ENVIRONMENTAL ASSESSMENT AND PRELIMINARY DESIGN REPORT ONE-STAGE SUBMISSION

HIGHWAY 6

FREELTON NORTHERLY 16.9 KM TO GUELPH

W.P. 65-76-05

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VOLUME 3

Ministry of Transportation
Ontario

HIGHWAY ENGINEERING SECTION
PEEL, HALTON AND HAMILTON
CENTRAL REGION

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Ministry of Transportation
Ontario

Environmental Technical Paper No.9

Background Fisheries Information and Impact Assessment

Highway 6
Freelton to Guelph
Update and Supplementary Investigations for Route Location and Preliminary Design
W.P. 65-76-05

DRAFT TECHNICAL PAPER

LANNING & DESIGN SECTION

Fenco MacLaren Inc.

PREFACE

This Technical Paper (No. 9) is one of a series of Technical Papers produced in support of Update and Supplementary Investigations conducted for the Route Location and Preliminary Design for proposed Highway 6 improvements between Freelton and Guelph.

The Technical Paper is composed of two reports which describe 1) background fisheries information compiled for the study area; and 2) an assessment of aquatic resources potentially affected by the proposed highway improvements.

The information contained in these reports is part of comprehensive environmental assessment documentation being prepared for MTO for the Preliminary Design of this segment of Highway 6.

In addition to the information contained within these documents, detailed fisheries investigations, including in-stream fish collections and the development of site-specific mitigation plans, will be conducted during subsequent planning and design phases of this project.

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Highway 6 - Freelton to Guelph
W.P. 65-76-05

BACKGROUND AND INVENTORY OF FISHERIES RESOURCES

1.0 DATA SOURCES, RELIABILITY AND INFORMATION GAPS

Proposed improvements for Highway 6 between Freelton and Guelph have been in the planning stages for several years. Initial studies of the natural environment in areas potentially affected by highway improvements or realignment were surveyed in 1987. Results of these studies were documented in a Pre-Submission Environmental Assessment Report to the Ontario Ministry of Transportation (MTO) produced by Fenco Engineers (Fenco 1987).

Since that time new legislation, policies and management initiatives have been developed which apply to Ontario's natural resources. In particular, the federal *Policy for the Management of Fish Habitat* has been more broadly applied to fisheries investigations in Ontario. This policy, and other legislation, policies and guidelines which apply to the Province's fisheries, have been taken into account. This study, therefore, represents an update of aquatic studies conducted in 1987 in light of resource management differences as well as changes in aquatic habitat occurring between these two periods.

The objective of the study outlined in the following pages was to provide an inventory of current fisheries resources of the study area, including fish habitat, based on published and unpublished mapping, reports, data files, personal communications and field investigations. Sensitive aquatic resources identified within the study area in this stage could then be considered in the subsequent assessment of impacts related to proposed highway improvements and ultimately in the Highway 6 design stages.

A variety of information sources were compiled and reviewed to establish baseline fisheries conditions of the study area. Report and map sources were supplemented by personal communications with staff of the Ontario Ministry of Natural Resources' (MNR) Cambridge District office, the Grand River Conservation Authority (GRCA), the Halton Region Conservation Authority (Halton RCA) and the Hamilton Region Conservation Authority (Hamilton RCA).

Published and unpublished fisheries information for this study was obtained primarily from the Cambridge District office of the MNR. This agency provided the following information:

- District resource mapping including:
  - Puslinch Township Fish & Wildlife Resources (1989)

  - Flamborough Township Fish & Wildlife Resources (1984)
- District Land Use Guidelines
- District Fisheries Management Plan
- unpublished fisheries reports
- unpublished stream survey reports
- Other reports
  - An Assessment of the Bronte Creek Watershed with Recommendations for Salmonid Management by Cam Portt and Associates (1981)

A number of data sources were reviewed to identify hydrogeological characteristics of the study area which are interrelated to fisheries resources. These included:

- Surface geology mapping
  - Ontario Geological Survey Map P2604
- Soils mapping
  - Ontario Soil Survey Report 35 - Wellington County
  - Ontario Soil Survey Report 32 - Wentworth County
- Aggregate resource inventory papers
  - Puslinch Township - Paper #50
  - Hamilton-Wentworth - Paper #50
- Aerial photography (stereo pairs)
- Water well records
- Other reports
  - Groundwater Resources of the Township of Puslinch by Gartner Lee Limited (1986)

Reference was made to earlier environmental studies undertaken on behalf of MTO by Fenco Engineers (1987) on the selected alignment of Highway 6.

Field reconnaissance was conducted during November and December of 1992 to verify and complement information obtained from other sources. Fish habitat assessment investigations were undertaken at a number of watercourses following the habitat assessment procedures described by the MNR *Manual of Instructions - Stream Surveys* (MNR 1985).

Site-specific habitat characteristics examined included:

- Bank stability
- Stream cover/canopy
- Bottom type
- Stream morphology
- Instream cover
- Terrain characteristics

- Land use
- Substrate condition
- Tributaries
- Agricultural tile outfalls
- Stream dimensions
- Spawning areas
- Spring sources
- Evidence of watercourse disturbance/management

Based on the assessment of fish habitat characteristics, comments were made regarding the potential of assessment sites as fish habitat.

Hydrogeological field investigations were also undertaken and examined the following general physical features of areas potentially impacted by proposed highway improvements:

- angles of stream bank slope
- stream width and depth
- local topography
- soil texture and structure
- stream bed substrates
- evidence of groundwater discharge.

Field observations were compared to mapped published data to identify high-potential discharge areas, and high and lower potential recharge areas.

Data sources reviewed during this study are considered to be generally reliable given the reputation of the agencies involved. Data gaps may exist however, since published information sources such as resource mapping may be out-dated. While we have attempted to review the most current information sources available, reliance on some out-dated information was necessary. These gaps will be filled with new availability of data, or data of recent studies, when possible.

2.0 DESCRIPTION

2.1 General

This section describes the general characteristics of the aquatic resources found within the Highway 6 study area. Descriptions of fisheries resources and general hydrogeological conditions are provided.

2.1.1 Fisheries

Fisheries resources of the study area are found in the streams and tributaries of three watersheds (Figure 1). They are:

- Bronte Creek Watershed
- Fletcher Creek Watershed and
- Galt/Mill Creek Watershed (also known as Aberfoyle Creek or Mill Creek).

Headwaters of all three watersheds arise in the same general area of Puslinch and Flamborough Townships. Groundwater upwelling/discharge in this area is the predominant source of clear, cool water for the upper reaches of these watersheds. The Galt Creek watershed drains the western portion of the study area to the southwest where it joins the Grand River and eventually Lake Erie. The Bronte Creek and Fletcher Creek watersheds both drain to Lake Ontario.

Bronte Creek Watershed

The Bronte Creek Watershed drains a large area bordered roughly on the north by Highway 401 and on the west by Highway 6 South. The headwaters of this watershed's principal watercourse, Bronte Creek, generally parallels Highway 6 South on the east side of the Highway from its source near Morriston to Freelton. Throughout the entire study area Bronte Creek is designated by the MNR as a coldwater stream (see Figure 1), that is streams which are capable of supporting coldwater fish species such as brook and brown trout[1]. A spawning and nursery area for coldwater species has identified on the Bronte Creek system immediately east of Highway 6 South roughly between Campbellville Road and Mountsberg Road (Figure 1). Redside dace, a nationally "vulnerable" species was collected downstream of the study area in 1984 and 1989.

Much of the upper reaches of the watershed supports a self-sustaining population of brook trout. Fish collections made within and downstream of the Highway 6 study area have documented the presence of these, and other coldwater fish populations. Fish collections for the Bronte Creek watershed are presented in Table 1. Several areas of the watershed have been historically stocked with brook, brown and rainbow trout. In its lower reaches, near Lake Ontario, Bronte Creek supports a limited spawning run of chinook and coho salmon.

[1] Scientific names of fish species inhabiting watercourses in the vicinity of the Highway 6 study area are provided in Table 1.

Fletcher Creek Watershed

The Fletcher Creek Watershed drains the portion of the study area roughly bounded by Highway 401 to the north and Highway 6 to the east. Drainage is to the southwest, where Fletcher Creek joins Spencer Creek which enters Lake Ontario at Coote's Paradise (western limit of Hamilton Bay).

Headwaters of Fletcher Creek arise just west of Highway 6 South and south of the CP Galt subdivision in the Fletcher Creek Swamp Forest. This swamp forest is a municipally-designated Environmentally Sensitive Area (ESA). The MNR has designated the portion of Fletcher Creek within the ESA as a coldwater stream. An extensive system of coldwater streams arises a considerable distance west of the study area from groundwater discharge areas found in the Fletcher Creek Swamp Forest and the Beverly Swamp to the south.

Significant fish species collected in 1984 and 1993from the Fletcher Creek watershed and areas below its confluence with Spencer Creek (Spencer Creek Watershed) include:

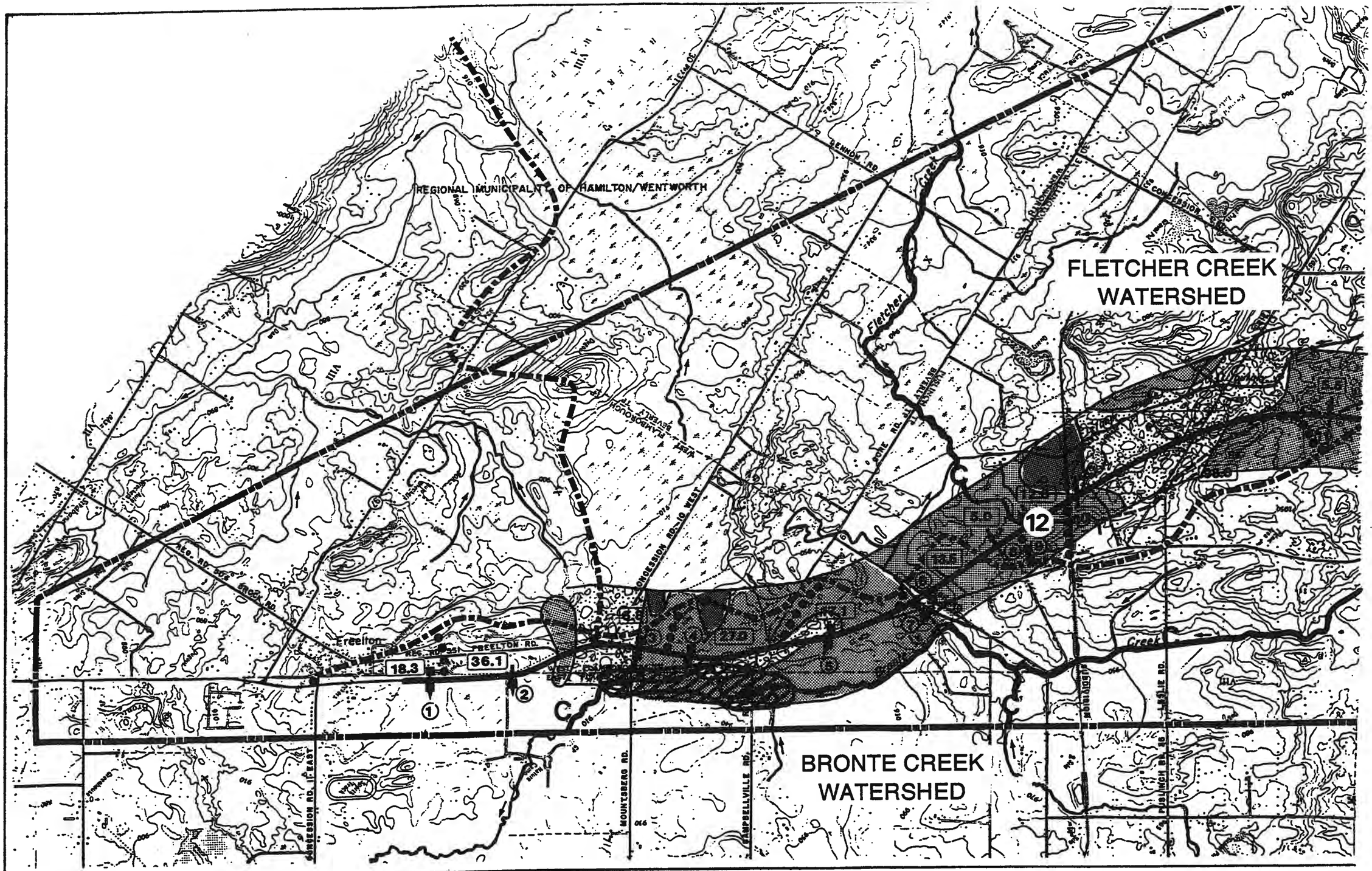
- brook trout (coldwater species)
- green sunfish (regionally rare species)
- redside dace (nationally vulnerable species).

