, 39 in 2001 and 97 so far in 2002 to the end of July. For multi-family units, there were 30 units built in 2000; and, 28 in 2001.

2.12 OTHER URBAN AND RURAL SETTLEMENTS

According to the 1996 census, there are 10 communities and 19 rural municipalities surrounding Brandon from which residents commute to Brandon for work. The communities are Virden, Rivers, Shoal Lake, Rapid City, Minnedosa, Neepawa, Carberry, Winnipeg, Wawanesa; and, Souris. The rural municipalities extend as far west as the R.M. of Woodnorth; as far north as the R.M. of Rosedale; as far east as the R.M. of North Norfolk; and as far south as the R.M. of Turtle Mountain. Of the total labour market about 25% are commuters. Only 11% of males and 5% of females who live in Brandon work elsewhere (B.E.D.B., 1997). However, 20% of males and 11% of women in surrounding towns commute to Brandon and 42% of males and 58% of females commute (that is, live in one census subdivision and work in another).

Figure 2.22 shows the source and distribution of workers as of 1996 commuting to Brandon. Data from the 2001 census is currently not available.

The combined population of the nine (9) surrounding towns with commuters to Brandon (Winnipeg eliminated) in 1996 was 14,617 (Statistics Canada, 1997), whereas in 2001 this had increased to 14,916. The combined population of the 19 rural municipalities with commuters to Brandon was 24,792 in 1996, which has dropped to 23,738. This indicates the trend for the rural population to decrease and the urban population to increase continues. However, when the City of Brandon population is included (39,175 in 1996 versus 42,242 in 2002), the Brandon area has had a net increase in population of approximately 2,312 (78,584 in 1996 compared to about 80,896) in the past 5 to 6 years. Based on the past 5 years, this represents a population increase in the Brandon region of 0.56% per year.

Table 2.4 gives the population of some of the individual towns and municipalities surrounding Brandon, from which workers are known to commute to Brandon.

Table 2.4: 1996 Population of Some Towns and Municipalities Near Brandon

Town	Population (1996)	Population (2001)	Rural Municipality	Population (1996)	Population (2001)
Carberry	1,493	1,510	Cornwallis	4,279	3,765[1]
Minnedosa	2,443	2,425	Clanwillian	470	467
Neepawa	3,301	3,330	Blanshard	655	686
Rapid City	408	424	Daly	895	906
Rivers	1,117	1,120	Elton	1,406	1,321
Shoal Lake	801	801	Hamiota	515	479
Souris	1,613	1,680	Minto	661	684
Virden	2,956	3,110	North Cypress	1,900	1,853
Wawanesa	485	516	North Norfolk	3,024	2,941
			Oakland	1,086	1,111
			Riverside	827	856
			Rosedale	1,644	1,598
			Saskatchewan	661	639
			Shoal Lake	621	578
			Sifton	759	766
			South Cypress	862	821
			Turtle Mountain	1,179	1,146
			Whitehead	1,535	1,457
			Whitewater	766	725
			Woodworth	1,047	939
TOTAL	**14,617**	**14,916**	**TOTAL**	**24,792**	**23,738**

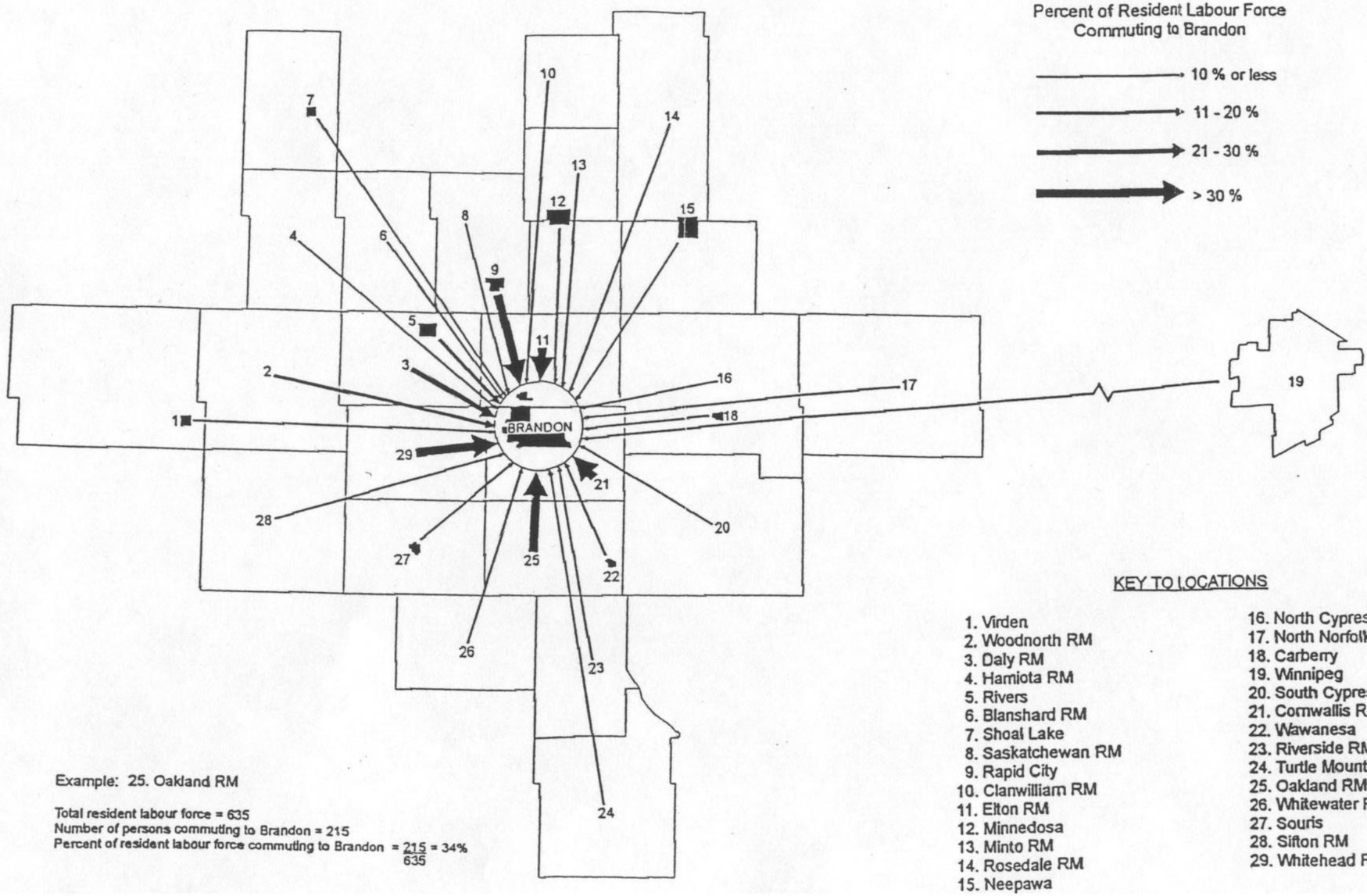
Note 1: Some changes in municipal boundaries have affected population numbers between the years 1996 and 2001 (Personal Communication – Sandy Trudel, B.E.D.B.).

2.13 TRANSPORTATION

The Brandon region is well serviced by a number of provincial roads and highways as well as rail lines and a regional airport. The transportation network, provided by the existing infrastructure, re-enforces Brandon's attractiveness to industry.

Brandon is home to seven (7) trucking/transport firms who have recognized the transportation infrastructure in the Brandon region and provides shipping services throughout North America (Brandon Community Profile, June 2001). The Trans-Canada Highway, Canada's major east-west route, runs in through the northern portion of the City of Brandon with Average Annual Daily Traffic counts (AADTs) of 4,720 west of PTH #10 (up 1.5%/year since 1996) and 5,840 in 2000 (lowest in previous 6-yr period) east of PTH #10 as of 2000. Provincial Highway #10 runs through the heart of the City of Brandon continuing as far north as Flin Flon while

Brandon Labour Market Area



Example: 25. Oakland RM

Total resident labour force = 635
Number of persons commuting to Brandon = 215
Percent of resident labour force commuting to Brandon = 215/635 = 34%

KEY TO LOCATIONS

1. Virden
2. Woodnorth RM
3. Daly RM
4. Hamiota RM
5. Rivers
6. Blanshard RM
7. Shoal Lake
8. Saskatchewan RM
9. Rapid City
10. Clanwilliam RM
11. Elton RM
12. Minnedosa
13. Minto RM
14. Rosedale RM
15. Neepawa
16. North Cypress RM
17. North Norfolk RM
18. Carberry
19. Winnipeg
20. South Cypress RM
21. Cornwallis RM
22. Wawanesa
23. Riverside RM
24. Turtle Mountain RM
25. Oakland RM
26. Whitewater RM
27. Souris
28. Sifton RM
29. Whitehead RM

Source: BEDB, Community Profile 1997

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Commuter Traffic Traveling to The City of Brandon

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connecting to major U.S. routes allowing travel as far south as Mexico. Immediately south of Brandon, PTH #10 South has AADTs of 4,470 in 2000 (4,520 in 1996) while immediately north of Brandon PTH #10 has AADTs of 4,600 in 2000 (4,410 in 1996) (Personal Communication - Mr. Upali De Silva, Manitoba Highways, Brandon).