Fish species collected from this watershed are listed in Table 1.

Galt Creek Watershed

Galt/Mill Creek and its tributaries drain primarily agricultural areas in the northern and western portions of the study area. The Creek and several of its tributaries have been designated by the MNR as coldwater streams. The fisheries resources of the Galt/Mill Creek system have been surveyed in at least three separate studies since the Hanlon Expressway was completed in 1976 in order to determine the effects of the highway facility on the watercourse and the need for habitat rehabilitation. Both brown and brook trout have been collected within the Highway 6 study area (see Table 1).

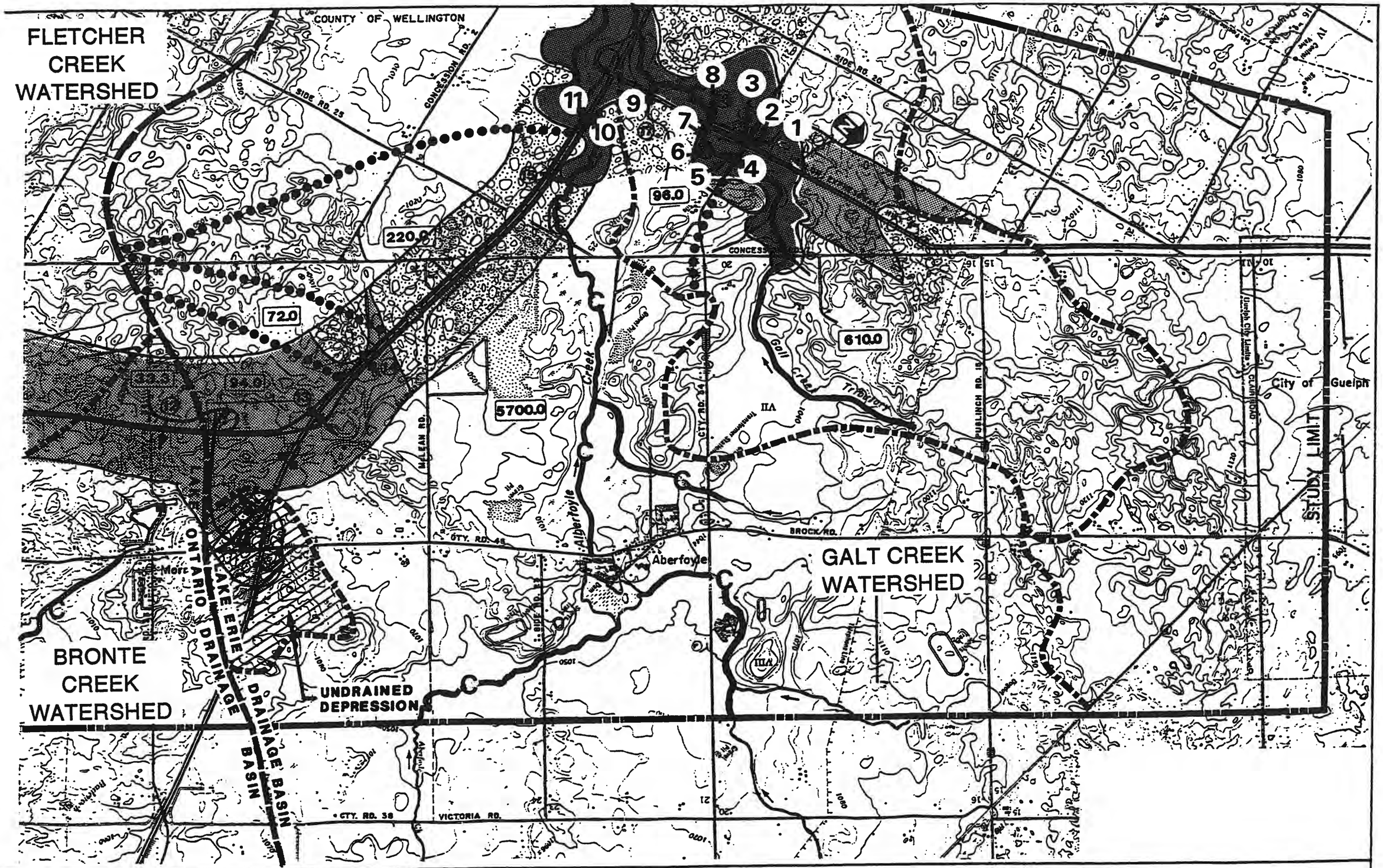
Areas of Galt/Mill Creek, primarily downstream of the study area, have been subject to extensive rehabilitation efforts by local fishing clubs, the MNR, and others. Several sections of tributaries in the vicinity of the Hanlon expressway have also received rehabilitation/restoration efforts. Rehabilitation/restoration techniques implemented on this watercourse have included alder pollarding, low level deflectors of assorted materials, log and rock riprapping, fencing and seeding. Based on redd surveys, rehabilitation/restoration measures have been successful in enhancing the coldwater fishery of Galt/Mill Creek.



HIGHWAY 6
FREELTON TO GUELPH

LEGEND:

- PROPOSED ALIGNMENT
- MAJOR WATERSHED
- ← ① CROSSINGS
- STUDY LIMITS
- UNDEFINED
- DRAINAGE AREA BOUNDARY
- 00.0 CATCHMENT AREA IN ha



3 FISH HABITAT ASSESSMENT LOCATION

C COLDWATER STREAM

■ CULVERT PHOTOGRAPH LOCATION

HIGH POTENTIAL DISCHARGE AREA

HIGH POTENTIAL RECHARGE AREA

LOWER POTENTIAL RECHARGE AREA

SPAWNING/NURSERY AREA

Figure 1

ASSESSMENT OF FISHERIES RESOURCES

2.1.2 Hydrogeology

Hydrogeological conditions of areas potentially affected by proposed Highway 6 improvements include areas of groundwater discharge and groundwater recharge.

High potential discharge areas were defined as areas of gravel (ice-contact or outwash), or peat and muck associated with gravel, found in local depressions. Groundwater flows would generally be directed to such high permeability materials (gravel; the presence of peat and muck is direct evidence of the year-round presence of water), and the topographic setting would tend to make such an area a groundwater discharge zone.

A high potential recharge area was defined as an area of ice-contact or outwash gravel, or exposed bedrock located at relatively high elevations. The generally high permeability of these soils, along with topography, would promote the rapid infiltration of surface waters into the groundwater regime.

The lower potential recharge areas were defined as areas of high relative elevation consisting of the stony, sandy silt Wentworth Till. The lower permeability of these soils, along with the steep slopes associated with this material, would tend to increase surface water runoff, thus limiting the amount of infiltration capable of recharging groundwater.

Potential discharge and recharge areas are identified on Figure 1.

High potential discharge areas potentially affected by proposed highway improvements are concentrated in the vicinity of the Highway 401 - Hanlon Expressway interchange. Actual groundwater upwelling was documented during field reconnaissance in the wetland in the northwest quandrant of the Hanlon Expressway - County Road 34 intersection. Strong evidence of upwelling was noted in the three other quadrants. This evidence included:

- low lying area adjacent to upland areas
- relatively coarse stream substrates
- presence of cool water plant species instream (watercress)
- generally swampy conditions (soft, wet, highly organic soils) between stream beds.

These conditions were also noted further south on the west side of the Hanlon Expressway closer to Highway 401. The presence of bank discharge was difficult to discern at these locations due to the abundant vegetation overhanging the banks.

TABLE 1

FISH COLLECTION RECORDS FOR STUDY AREA WATERSHEDS

Scientific Name	Common Name	Bronte Creek Watershed		Fletcher Creek Watershed	Galt Creek Watershed	
		A[1]	B[1]	B[2&3]	A[4]	B[5]
CYPRINIDAE	**Carps and Minnows**					
Clinostomus elongatus	redside dace			X		
Notropis cornutus	common shiner			X	X	X
Margariscus margarita	pearl dace			X		
Notropis heterolepis	blacknose shiner		X	X	X	X
Phoxinus eos	northern redbelly dace		X	X		
Phoxinus neogaeus	finescale dace			X		
Pimephales notatus	bluntnose minnow			X		
Pimephales promelas	fathead minnow		X	X		
Rhinichthys atratulus	blacknose dace		X	X	X	X
Rhinichthys cataractae	longnose dace		X			X
Semotilus atromaculatus	creek chub		X	X	X	
CATOSTOMIDAE	**Suckers**					
Catostomus commersoni	white sucker			X	X	X
Hypentelium nigricans	northern hognose sucker					X
ESOCIDAE	**Pikes**					
Esox lucius	northern pike			X		
UMBRIDAE	**Mudminnows**					
Umbra limi	central mudminnow			X	X	X
SALMONIDAE	**Trouts**					
Salmo trutta	brown trout		X		X	
Salvelinus fontinalis	brook trout	X	X	X	X	X

TABLE 1 (continued)

FISH COLLECTION RECORDS FOR STUDY AREA WATERCOURSES

Scientific Name	Common Name	Bronte Creek Watershed		Fletcher Creek Watershed	Galt Creek Watershed	
		A[1]	B[1]	B[2&3]	A[4]	B[5]
GASTEROSTEIDAE	**Sticklebacks**					
Culaea inconstans	brook stickleback			X	X	X
COTTIDAE	**Sculpins**					
Cottus bairdi	mottled sculpin			X		
CENTRARCHIDAE	**Sunfishes**					
Ambloplites rupestris	rock bass				X	X
Lepomis cyanellus	green sunfish			X		
Lepomis gibbosus	pumpkinseed			X		
Micropterus salmoides	largemouth bass			X		
PERCIDAE	**Perches**					
Etheostoma caeruleum	rainbow darter				X	X
Etheostoma nigrum	johnny darter			X		
Perca flavescens	yellow perch			X		

Note: A = collection records for Highway 6 study area
B = collection records for downstream of Highway 6 study area

Data Sources: 1 C. Portt and Associates, 1981
2 unpublished M.Sc. thesis data, 1984
3 HRCA Stream Survey records, 1993
4 FaunAquatics Canada, 1981
5 MNR Stream Survey records, 1976

Small pockets of potential groundwater discharge are also located around the CP Rail line just west of Highway 6 and slightly north of Freelton, west of Highway 6.

High potential recharge areas are scattered throughout the highway corridor proposed for improvements but are concentrated primarily around Highway 401 between the Highway 6 South interchange and the Highway 6 North interchange and are associated with nearby sand and gravel extraction north and south of Highway 401. Contiguous blocks of lower potential recharge areas along the proposed highway route are located between Highway 401 and Crieff Road, and south of Crieff Road to Concession Road 10W.

2.2 Watercourse Characteristics at Crossing Locations

This section describes fish habitat characteristics at watercourse crossing locations in the three watersheds. Fish habitat parameters for the twelve stations noted on Figure 1 are presented on Table 2.

2.2.1 Galt/Mill Creek

Five general areas were identified for more detailed examination in the Galt/Mill Creek watershed. They were:

1. Galt/Mill Creek tributary #1 (west branch)

   - tributary draining the northwest and southwest quadrants of the Hanlon Expressway - County Road 34 intersection.

2. Galt/Mill Creek tributary #1 (east branch)

   - tributary draining the northeast and southeast quadrants of the Hanlon Expressway - County Road 34 intersection.

3. Galt/Mill Creek tributary #1 (combined flows)

   - areas downstream of convergence of east and west branches described in 1. and 2. above (former McCrimmon property).

4. Galt/Mill Creek tributary #2

   - small tributary draining central area between Highway 401 and County Road 34.

5. Galt/Mill Creek

   - main branch of Galt/Mill Creek which crosses beneath Highway 401 just east of the Highway 401 - Hanlon Expressway interchange.

The following notes document existing conditions at these five locations.

2.2.1.1 Galt/Mill Creek tributary #1 (West Branch)

Fish habitat assessments were conducted at three locations in the vicinity of the west branch of tributary #1 (see Figure 1). The northwest quadrant of this interchange is a groundwater discharge area. Evidence of groundwater discharge was observed at Station 1 (upwelling, mushy ground, bank moisture, etc.). Fish habitat characteristics of this assessment station are detailed in Table 2 and are summarized as:

- lack of pools or riffle areas
- predominantly open/shrub marsh setting
- abundant "soft" substrates composed of muck and detritus

Channel width and depth at Station 1 was approximately 0.75 m and 15 cm, respectively. The area is not likely suitable as salmonid habitat due to shallow depths, braided stream channels, absence of riparian vegetation, and an abundance of detritus and silts. It may be suitable for other small fish.

Habitat conditions were suitable for a variety of fish species, including trout, at Stations 2 and 3. Fish habitat characteristics at these assessment locations were characterized by dense cedar cover, areas of "harder" substrates such as gravel and sand, and a variety of instream structure providing cover for fish. Stream dimensions were noted to be slightly wider and deeper than at Station 1. Two unidentified trout species (approximately 10-15 cm in length) were observed at Station 2.

2.2.1.2 Galt/Mill Creek tributary #1 (East Branch)

A total of four habitat assessments were conducted on the east branch of this tributary: one

upstream of County Road 34; three downstream of County Road 34.

Upstream of County Road 34, existing fish habitat is considered to be of marginal to moderate value. While cover provided by riparian vegetation and instream structure is considered to be excellent, flows are conveyed via a diffuse channel within a large swamp of hardwoods and conifers. Riffle-pool complexes were not present within the assessment length. Substrates were predominantly comprised of detritus and muck (see Table 2). This area is considered to be a groundwater discharge zone as evidenced by the surrounding topography (high ground to the north and east) and the swampy nature of the surface soils. Combined with an abundance of detritus, muck, and silt substrates, the value of this habitat is somewhat reduced. The presence of watercress (Nasturtium officinale) in this segment suggested the good quality, cool water of this tributary.

Downstream of County Road 34, water quality conditions are also good as evidenced by abundant watercress. This area is also presumed to be a groundwater discharge area for the same reasons as outlined above. Fish habitat improved with increased distance downstream of County Road 34. The following fish habitat characteristics were noted at Station 5:

- combination of partly open and dense vegetative canopy
- diverse instream cover and substrates
- absence of riffle-pool complexes.

Habitat characteristics at Station 6 were similarly good with more abundant sand and gravel substrates but substantially less riparian canopy present. Pools, riffles, and runs were observed along the assessment location length. Surrounding land uses included pasture and crop, although the majority of Station 6 was contained within a wooded area. One brook trout was observed moving on and off a redd. Based on its proximity to the Hanlon Expressway, it appeared that the segment of this tributary had been realigned and fish habitat rehabilitated (i.e., abundant sand and gravel). At Station 7, habitat characteristics included high quantities of riparian and instream cover, suitable stream dimensions and flow, and areas of favourable substrates. Approximately 10 to 15 redds were noted in the 100 m length of stream assessed. One brook trout (approximately 23 cm in length), which had succumbed for unknown reasons, was collected.

2.2.1.3 Galt/Mill Creek tributary #1 (Combined Flows)

The combined flows of this tributary have been referred to, by others, as McCrimmon's Tributary. Below the convergence of the two branches (Station 8), fish habitat is considered

TABLE 2
HIGHWAY 6 AQUATIC HABITAT INVENTORY
STREAM ASSESSMENT

PARAMETER	STATION NUMBER											
	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
Sample Date	08/12/92	08/12/92	08/12/92	08/12/92	08/12/92	08/12/92	08/12/92	08/12/92	08/12/92	09/12/92	09/12/92	09/12/92
Air Temperature (C)	-4.0	-4.0	-4.0	-2.0	-2.0	-3.0	-2.0	-2.0	-3.0	-5.0	-5.0	-2.0
Sample Time (Hrs)	1130	1200	1215	1411	1430	1445	1504	1530	1557	0840	0946	1115
BANK STABILITY (%)												
Highly unstable	0	0	0	0	0	0	0	0	0	0	0	0
Moderately unstable	0	5	0	0	0	5	40	0	0	0	10	5
Stable	100	95	100	100	100	95	60	100	100	100	90	95
STREAM MORPHOLOGY (% area)												
Riffles	0	0	0	0	0	10	0	10	0	0	5	5
Pools	5	0	0	0	5	20	0	10	0	0	5	0
Runs	95	100	100	100	95	70	100	80	100	100	90	95
Flats	0	0	0	0	0	0	0	0	0	0	0	0
STREAM COVER/CANOPY (%)												
Dense	0	60	90	95	50	0	100	90	0	90	40	5
Partly open	20	40	10	5	50	15	0	10	40	0	50	80
Open	80	0	0	0	0	85	0	0	60	10	10	15

TABLE 2
HIGHWAY 6 AQUATIC HABITAT INVENTORY
STREAM ASSESSMENT

PARAMETER	STATION NUMBER											
	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
INSTREAM COVER (%)												
Undercut banks	50	80	100	40	40	50	60	50	0	0	5	25
Boulder	0	0	0	0	0	0	0	0	0	0	0	0
Log & tree	10	15	25	60	20	0	30	15	0	15	15	5
Log Jams	0	0	0	5	2	0	0	0	0	0	0	0
Organic debris	5	10	10	40	15	10	30	5	15	10	15	30
Macrophytes	0	10	5	20	8	10	0	10	70	40	25	10
BOTTOM TYPE (%)												
Rock	0	0	0	0	0	0	0	0	0	0	0	0
Boulder	0	0	0	0	0	0	0	0	0	0	0	0
Rubble	0	0	0	0	0	5	0	0	0	5	15	0
Gravel	0	10	15	0	0	80	25	40	0	60	70	5
Sand	0	10	5	0	10	15	30	50	0	30	15	10
Silt	0	0	5	5	15	0	0	0	0	0	0	30
Clay	0	0	0	0	0	0	0	0	0	0	0	0
Muck	60	0	0	20	35	0	0	0	0	0	0	55
Marl	0	40	50	0	0	0	0	0	40	0	0	0
Detritus	40	40	25	75	40	5	45	10	60	5	0	0

TABLE 2
HIGHWAY 6 AQUATIC HABITAT INVENTORY
STREAM ASSESSMENT

PARAMETER	STATION NUMBER											
	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
TERRAIN CHARACTERISTICS (%)												
Cultivated	0	0	0	0	0	0	0	0	50	0	0	0
Pasture	0	0	0	0	0	0	0	0	0	0	0	0
Meadow	0	0	0	0	0	25	0	0	50	0	0	0
Upland Hardwood	0	0	0	0	0	0	0	0	0	0	0	0
Upland Coniferous	0	0	0	0	0	0	0	0	0	0	0	0
Swamp Hardwood	0	0	0	40	50	75	50	0	0	85	100	0
Swamp Coniferous	0	50	80	60	50	0	50	100	0	5	0	0
Shrub marsh	50	50	0	0	0	0	0	0	0	0	0	85
Open marsh	50	0	0	0	0	0	0	0	0	0	0	15
Lawn	0	0	0	0	0	0	0	0	0	0	0	0
Impervious surface	0	0	20	0	0	0	0	0	0	10	0	0
LANDUSE (% Adjacent)												
Pasture	0	0	0	0	0	10	0	0	50	0	0	0
Crop	0	0	0	0	0	10	0	0	50	0	0	0
Feedlot	0	0	0	0	0	0	0	0	0	0	0	0
Sewage Treatment Plant	0	0	0	0	0	0	0	0	0	0	0	0
Private Dwelling	0	0	0	0	0	0	0	0	0	0	0	10
Woodlot	0	0	0	0	0	80	0	0	0	100	100	0
Recreation Area	0	0	0	0	0	0	0	0	0	0	0	0
Conservation Area (ESA)	100	100	100	100	100	0	100	100	0	0	0	90
Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 2
HIGHWAY 6 AQUATIC HABITAT INVENTORY
STREAM ASSESSMENT

PARAMETER	STATION NUMBER											
	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
STREAM DIMENSIONS												
Length (m)	100	100	100	100	100	100	100	100	100	100	100	100
Mean Width (m)	0.75	0.85	0.60	2.50	1.50	1.20	2.00	2.50	2.50	4.50	3.00	1.40
Mean Depth (cm)	15.0	15.0	20.0	15.0	10.0	15.0	20.0	20.0	5–10	18.0	25.0	15.0
Average Velocity (cm/s)	0.50	0.50	0.60	0.25	0.50	0.25	0.50	0.20	5–10	0.80	1.00	0.30
BARRIERS (no. of)												
Natural	0	0	0	0	0	0	0	0	0	0	0	0
Artificial	0	0	0	0	0	0	0	0	0	0	0	0
SUBSTRATE CONDITION–												
Overlying Sediment (% of area)												
Slight	0	0	0	0	0	0	0	0	0	15	5	0
Medium	0	0	0	0	0	0	80	0	0	0	10	0
Heavy	0	0	0	0	0	0	0	0	0	0	0	0
Overlying Algae (% of area)												
Slight	0	0	0	0	0	0	0	0	0	0	0	0
Medium	0	0	0	0	0	70	0	0	0	0	0	0
Heavy	0	0	0	0	0	0	0	0	0	0	0	0
SPAWNING AREA												
Species Code							78/80	78/80			78/80	
Time of Year							F/W	F/W			F/W	
No. of Redds							10–15				15–20	

Note: Species Code 78 = brown trout, Species Code 80 = brook trout
Time of Year F/W = Fall/Winter

to be of excellent quality. Habitat characteristics such as instream and riparian cover, stream morphology, and substrate composition and condition were highly favourable for coldwater fish species (Table 2). These are summarized as:

- diverse stream morphology (riffles, pools, and runs)
- dense and partly open stream canopy
- diverse and abundant instream cover and "hard" substrates.

Watercress stands were abundant. While no redds were seen, numerous trout (brook and brown) were observed. This area was indicated to be a high potential discharge zone due to the topographic location (lowland), the coarse nature of the stream substrate, the peaty nature of the soils, as well as the outwash and ice-contact gravels mapped near this location.

2.2.1.4 Galt/Mill Creek tributary #2

This tributary differs dramatically from the tributary discussed above. The tributary meanders through pastured and cultivated lands and enters a small wetland on the east side of the Hanlon Expressway. The area is essentially open (i.e., no stream cover or canopy). Substrates are dominated by detritus. Detailed composition of habitat parameters are provided in Table 2. Although minimal fish habitat is available, the presence of watercress suggests that flow may be derived from a groundwater source, which may be important to downstream fish habitat. This area is mapped as a recharge area due to the presence of subsurface gravels, and its topographically higher elevation relative to the adjacent wetland. However, some local groundwater discharge occurs due to the nearness of the water table to the ground surface.