With the construction of the Eastern Access Route, there is now a two-lane highway which allows heavy traffic to bypass downtown Brandon and provides convenient access to Brandon's industrial area, in particular, the City of Brandon's IWWTF and the Maple Leaf Pork. site, which is situated along the eastern side of this by-pass route. The Eastern Access Route currently sees traffic loads (0.5 km S of junction of PTH 457) of 2,820; however, there is no data available as to the percentage of truck traffic. (Personal Communication – University of Manitoba Traffic Information Group).

Prior to the construction of the original Maple Leaf development, Brandon already had completion of the Eastern Access Route on its planning books. Therefore, the total impact of the completion of the Eastern Access Route to join up with P.T.H. #10 South should not be attributed to the Maple Leaf plant. In fact, only a portion of the trucks coming to and from the Maple Leaf plant daily utilize the Eastern Access Route.

The City of Brandon was founded as a result of the Canadian Pacific Railway main line that has a yard in the heart of the city and accordingly can provide national/international rail access. The Canadian National Railway main line is also nearby, approximately 15 km north of the city. The Maple Leaf Pork site itself is bordered by a transfer line along its western and northern boundaries that would provide convenient access to the rail lines. There are no plans for Maple Leaf Pork to utilize rail access at the site.

A regional airport exists on the north side of the City of Brandon, which is open on a 24-hour basis and is currently serviced by a commuter airline - Perimeter Airlines (Winnipeg-Brandon-Dauphin-North Destinations) (Personal Communication – Brandon Airport Manager).

2.14 CULTURAL SETTING

2.14.1 Heritage Resources

An archaeological impact assessment has been conducted on the site by qualified archaeological consultants, Quaternary Consultants Limited, prior to the original construction on the site. The methodology consisted of parallel foot traverses to provide visual inspection of the area. Particular attention was paid to knolls that could have provided vantage points for game observation and linear ridges that could have served as transit corridors. Sub-surface shovel tests were conducted in areas that appeared to exhibit soil aggradation. These test areas

were excavated to the underlying gravel stratum or the depth of frost (as deep as 0.65 m or 2.13 ft, in some locations).

One archaeological site was located on the property. The site consisted of an isolated artifact; the broken base of a Plains Side-notched projectile point, 300 to 600 years old. It was located on the eastern side of the property, approximately 30 m (98 ft) west of the road and half way between the Centra Gas line and the approach at the top of the knoll. Intensive examination at this location found no associated features, such as tipi rings and shovel testing indicated no buried soil zones.

As a result of the Heritage Resource Impact Assessment conducted under the terms of Heritage Permit A1-98, issued by Historic Resources Branch, Manitoba Culture, Heritage and Citizenship, Quaternary Consultants Limited have recommended that there are no further archaeological concerns and that construction can be allowed to proceed without impact to heritage resources. Since the time of this assessment in 1998, the majority of the site has been re-graded. The current proposed Development will be built on areas already disturbed by the original construction and the likelihood of impacts on heritage resources is now even more remote.

2.14.2 Aboriginal Peoples

Currently, aboriginal peoples make up about 10% of the population in Brandon. In 1991, the aboriginal population of Brandon was 1,705 (Statistics Canada, 1992), while in 1996 the population had risen to 2,785. The Friendship Centre in Brandon believes the actual aboriginal population of Brandon is about 5,000 (Personal Communication – Dr. Richard Rounds). Aboriginal languages spoken in the Brandon area include Cree and Ojibway.

It is interesting to note that as of July 2002 over one-third (36%) of the workforce at Maple Leaf Pork is aboriginal. Aboriginals commute at least from as far away as Long Plain Reserve (Portage la Prairie), approximately one and one quarter hours away (Personal Communication – Chief Dennis Pache).

2.14.3 Population Trends

The population of the Brandon region has slowly increased in recent years as indicated by an increase of 1.2% from 90,784 persons in 1991 to 91,816 persons in 1996. This represents an annual increase of 0.24%. From 1996 to 2001, the annual increase of population in the region has been 0.56%. The data indicates a continuing slight increase the City of Brandon population but a slight decrease in rural population.

2.14.4 Education

Within the City of Brandon there are approximately 23 public schools to instruct approximately 8,000 students, as well as three high schools and one private school. There are also two colleges and one university: the Assiniboine Community College; a Fire College; and, Brandon University. Figure 2.23 indicates the breakdown of education/training levels in Brandon.