2.2.1.5 Galt/Mill Creek

Fish habitat assessment surveys were conducted upstream and downstream of Highway 401. Both locations represented excellent fish habitat based on the parameters examined. The upstream station (Station 10) was wider, shallower and more open than the downstream station (Station 11). Both assessment locations had diverse instream cover provided by fallen logs and trees, and diverse and abundant substrates comprised of rubble, gravel and sand. Dimensions of Galt/Mill Creek averaged 4.5 m wide and 18 cm deep at the upstream station (Station 10), and 3.0 m wide and 25 cm deep downstream of Highway 401 (Station 11). The combination of increased instream structure and meanders downstream of Highway 401 (Station 11) provide more opportunities for salmonid spawning. Numerous redds were noted in the section of stream assessed, as well as downstream. Both areas examined, and extending upstream and downstream, are considered to be high potential

groundwater discharge zones due to the topographically low location, the swampy nature of the soils and the presence of topographically higher gravels (recharge area) adjacent to this area. Again, the clear and cool qualities of this watercourse were supported by an abundance of watercress.

2.2.2 Bronte Creek

Bronte Creek is crossed only once by the existing alignment of Highway 6 at Morriston. Since the alignment and improvements proposed for Highway 6 will not require a crossing of Bronte Creek, no formal fish habitat assessment studies were conducted. General observations of fish habitat were made at the crossing location at Morriston. At this location Bronte Creek is approximately 0.8 m wide. Minimal flow was noted during field observations. The stream channel was largely overgrown with emergent vegetation. Based on these observations, this area of Bronte Creek appears to be more important as a contributor of clear, cool baseflow to downstream areas rather than important as productive salmonid habitat. Published mapping indicates that the headwaters of this creek are located in a hummocky silt till, assessed as a low-potential recharge area.

2.2.3 Fletcher Creek

One of the headwater tributaries of Fletcher Creek is crossed by Fielding Lane, just south of the CP Rail line. As part of the Update and Supplementary Investigations, a fish habitat assessment was conducted downstream of this crossing. At this location the watercourse is characterized by a small channel through dense emergent vegetation. The channel morphology was predominantly a run (one small riffle area only). A partly open canopy was provided, over the majority of the assessment length, by shrubs and tall emergent species. Stream substrates were largely dominated by "soft" sediments of muck and silt. Minimal flow was noted during field assessment in December. The watercourse was observed to be dry during summer. As fish habitat this crossing site was rated as having low potential. Published geological data for this area suggest the area to be primarily a low-potential recharge area (a silt till highland). A small mapped discharge area is located west of this location.

3.0 ENVIRONMENTALLY SENSITIVE AREAS/ISSUES

The headwater area and coldwater streams and tributaries found within the study area represent environmentally sensitive areas. Coldwater fisheries resources are highly valued in southern Ontario for several reasons. Firstly, these watercourses support high quality fish

species highly desired by recreational fishermen. Secondly, development pressures in southern Ontario are impacting critical coldwater habitat parameters primarily through reductions in baseflow, removal of riparian vegetation and measures which lead to elevated water temperatures. The MNR expects that angler demand for coldwater species will exceed the natural production of these species (MNR 1983). The strategy then is the protection and rehabilitation of sensitive headwater areas or coldwater streams to sustain the coldwater fishery of the area. All three study area watersheds share a similar geographic source of groundwater which provides baseflow to their coldwater streams.

Additional to the sensitivity of coldwater fish species, the federal Department of Fisheries and Oceans' *Policy for the Management of Fish Habitat* serves to protect the habitats of all fish species. This includes coldwater and warmwater fish and their habitats, as well as regionally, provincially and nationally significant fish species, such as the redside dace.

While not directly crossed by the proposed Highway 6 alignment, sensitivities of the Bronte Creek system are related to construction impacts (sedimentation and erosion) and modifications to baseflow in tributaries to this system. Two areas are of particular importance. They are:

- designated spawning and nursery area east of the existing Highway 6 South alignment between Mountsberg Road and Campbellville Road
- tributaries to Bronte Creek which cross Highway 6 South between Freelton and Campbellville Road.

Downstream of the study area redside dace have been collected.

Sensitive issues related to the Fletcher Creek watershed are primarily concerns of highway construction on groundwater discharge areas which provide baseflow to sensitive downstream watercourses. These areas are primarily located downstream of the area proposed for highway improvements. Redside dace have also been collected in Fletcher Creek (1993 collections), although well downstream of the study area.

The most sensitive area potentially affected by the proposed Highway 6 improvements is the Galt Creek watershed, and more specifically the area located in the vicinity of the intersection of County Road 34 and the Hanlon Expressway. These heavily wooded areas are suggested to represent areas of groundwater discharge and presently support populations of brook and brown trout. Direct evidence of groundwater discharge (mid-stream upwelling), as well as abundant indications of circumstantial evidence (topographic location, coarse subsurface soils, swampy surface soils, cool water vegetation) suggest that much of

the area surrounding this intersection contributes a substantial base flow to the nearby watercourses. The sensitivity of this area is further emphasized as this area is proposed for significant development. Evidence of trout spawning on realigned sections of a Galt/Mill Creek tributary, presumably realigned due to Hanlon Creek construction, indicate that this habitat can be restored and utilized by native coldwater species.

The main branch of Galt/Mill Creek is also considered to be sensitive. Evidence of spawning was abundant, particularly downstream of Highway 401. Spawning habitat and rehabilitation efforts downstream would be susceptible to the impacts of Highway 401 widening and off-ramp redevelopment. As existing culverts which convey Galt/Mill Creek flows already extend well beyond the existing Highway 401 right-of-way, sensitivities of the watercourse are somewhat reduced since construction requirements (i.e., culvert extension) will be reduced. The productive capacity of this watercourse to support coldwater fish species cannot be compromised.

4.0 REFERENCES

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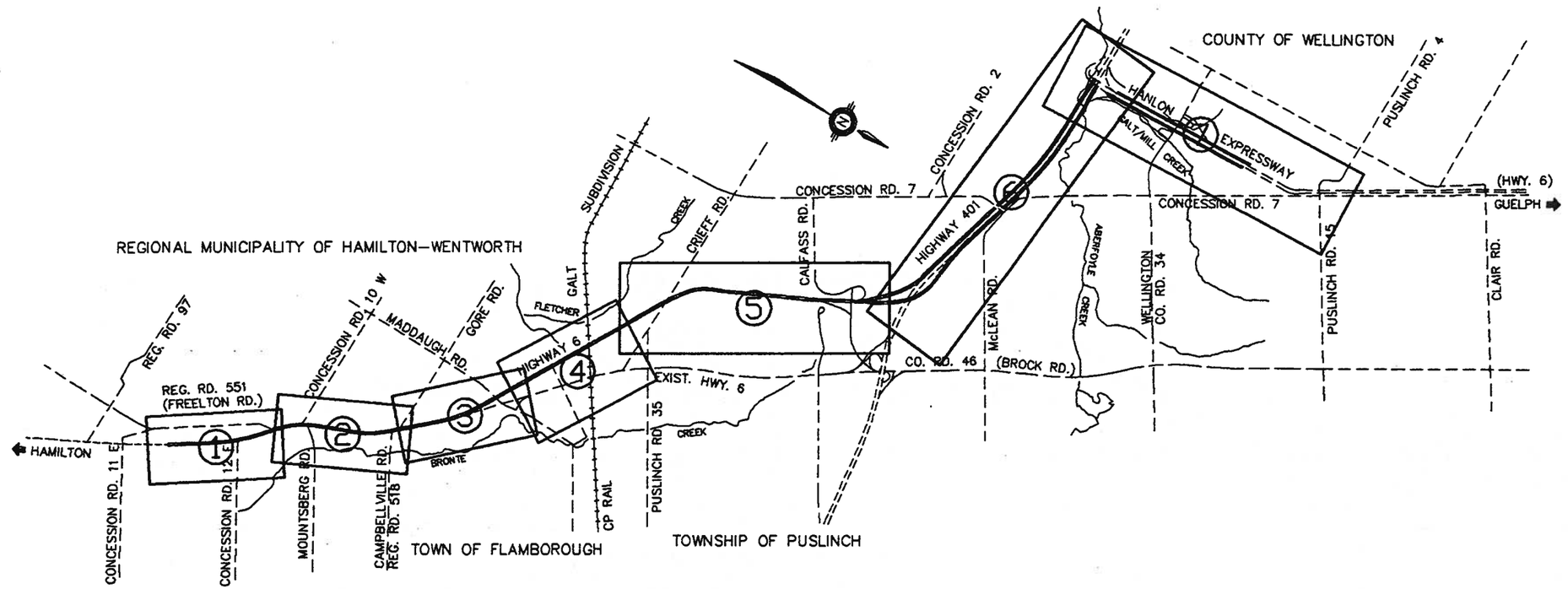
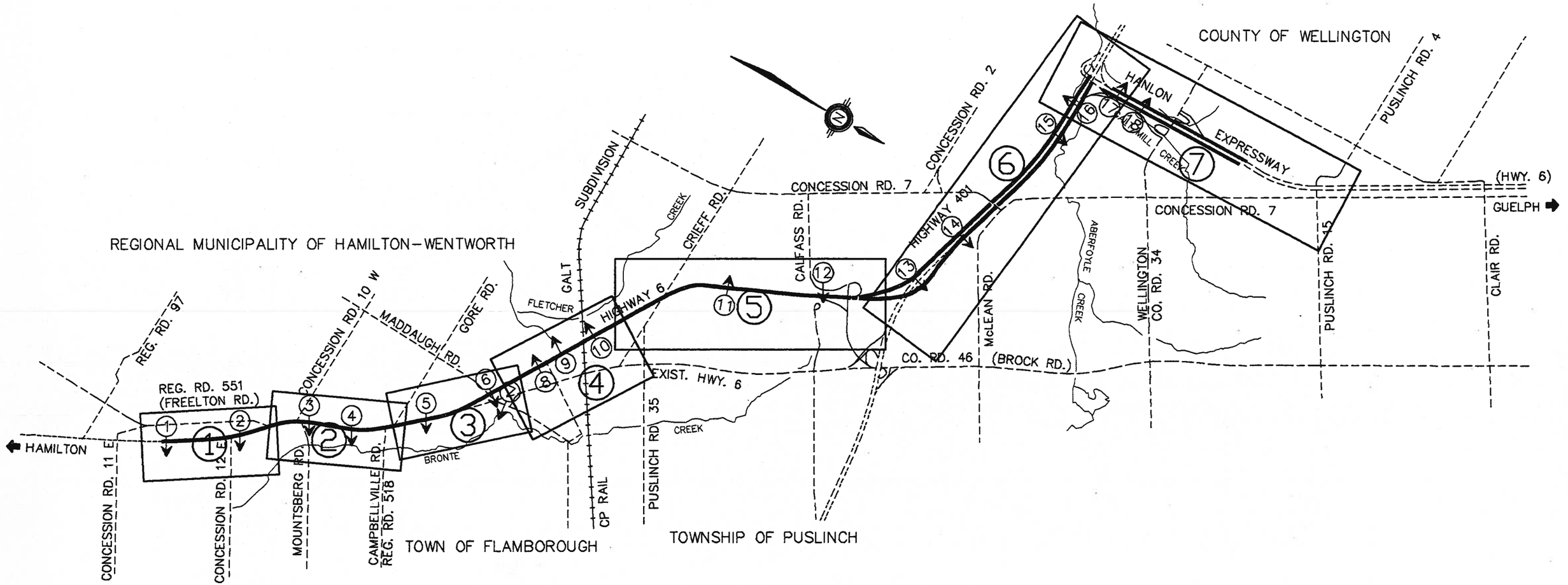


LEGEND
—— Existing Roadway
▬▬ 1987 Technically Preferred Route

FENCO MacLAREN INC.

KEY PLAN OF HIGHWAY 6 IMPROVEMENT SECTIONS

FIGURE 1



FENCO MacLAREN INC.

LEGEND

---- Existing Roadway

━━ 1987 Technically Preferred Route

←① Culvert Crossings

CULVERT LOCATIONS

FIGURE 2

Highway 6 - Freelton to Guelph
W.P. 65-76-05

Impact Assessment of Highway 6 Improvements
Aquatic Resources

1.0 INTRODUCTION

An impact assessment of aquatic resources was undertaken for areas potentially affected by the Highway 6 improvements proposed by the Ministry of Transportation (MTO) in the Town of Flamborough, and Puslinch Township under W.P. 65-76-05. This impact assessment included hydrogeological considerations potentially affecting the aquatic resources of the study area through contributions of groundwater to surface watercourses. Background information on aquatic resources (including hydrogeological conditions) associated with the proposed study was documented in a working paper prepared by Fenco MacLaren and submitted to the MTO in February 1993.

Based on field investigations conducted in November and December of 1992, and September of 1993, potential impacts of the highway improvements were predicted for the seven highway sections identified on Figure 1. The following highway sections were examined:

Sections 1, 2 and 3	Widening of existing Highway 6 from Freelton to Maddaugh Road (one route proposed and evaluated for impacts)
Section 4	New Highway 6 route between Maddaugh Road and Crieff Road (the Canadian Pacific (CP) Galt Subdivision) (one route proposed and evaluated for impacts)
Section 5	New Highway 6 route between Crieff Road and Calfass Road (three alternatives proposed and evaluated for impacts)
Section 6	Highway 401 widening between interchange with Highway 6 South and Hanlon Expressway (one route proposed and evaluated for impacts)
Section 7	Hanlon Expressway between Highway 401 and Puslinch Road 4/15 (two interchange alternatives proposed and evaluated for impacts).

New provincial policy initiatives (e.g., 1992 Wetland Policy, 1993 MTO/MNR (Ontario Ministry of Natural Resources)/DFO (Department of Fisheries and Oceans) Fisheries

Protocol) were considered in the determination of potential effects. Recommendations were then developed with respect to appropriate mitigation measures to avoid or reduce the potential for adverse impacts of each highway section on the aquatic environment. These included, as appropriate, recommendations for the development of compensatory measures to offset the unavoidable loss or disruption of fish habitat required to achieve the objectives of DFO's *Policy for the Management of Fish Habitat*. Net effects were then predicted.

For highway sections having route alternatives, evaluation criteria were developed and considered in the comparison of aquatic resources and hydrogeological conditions associated with each of the alternatives. Based on the magnitude and sensitivity of aquatic biological characteristics to the proposed highway improvements, the alternatives were ranked. Alternatives were also ranked based on their potential impact to significant groundwater and geological characteristics.

This aquatic impact assessment is one of several supplementary assessment studies being conducted by various disciplines to address pre-submission comments on the draft Environmental Assessment Report for the selection of a technically preferred route for the improvements of Highway 6 between Freelton and Guelph.

2.0 IMPACT ASSESSMENT OF HIGHWAY SECTIONS

2.1 Highway Sections 1, 2 and 3 - Freelton to Maddaugh Road

Description of Aquatic Resources

Widening of the existing Highway 6 is proposed in highway sections 1, 2 and 3 (see Figure 1). Surface waters crossing these highway sections generally flow from west to east beneath existing Highway 6 South. Figure 2 shows the location of culverts for these three, and all other highway sections. Highway sections 1, 2 and 3 are wholly within the Bronte Creek watershed. The headwaters of the principal watercourse in this section of the watershed, West Bronte Creek, generally parallel Highway 6 on the east side of the Highway from its source, near Morriston, to Freelton. West Bronte Creek is generally offset from Highway 6 by approximately 300 metres, with maximum and minimum separations of 950 and 100 metres, respectively. Throughout highway sections 1, 2, and 3, Bronte Creek is designated by the MNR, as a coldwater stream. Also designated by the MNR is a spawning and nursery area for coldwater fish species located immediately east of Highway 6 roughly between Campbellville Road and Mountsberg Road.

Two pockets of high potential recharge areas are found within these highway sections. High potential recharge areas are defined as areas of ice-contact or outwash gravel, or exposed bedrock, located at high relative elevations. The generally high permeability of these areas, along with the associated topography, promote rapid infiltration of surface waters. These areas are identified in Figure 1. The southern-most deposit of permeable soils is located in an area which surrounds the intersection of Highway 6 and Flamborough Concession 10W. The second pocket of permeable soils, which correspond to high potential recharge areas, occurs in a narrow band roughly paralleling the Highway from an area south of Mountsberg Road to north of Gore Road. As there are no mapped groundwater discharge areas immediately adjacent to Highway 6 South within these sections, all other areas abutting the Highway are considered to be of lower potential recharge than those discussed. High potential discharge areas (see Figure 1 for locations) are defined as high permeability zones (sand and gravel with or without associated peat and muck) located in depressions. Lower potential recharge areas are defined as topographic highs consisting of lower permeability tills.

Potential Impacts

Widening of the existing Highway 6 is proposed in highway sections 1, 2 and 3. As such, impacts on the aquatic biological resources of the area are largely limited to the impacts of culvert extensions (instream work) and general highway construction impacts which may indirectly affect aquatic resources (e.g., erosion and sedimentation) in the immediate vicinity and downstream of the works. Roadway widening along these sections may reduce potential recharge of groundwater in the high potential recharge areas. Infiltrating groundwater may be contaminated by highway runoff (salt, gasoline, oils).

Only mapped recharge zones are potentially affected by the widening of Highway 6 in these highway sections. Highway widening through the southern-most deposit may encroach on high potential recharge areas over a distance of approximately 250 metres. Highway widening between Mountsberg Road and Gore Road may encroach on approximately 800 metres of high potential recharge area. Highway widening in the remainder of highway sections 1, 2 and 3 will encroach on areas of lower potential recharge. No mapped groundwater discharge areas would be affected.

Proposed Mitigation

Because of the sensitive fisheries resources paralleling the sections of Highway 6 proposed for widening and potential impacts on high potential recharge areas which discharge to the West Bronte Creek system, appropriate considerations which protect aquatic resources

should be incorporated into the development of construction mitigation measures, as well as the design and development of stormwater management plans. For example, the period of instream work by construction equipment should be minimized to reduce a variety of potential impacts associated with sedimentation and contamination. Seasonal fluctuation in precipitation should also be considered prior to commencing instream work to avoid high flow conditions, as much as possible and should be coordinated with the construction "window" recommended by the MNR. Standard erosion control measures (e.g., rock flow checks) should be implemented to reduce impacts to the aquatic community adjacent and downstream of the highway. The use of Best Management Practices (BMP's), such as infiltration ponds and grasses swales, can promote surface water infiltration while, with the aid of natural filtration in vegetated areas, reducing the potential for groundwater contamination.

Net Effects

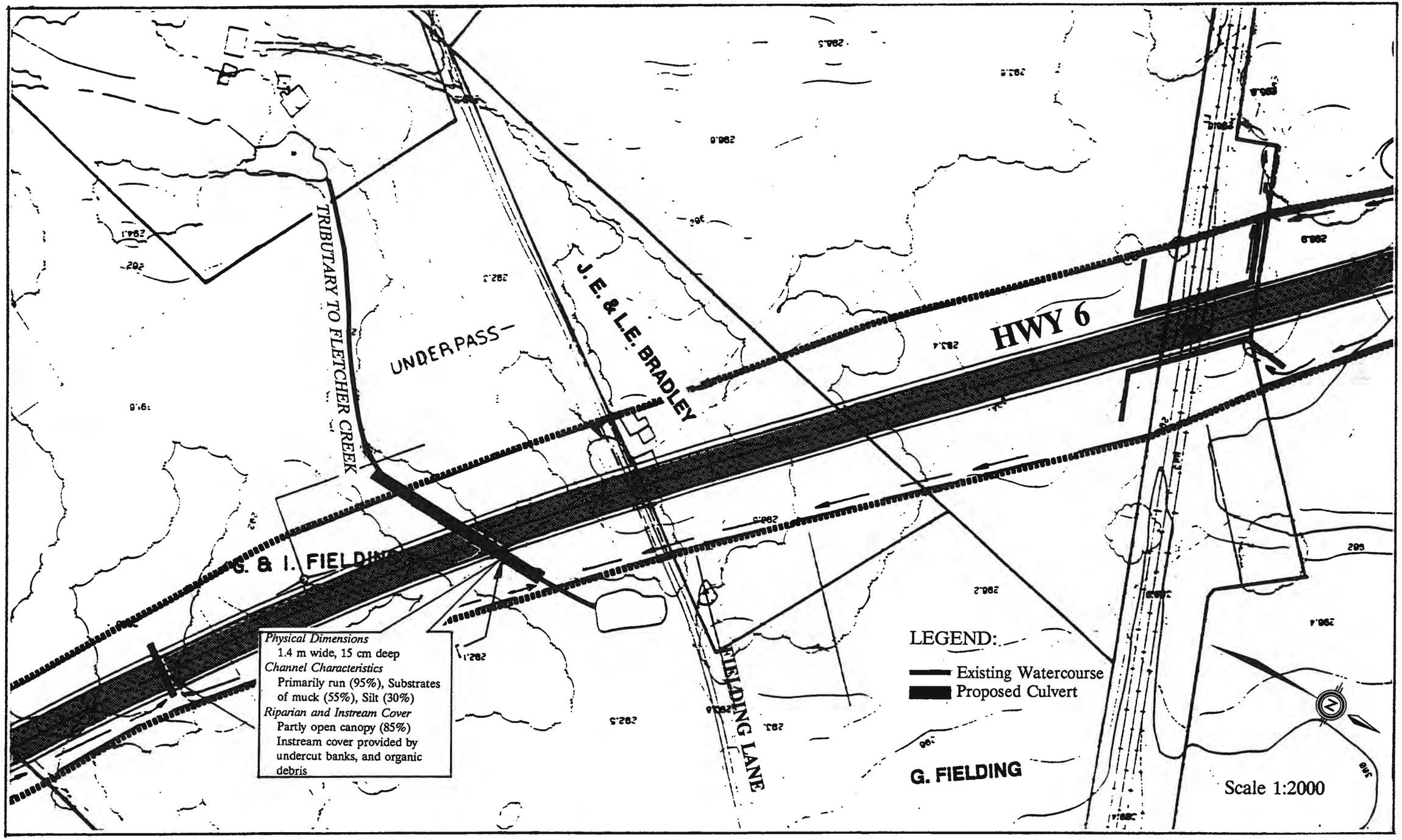
No net adverse effects on aquatic resources are anticipated from the construction of culvert extensions in those highway sections following implementation of available mitigation measures, in consideration of the requirement for minor instream construction work and the small and temporary flow characteristics of potentially affected watercourses. The use of BMP's is anticipated to produce no net effect on groundwater recharge rates (rates will be maintained at present levels), or recharge water quality. However, recharge water quality will depend significantly on the net increase or decrease of the amount and type of deicing chemicals used.

2.2 Highway Section 4 - Maddaugh Road to Crieff Road

Description of Resources

Only one watercourse is potentially affected by this section of new highway. One of the headwater tributaries of the Fletcher Creek system arises in the vicinity of the proposed route along Fielding Lane (Figure 3). Existing fish habitat characteristics were described during field investigations conducted in November/December 1992 and are summarized on Figure 3. Conveyance of Fletcher Creek flows, which are seasonal in this area of the drainage basin, will be required beneath the highway via a culvert. No diversion of the headwater stream is required.