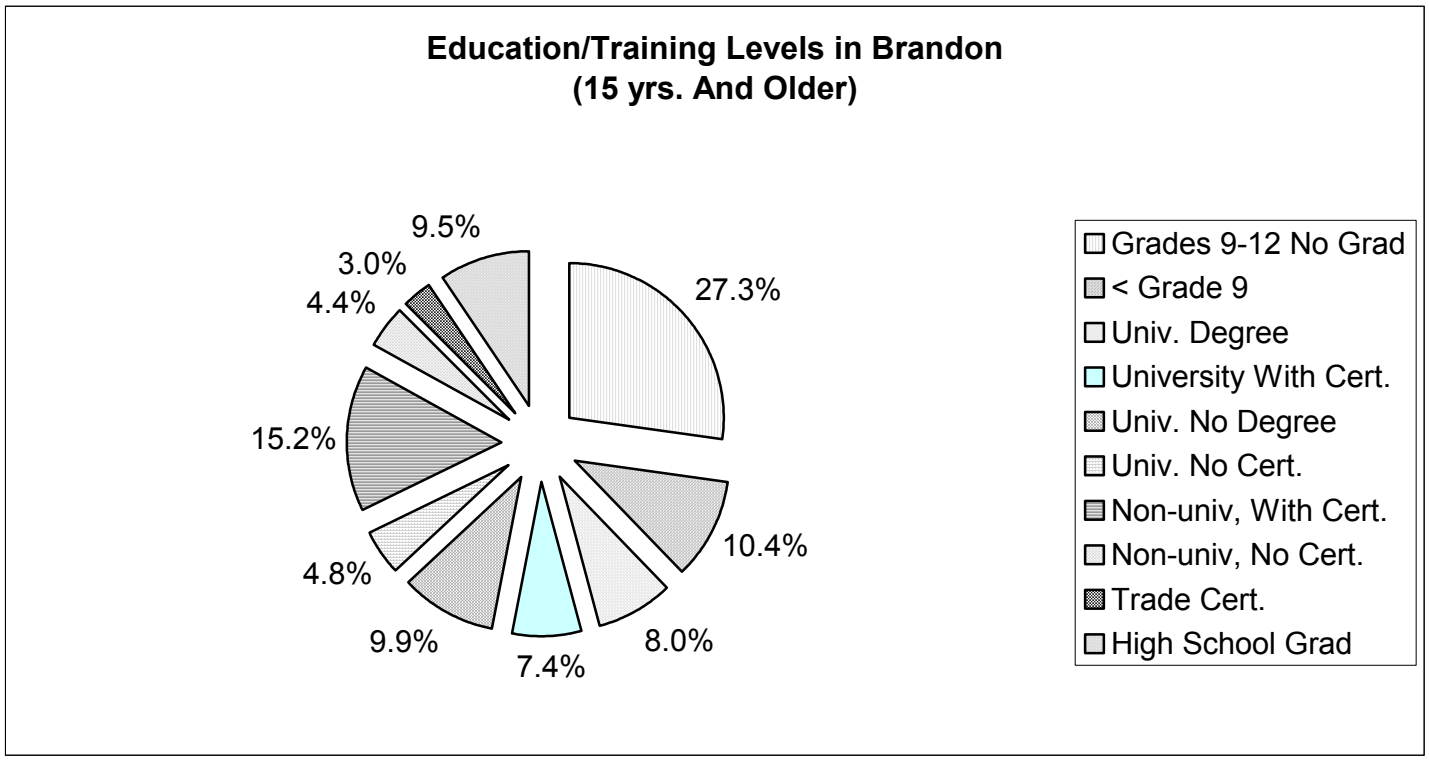

Figure 2.23: Education Training Levels in Brandon
Source: Brandon Community Profile, June 2001

2.14.5 Agriculture

The agricultural industry accounts for approximately 19% of all employment in the region. As would be expected, the agricultural sector dominates the rural areas. Forty-three percent (43%) of the workforce in rural areas, 10% in rural towns and villages; and, only 2% in the City of Brandon are directly involved in agriculture. Typical agricultural products cultivated and/or grown in the region include wheat, barley, rye, oats, canola, flax, buckwheat, potatoes, pulses, forages, hogs, beef cattle, dairy, poultry and eggs and PMU. The rich, fertile land allows cultivators to adjust the relative proportions of the various products in order to meet market demands.