Within this highway section a mapped area of high potential recharge area is found immediately north of the CP Galt Subdivision. This area is also considered to be a sand and gravel resource of tertiary (low) significance. The proposed route also passes



PROPOSED HIGHWAY 6 ALIGNMENT INTERSECTING A TRIBUTARY TO FLETCHER CREEK (Fish Habitat Assessment Information in Boxes)

Figure 3.

immediately adjacent to a mapped high potential discharge area located west of the proposed route near the CP Galt Subdivision. The remainder of the route crosses mapped low potential recharge area. Four water wells were noted to be within approximately 150 of the right-of-way.

Potential Impacts

Potential impacts of this section of highway development on aquatic resources can be partitioned into potential on-site and off-site impacts based on the sensitivity of these specific locations. On-site impacts are primarily related to physical impacts on fish habitat (i.e., physical loss or alteration of habitat). The proposed route will require the removal of approximately 40 metres of habitat (streambed, banks and riparian vegetation) to accommodate right-of-way requirements. While the loss of seasonal fish habitat on-site will result from the development of this highway section, the significance of this habitat is considered to be of low value due to the intermittent status of this watercourse. The sensitivity of off-site areas potentially affected by this section of highway development is higher than on-site. Downstream, Fletcher Creek provides an important source of water to the provincially significant Beverly Swamp area. As well, downstream areas of Fletcher Creek support redside dace (Clinostomus elongatus), a nationally "vulnerable" fish species. Recent (1993) fish collections in Fletcher Creek, downstream of the study area, were conducted by the Hamilton Region Conservation Authority. Significant species collected were brook trout (coldwater species) and green sunfish (regionally rare species). The sensitivity of these downstream areas increases the potential significance of the proposed highway development at Fletcher Creek.

Potential hydrogeological impacts to this area are primarily associated with reduced infiltration rates beneath the (essentially impermeable) road surface, and contamination of infiltrating surface water by road salt and other contaminants associated with highways such as vehicle fluids and chemicals leached from the roadway. Approximately 2.7 ha of mapped high potential recharge area located north of the CP Galt Subdivision is potentially affected by this highway section.

Planned excavation depths are expected to be fairly shallow (maximum 4 m) and limited to a relatively short interval (approximately 120 m). These conditions are not expected to affect the local groundwater flow regime (by promoting premature groundwater discharge to surface water bodies), including water wells, to any significant degree.

Proposed Mitigation

In consideration of the sensitivity of downstream resources and the loss of on-site habitat, an appropriate level of protection should be incorporated into the development of construction mitigation measures and stormwater plans to ensure a high level of protection of downstream resources. Opportunities to mitigate potential construction impacts include: minimizing the extent of instream work; scheduling construction to coincide with favourable seasons (i.e., low precipitation) to avoid high flow conditions; application of erosion control measures, including sediment barriers, traps and/or check dams; and maintenance of riparian vegetation. Finally, specific compensatory measures, if necessary, should be developed and implemented to compensate for any net loss of fisheries habitat. BMP's will be used to promote infiltration and prevent possible reductions in baseflow rates.

Net Effects

The overall potential impact of this highway section is expected to be low due to the seasonal status of the watercourse crossing, the availability of mitigation measures to effectively minimize off-site impacts, the rather small area of recharge potentially affected, and the low significance of the sand and gravel resource.

2.3 Highway Section 5 - Crieff Road to Highway 401

Three route alternatives are proposed for this highway section. A description of aquatic and hydrogeological characteristics and potential impacts of each are provided below.

2.3.1 Alternative 1

Description of Resources

There are no watercourses or ponds potentially impacted by this route alternative.

The majority of the length of this route alternative traverses mapped low potential recharge areas (areas of relatively low permeability surficial silt-sand tills). A mapped high potential recharge zone is found toward the south end of this route alternative. This recharge area is also considered to be a sand and gravel resource area of tertiary (low) significance. At least three water wells are within 150 m of the right-of-way; more unrecorded wells may be present in the Telfer Glen Residential Subdivision off Calfass Road.

Potential Impacts

A summary of potential impacts, measured by a series of indicators, is provided in Table 1.

As described previously, potential impacts to this area are related to the reduction of infiltration rates beneath the road surface, and contamination of infiltrating surface water by compounds associated with highways. Groundwater impacts would be minimal over the majority of this route alternative as surface water infiltration into the groundwater regime would be expected to be low due to the relatively impermeable surficial soils. Approximately 8.5 ha of mapped high potential recharge area is crossed by this route alternative toward the south end of the route on both sides of Crieff Road. Overall, the estimated impact to infiltration rates is expected to be low to moderate since the recharge area potentially lost (covered by pavement) by this route alternative is only about 10% of the entire recharge area. The impact on the area as a sand and gravel resource is also expected to be low to moderate for the same reason. Approximately 1.1 km of this route encroaches on the recharge area and could produce low to moderate impacts through contamination of the infiltrating water if appropriate protective measures were not incorporated into the highway design. However, at least three unlicensed pits have been, or are still, operating in the eastern part of this recharge area. The contaminants introduced in these localized areas may reduce the overall impact of a route constructed through this area, which provides some base flow to at least one tributary of Fletcher Creek and nearby swampy areas. Excavation depths into the high potential recharge area are anticipated to be high (greater than 10 m in some areas) and to occur over a significant length of the route (approximately 400 m). The extent of the proposed road cut through this area could produce locally significant effects on groundwater flow by allowing the formation of springs along the cut face, thus prematurely diverting some groundwater to the surface water regime. The magnitude of this effect, however, will depend on the depth to the water table in the vicinity of the proposed cut area.

This route does not encroach on geologically sensitive areas (i.e., mapped Areas of Natural or Scientific Interest (ANSIs)) and does not encounter exposed bedrock. Table 1 summarizes these results.

Mitigation

Mitigation measures for the protection of surficial aquatic resources are not required since there are no watercourses or ponds potentially affected by this route alternative. Control of surface water runoff with roadside ditching and other BMP's will promote infiltration while reducing the potential for groundwater contamination. Redirection of groundwater

discharge in "cut" areas to infiltration ponds would promote recharging and offset impacts of the highway's impermeable surface in reducing infiltration.

Net Effects

No net loss of fisheries habitat is anticipated from highway improvements associated with this alternative. No net effect to the groundwater regime is anticipated.

2.3.2 Alternative 2

Description of Resources

There are no watercourses or ponds potentially impacted by this route alternative.

Hydrogeologically, the description of route alternative 2 is very similar to route alternative 1 (see Table 1). Most of this route alternative traverses mapped low potential recharge areas. A mapped high potential recharge area is found on both sides of Crieff Road near the south end of this route alternative. There are no mapped areas of groundwater discharge found within this route alternative.

Potential Impacts

Alternative 2 would cover (in fill or pavement) approximately 8.6 ha of area mapped as high potential recharge area, and also considered to be a sand and gravel resource of tertiary significance. Again, this translates into about 1.1 km of highway crossing this area. The potential impacts associated with a highway constructed in this geological setting (reduced recharge and possible contamination of recharge water) were outlined in the description of route alternative 1. The planned depth of excavation through the recharge area is essentially the same as for Alternative 1, with the same potential effects. About 4 water wells are within 150 m of the right-of-way.

Mitigation

Mitigation measures for the protection of surficial aquatic resources are not required since there are no watercourses or ponds potentially affected by this route alternative. Area groundwater resources can be protected by utilizing a combination of stormwater BMP's (i.e., grassed swales and infiltration ponds) to reduce groundwater contamination while promoting groundwater recharge.

TABLE 1

HIGHWAY 6 - FREELTON TO GUELPH
WP 65-76-05

Evaluation of Alignment Alternatives
Crieff Road to Highway 401

Factor: Aquatic Resources	Alternative #1	Alternative #2	Alternative #3
Indicator • number of designated coldwater stream crossings	• no watercourses affected	• no watercourses affected	• no watercourses affected
• number of spawning/ nursery areas affected	• no watercourses affected	• no watercourses affected	• no watercourses affect
Mitigation Measures	• no mitigation required as no watercourses affected	• no mitigation required as no watercourses affected	• no mitigation required as no watercourses affected
Net Effects	• no net impact anticipated	• no net impact anticipated	• no net impact anticipated

Factor: Geology/Hydrogeology	Alternative #1	Alternative #2	Alternative #3
• area of sand and gravel resources affected	primary = 0 secondary = 0 tertiary = 8.5 ha	primary = 0 secondary = 0 tertiary - 8.6 ha	primary = 0 secondary = 0 tertiary = 4.8 ha
• area of bedrock resources affected	0	0	0
• number of Earth Science ANSIs affected	0	0	0
• area of high potential upwelling areas affected	0	0	0
• area of high potential recharge areas affected	8.5 ha	8.6 ha	4.8 ha
• number of wells potentially affected - directly - within 150 m of R.O.W.	 0 3	 0 4	 0 5
Mitigation Measures	use stormwater BMP's such as infiltration ponds to maintain infiltration rates as well as prevent contamination	use stormwater BMP's such as infiltration ponds to maintain infiltration rates as well as prevent contamination	use stormwater BMP's such as infiltration ponds to maintain infiltration rates as well as prevent contamination
Net Effects	• no effect on recharge volumes or groundwater quality anticipated • minor impact on low-significance sand and gravel resources	• no effect on recharge volumes or groundwater quality anticipated • minor impact on low-significance sand and gravel resources	• no effect on recharge volumes or groundwater quality anticipated • minor impact on low-significance sand and gravel resources

Net Effects

No net loss of fisheries habitat or groundwater resources is anticipated.

2.3.3 Alternative 3

Description of Resources

There are no watercourses or ponds potentially impacted by this route alternative.

Alternative 3 is located east of both Alternatives 1 and 2 and, as such, traverses a smaller area of mapped high potential recharge (approximately 4.8 ha or about 55% of the other alternative routes). This is equivalent to about 640 m of linear route through this geological regime. The remainder of the area traversed is mapped as low potential recharge. There are no mapped areas of groundwater discharge found within this route alternative. Five wells are found to be within 150 m of the right-of-way.

Potential Impacts

The potential impacts of routing a road through this geological setting are discussed in the description of route alternative 1. The planned excavation depth through the high potential recharge area is quite low (it is essentially at present grade) and should have little effect on the groundwater flow regime.

Mitigation

Mitigation measures for the protection of surficial aquatic resources are not required since there are no watercourses or ponds potentially affected by this route alternative. Using a combination of stormwater BMP's, groundwater recharge can be promoted, and groundwater contamination prevented.

Net Effects

No net loss of fisheries habitat is anticipated. No loss of groundwater recharge volumes or reduction of groundwater quality is anticipated due to highway improvements of this alternative.

2.3.4 Comparison of Alternatives

As there are no watercourses or ponds potentially impacted by the three alternatives, comparison of alternatives in this highway section was based on hydrogeological characteristics only (see Table 1).

Both alternatives 1 and 2 potentially impact a significant area of high potential recharge (8.5 ha and 8.6 ha, respectively) which is also considered to be a sand and gravel resource of tertiary significance (see Table 1). Alternative 3 potentially impacts only 4.8 ha of this recharge/sand and gravel resource area.

Proposed "cut" depths may also produce local groundwater flow changes. For both Alternative 1 and 2, excavations into the high potential recharge areas are expected to be extensive (up to 10 m deep over a length of 400 m). For Alternative 3, requirements for excavation are minimal and thus, impacts to groundwater flows are not expected.

There do not appear to be any water wells directly affected (i.e., within the right-of-way) by any of the route alternatives, however, there are 3 wells within 150 m of alternative 1, 4 wells within 150 m of alternative 2, and up to 5 wells within 150 m of alternative 3.

No areas of groundwater discharge are encountered along any of these three route alternatives.

Based on the evaluation indicators listed on Table 1, route alternative 3 would appear to have the least potential impact on hydrogeologic resources in this highway section.

2.4 Highway Section 6 - Highway 401 Corridor Improvements

Description of Resources

Proposed highway improvements in this section include right-of-way requirements for the protection of eight basic lanes for Highway 401 (ultimately) and for Highway 6 northbound and southbound parallel extended ramps (3 lanes each). Included within this highway section are several culvert extensions along Highway 401 (see Figure 2) and the interchanges at Brock Road (existing Highway 6) at new Highway 6 and at the Hanlon Expressway. Components of these interchanges include:

- interchange modifications to the Brock Road/Highway 401 interchange ramps;

- construction of new interchange ramps (south-west and west-south) for the new segment of Highway 6;
- modifications to the Hanlon Expressway interchange including elevated directional ramps.

Aquatic resources found within this highway section are located at the extreme limits of the Highway 401/Highway 6 section (Section 6). A large pond is located at the eastern limit of this section, south of the existing Highway 6 interchange (Figure 4). The pond is essentially a flooded depression which is isolated from area watercourses, and is also considered to be a Class 7 wetland. This wetland is more fully considered under the Terrestrial Biology documentation for the Highway 6 Route Location and Preliminary Design project (documented under separate cover). At the western end of this highway section (Hanlon Expressway interchange) proposed highway improvements will encroach on Galt/Mill Creek (also known as Aberfoyle Creek), a coldwater fishery stream (Figure 5).

The protection for future widening of Highway 401 and construction of the Highway 6 extended ramps east of the Hanlon Expressway will result in additional property requirements, on both the north and south sides of the 401, and therefore encroachment on Galt/Mill Creek (see Figure 5). An extension of the existing concrete box culvert carrying Aberfoyle Creek under Highway 401 will be required on the north side of Highway 401 to accommodate the proposed offramps. An evaluation of Galt/Mill Creek fisheries habitat was undertaken in November/December 1992 in the vicinity of this encroachment. Figure 5 provides a summary of the existing fish habitat conditions and proposed works in this area.

Potential Impacts

Potential impacts of highway improvements at Galt/Mill Creek will be related to construction and operation adjacent to this high quality coldwater system. Construction impacts on the north side of Highway 401 will include the physical loss or alteration of approximately 40 metres of Galt/Mill Creek habitat, the loss of riparian vegetation, and the potential for downstream sedimentation effects. Potential impacts on the south side of Highway 401 will largely be limited to the loss of riparian vegetation since the ramp to eastbound Highway 6/Highway 401 will be elevated over Galt/Mill Creek (see Figure 5). Potential operation impacts will be associated with the management of stormwater which may affect downstream areas of the watercourse. Field survey of the area immediately downstream of Highway 401 (Station #11) supported the designation of this watercourse as important coldwater fish habitat (i.e., the presence of spawning "redds").

The increased amount of right-of-way required for the protection of ultimately eight highway lanes potentially impacts approximately 14.6 ha of mapped high potential recharge area, the majority of which is found just east and north of the Hanlon Expressway - Highway 401 interchange. Approximately 75% of this area (or 10.9 ha) is considered to be a sand and gravel resource of primary (high) significance. This resource is presently being worked by several large-scale extraction operations. The remainder of this area (3.7 ha) is considered to be of tertiary (low) significance. About 1.3 ha of mapped high potential discharge (groundwater upwelling) area is potentially impacted just east of the Hanlon Expressway - Highway 401 interchange. At the Highway 401-Highway 6 interchange, approximately 3.2 ha of mapped recharge area is affected by modifications to the interchange. There do not appear to be any significant road cuts associated with the right-of-way widening or ramp construction. One well was found within the proposed new right-of-way, and three more are found within 150 m of the right-of-way.

Potential impacts to the hydrogeological resources of this area may include the reduction of infiltration rates caused by the impermeable road surface, and contamination of infiltrating surface water by road salt and other contaminants associated with highways. As well, it is possible that dewatering requirements of high potential discharge areas during construction may cause temporary changes to the groundwater regime.

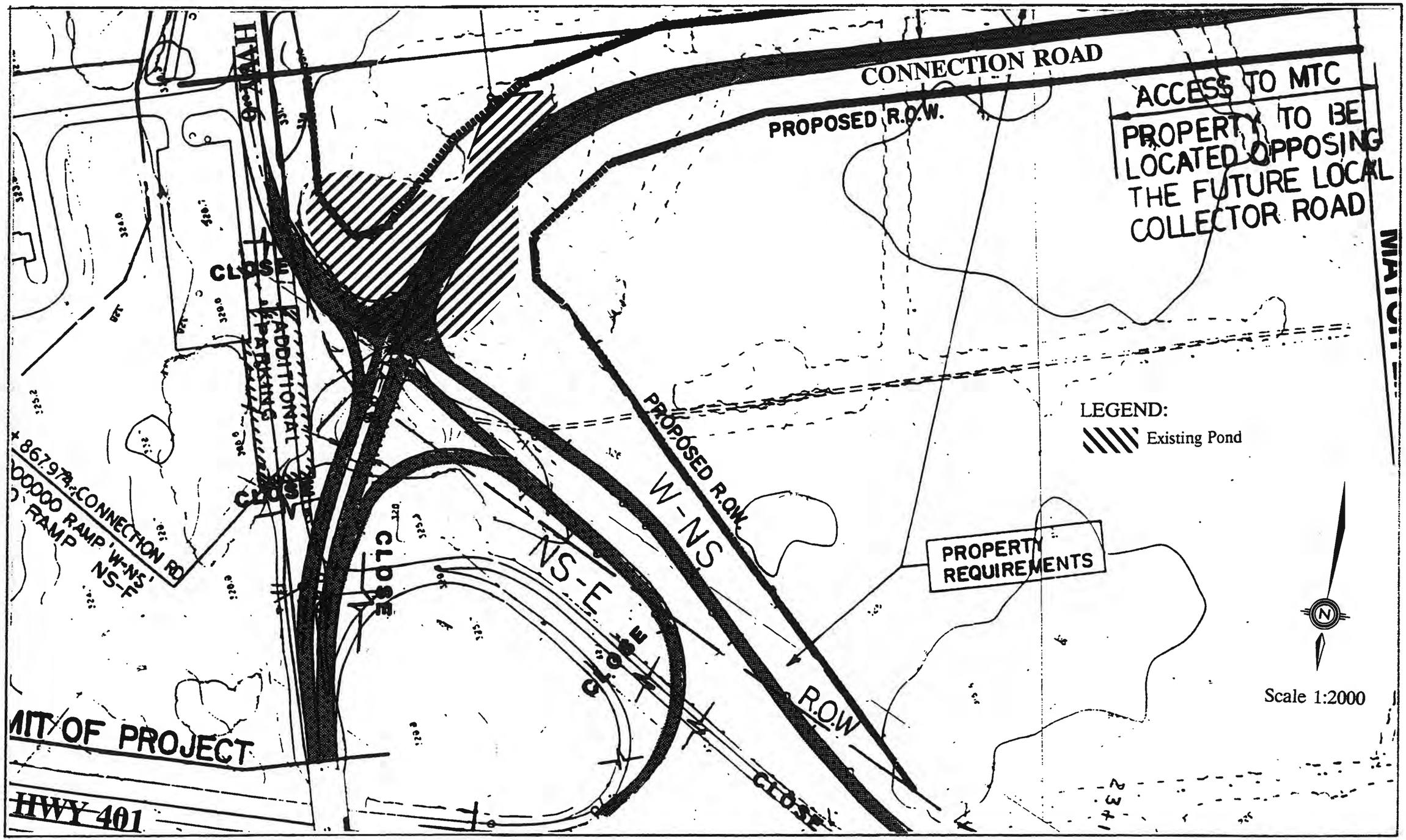
Potential impacts of Highway 401 corridor improvements are summarized in Table 2 for aquatic resource and hydrogeological indicators.

Mitigation

In consideration of the sensitivity and significance of the Galt/Mill Creek fishery, the area between the existing highway and the proposed ramp is recommended to be maintained as open (i.e., two separate culverts rather than one extended culvert). It is also recommended that culvert installation be undertaken "in the dry" to protect downstream fish and fish habitat from sedimentation effects.

The dry crossing should include the following measures to further minimize construction impacts:

- a typical flume technique or "pond and pump" method should be used to convey flows, through the construction area;
- any fish stranded in the dewatering (construction) zone should be captured and transferred to an unaffected section of the stream;



HIGHWAY 6/CONNECTION ROAD INTERCHANGE

Figure 4.

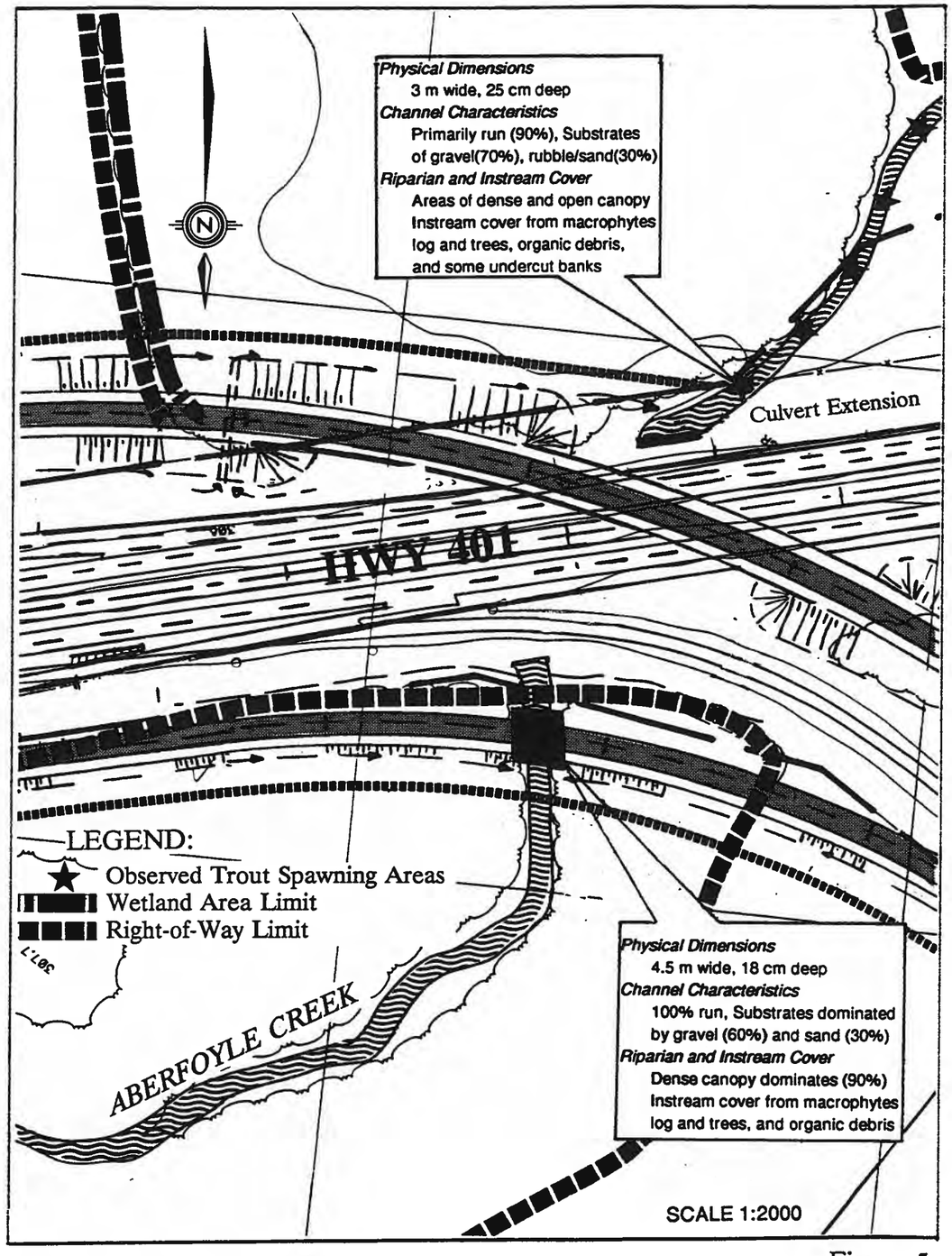


Figure 5.