The predominant agriculture in the area surrounding Brandon is the production of cereal crops; primarily wheat and barley. The acreages seeded to wheat and barley is followed by canola and potatoes.

2.15 THREE KILOMETRE RADIUS FROM PROPOSED PLANT SITE

Table 2.5 lists all private residents and businesses encountered within a 3 km radius of the site plus a few just beyond. The I.D. Numbers shown, correspond to the I.D. Numbers indicated on Figure 2.5, which indicates their relative locations. The 3 km radius extends north across the Assiniboine River to 28-10-18W and east across the Assiniboine River to 14-10-18W. In a southern direction the radius reaches 4-10-18W and to 18-10-18W (near the Simplot Plant) in a westerly direction.

Table 2.5: Residents and Businesses Near the Maple Leaf Pork Site

I.D. No.	Name	Estimated Residential Population
1	James Terhune, Carmen Denbow	2
2	Shur-Gro, Cominco Fertilizers, Simplot Bulk Site	
3	Wesman Salvage	
4	Abandoned Farm Yard (reportedly owned by Gary Keeble)	
5	East End Auto Wreckers	
6	Paul's Hauling (Anhydrous Ammonia) (Trailer)	
7	Abandoned House	
8	Harvest Salvage	
9	Burned Down House	
10	Bradley Sand and Gravel (Equipment Yard)	
11	Bradley Sand and Gravel (Offices)	
12	Western Co-operative Fertilizer Ltd. (Plant)	
13	Simplot Millennium Park	
14	Nexen Chemical Plant	
15	L & R Transport	
16	Anderson Auto Parts and Brandon Towing: Jim Anderson	
17	Eastview Landfill Site and Brandon Waste Water Treatment Lagoon	
18	Brandon Wildlife Range	
19	Manitoba Hydro (Thermal Station, Service Centre and Sub-Station)	
20	Trailer and Industrial Site (Not identified)	
21	D. Kostiw	2
22	J. Burney	1
23	Wally and Anna Plett	2
24	Dennis and Bonnie Sanders	2
25	Phil and Vivian Jones	2
26	Murray McMillan	2
27	Gary Havenstock	2
28	Jim Reid	4

I.D. No.	Name	Estimated Residential Population
29	Steel Plus	
30	Phil Ritchie	5
31	Howard and Tammy Kelly	2
32	Mike and Naomi Wadddell	6
33	Fred Driedger – Evergreen Nursery	4
34	Dennis Kelly	1
35	East 40 Packers	
36	Rainbow Eavestroughing Ltd.	
37	Mel Brown	1

Note: The locations of the above Residents or Businesses are shown on Figure 2.6

An estimated seven (7) residences and 13 businesses exist within a 3 km (2 miles) radius of the proposed site. No schools, hospitals, personal care homes, hotels, or other such institutions were found in the area. The Brandon Eastview Landfill site exists to the northwest of the site (I.D. Number 7 on Figure 2.6). A number of small businesses were encountered including automobile repair shops, scrap yards; and, some farms. In terms of larger businesses, the area is home to a number of industries including; L&R Transport, Simplot, Westco, Nexen Chemicals, several gravel operations and Manitoba Hydro's thermal generating station.

2.16 TEN KILOMETRE RADIUS FROM PROPOSED PLANT SITE

A 10 km radius from the site encompasses nearly the entire City of Brandon to the west, extends to the Brandon Hills to the south, nearly to the Town of Shilo to the east and approximately 2.5 miles north of the Trans-Canada Highway to the north. Figure 2.5 indicates the location of the 10 km radius around the plant site relative to these points.

Chater, a small settlement centre, is approximately 4.0 km (2.5 miles) to the northeast of the site; and several quarter sections of land 6.4 to 10 km (4 to 6 miles) east and northeast of the site are designated and developed as Rural Residential. Immediately east of the plant in the R.M. of Cornwallis are a number of gravel pits. There are some smaller industries located throughout the balance of the Industrial Area; however, the heavier concentration of industrial development is in the Green Acres Industrial Subdivision 4.0 km (2.5 miles) west. The Green Acres residential area is approximately 4.8 km (3 miles) west of the plant (Personal Communication - Al Shier, Regional Manager, Rural Development, Brandon).

The City of Brandon and the Rural Municipalities of Cornwallis and Elton are partners in the Brandon and Area Planning District. The R.M. of Cornwallis surrounds the City on the east,

south, west and partly on the north. The R.M. of Elton borders the City partly on the north. This means that all lands within a 10 km radius of the proposed site are under the jurisdiction of either the City of Brandon or Municipalities that support this Proposal.

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