PROPOSED HIGHWAY 401/HANLON EXPRESSWAY DIRECTIONAL RAMP CROSSINGS OF GALT/MILL CREEK

(Fish Habitat Assessment Information in Boxes)

TABLE 2 **HIGHWAY 6 - FREELTON TO GUELPH**
WP 65-76-05
Evaluation of Highway 401 Corridor Improvements

Factor: Aquatic Resources	Highway 401 Widening
Indicator • number of designated coldwater stream crossings	1 (Galt/Mill Creek)
• number of other watercourse crossings	one large pond
• length of stream diversion required	none
• number of spawning/nursery areas affected	none
Mitigation Measures	• keep Galt/Mill Creek open between existing highway culvert and culvert for proposed ramp • implement dry crossing procedures for Galt/Mill Creek - ensure flume is sufficient in capacity and length - transfer stranded fish from damming to unaffected sections of stream - select low flow period for crossing in consideration of long range weather forecasts - notify OMNR prior to commencement of crossing - restrict time permitted to conduct crossing - keep silt fence barrier on-site as a contingency - carry out clean-up, bank stabilization and revegetation as soon possible following completion of the crossing • develop specific compensatory measures to offset the net loss of fisheries habitat
Net Effects	• Compensatory measures can be effectively developed and implemented to ensure that the DFO Policy objective of "no net loss" of fish is achieved.

TABLE 2 (Con't) HIGHWAY 6 - FREELTON TO GUELPH
WP 65-76-05
Evaluation of Highway 401 Corridor Improvements

Factor: Geology/Hydrogeology	Highway 401 Widening
Indicator: • area of sand and gravel resources affected	primary = 10.9 ha secondary = 0 tertiary = 3.7 ha
• area of bedrock resources affected	0
• number of Earth Science ANSIs affected	0
• area of high potential upwelling areas affected	1.3 ha
• area of high potential recharge areas affected	14.6 ha
• number of wells potentially affected - directly - within 150 m of R.O.W.	 1 3
Mitigation Measures	• use of stormwater BMP's to maximize infiltration while minimizing contamination potential of infiltrating waters • reduce effects of dewatering by maintaining shallow operations and minimizing affected area
Net Effects	• no reduction in recharge volume or quality anticipated • loss of some sand and gravel resources of both primary and tertiary significance • one water well may require replacement

- should the flume method be used, flume pipes should be of sufficient capacity and length to handle anticipated flows and to span the entire construction area, respectively;
- should the "pond and pump" method be used, pump capacity should be sufficient to move anticipated flows and a back-up pump should be readily available;
- construction should be scheduled with favourable seasonal weather conditions prior to initiating the actual crossing (i.e., a seasonal low flow period);
- the MNR construction window of June 1 - September 1 should be recognized to protect sensitive coldwater fishery;
- appropriate sedimentation control devices should be maintained on-site during the crossing as a contingency measure;
- MNR should be notified prior to initiation of the crossing;
- the actual crossing period should be restricted to as short a time as possible;
- clean-up (e.g., removal of the flume pipe), bank stabilization (e.g., through placement of rip rap) and revegetation should be carried out as soon as possible following completion of the crossing.

Specific compensatory measures should be developed and implemented to offset the net loss and/or disruption of fisheries habitat in Galt/Mill Creek. This may include the development of a formal compensation plan required by the DFO.

Potential groundwater contamination in high potential recharge areas can be minimized by the use of BMP's. The potential for modifications to groundwater flow, though temporary, can be reduced by minimizing the extent of dewatering activities. Extraction of high quality granular materials prior to, or as part of, highway construction will minimize the loss of this resource.

Net Effects

On the basis of aquatic biological and hydrogeological impacts, the relative potential impact on aquatic resources due to the Highway 401 corridor improvements is expected to be moderate. This assessment is based on the loss of the large pond at the eastern limit of this

section resulting from the construction of the new Connection Road between the existing and new Highway 6, potential impacts to the coldwater fishery of Galt/Mill Creek and the relatively small area of high potential recharge/primary sand and gravel resources possibly impacted.

Compensatory measures, however, can be effectively developed and implemented to ensure that the DFO Policy objective of "no net loss" of fish habitat is achieved. No net loss in groundwater recharge volumes or quality is anticipated due to highway construction. A small net loss of high quality granular deposits is expected.

2.5 Highway Section 7 - Highway 401 to Puslinch Road 4/15

Two interchange alternatives were compared for this highway section.

Alternative 7 is a modification of an alternative originally proposed in the Environmental Assessment Report prepared by Fenco MacLaren and submitted for Pre-Submission Review in 1987. For Alternative 5 - Modified, access to the Hanlon Expressway for County Road 34 is located approximately 850 m north of the existing intersection.

2.5.1 Alternative 7

There are two areas of this alternative which have the potential to affect aquatic resources. They are:

- northbound Hanlon Expressway offramps/transfer lanes to County Road 34 at an unnamed tributary; and
- County Road 34 interchange at coldwater tributaries east and west of the Hanlon Expressway.

Northbound Hanlon Expressway Offramps to County Road 34

Description of Aquatic Resources

Offramp/transfer lane requirements for northbound Hanlon expressway traffic exiting at County Road 34 are illustrated on Figure 6. Proposed right-of-way requirements will encroach on properties to the east of the existing expressway and will impact on a small headwater tributary which arises on the Reid property located north of Highway 401. Approximately 70 metres of this tributary will be conveyed through a new culvert(s). Field observations of this watercourse indicated that it does not share the same significance as

other watercourses in the local area, due to its size, limited catchment area, and historical channelization. Figure 6 summarizes existing conditions of the watercourse as well as highway improvements plans for this area.

Potential Impacts

Potential impacts on the headwater tributary will largely be associated with sedimentation and erosion concerns caused by instream construction and filling. Although less sensitive than other area watercourses, this tributary joins high quality coldwater fish habitat west of the Hanlon Expressway. Proper management of water quality during construction and operation of the proposed alternative is therefore critical to the health of downstream aquatic resources.

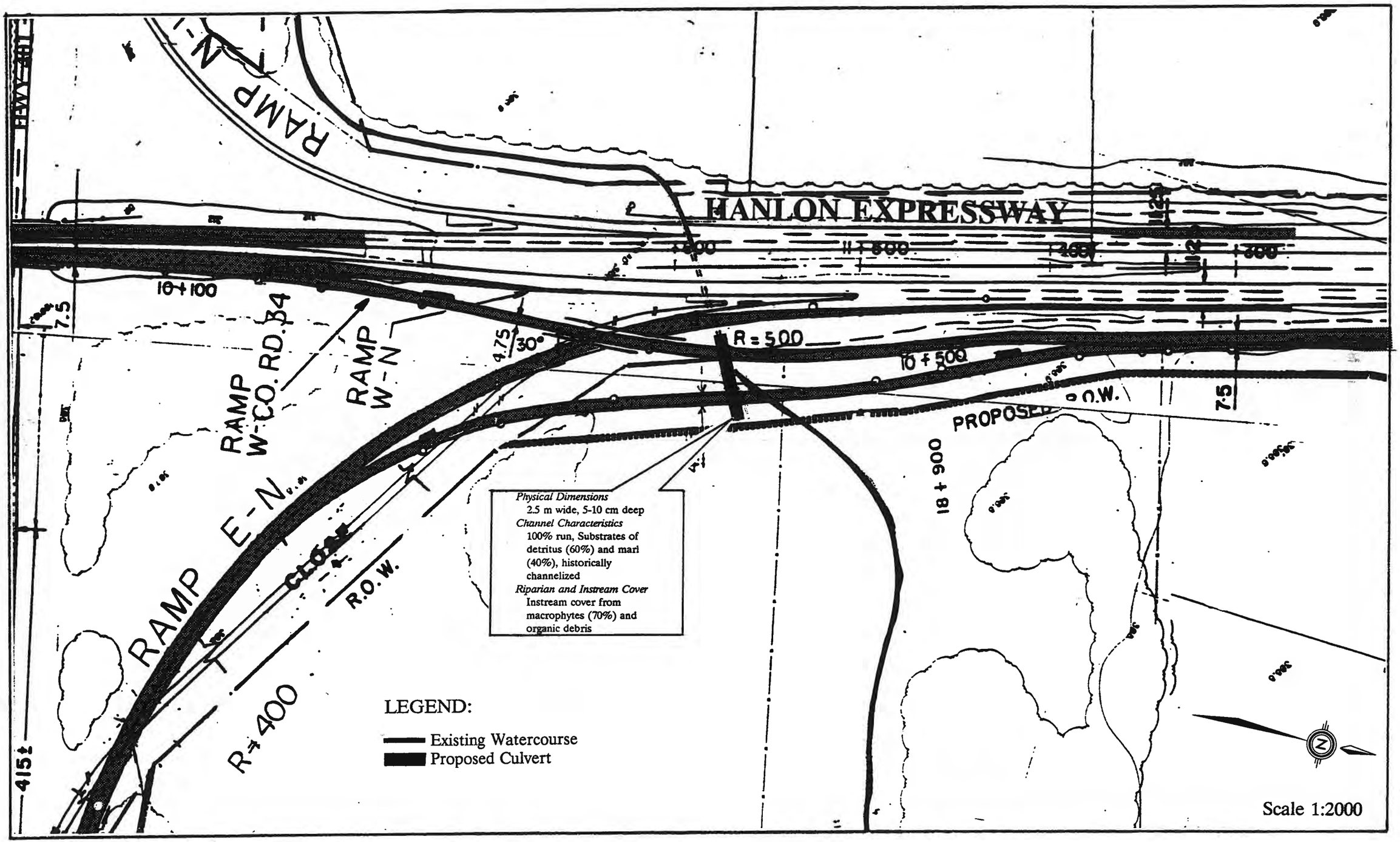
A relatively small area (approximately 0.6 ha) of high potential recharge area may be impacted south of the interchange. An additional 1.2 ha may be impacted (over and above the present Highway 401 design) due to the Hanlon Expressway offramps connecting to County Road 34. This area is also considered a sand and gravel resource of primary significance.

Potential impacts to the high potential recharge areas would consist of degrading the quantity and/or quality of the recharging (infiltrating) water. Reduced infiltration could result due to the placement of an impermeable layer (the paved roadway) over portions of the recharge area. Impact on groundwater quality could occur by contamination of infiltrating surface water with road salt or other chemicals associated with the roadway. There does not appear to be any significant road cuts associated with this alternative. One water well appears to be directly affected by this alternative (i.e., within the designed right-of-way).

Mitigation

Because of the sensitivity of fisheries resources in the downstream receiving watercourse, appropriate considerations which protect aquatic resources should be incorporated into the development of construction mitigation measures, as well as the design and development of stormwater management plans for this section of highway improvements.

A new culvert will be required to convey flows of this small tributary beneath the proposed ramps. While physical loss or disruption of fish habitat will occur as a result of culvert construction, the area to be affected does not represent good fish habitat. The tributary however, is a contributor of groundwater to downstream receivers, as evidenced by the



COUNTY ROAD 34 OFFRAMP TRIBUTARY
(Fish Habitat Assessment Information in Box)

Figure 6.

presence of watercress. Therefore, the protection of water quality should be emphasized rather than the maintenance of physical habitat (i.e., by having two separate culverts).

Mitigation measures recommended for culvert construction at this tributary should include:

- minimize extent/period of instream construction work;
- conduct instream work during low flow conditions and within construction window established by MNR for the protection of coldwater fisheries (i.e., June 1 - September 1);
- utilize standard erosion control measures (e.g., sediment barriers, traps and check dams) to reduce impacts to the downstream aquatic community;
- store surplus silt fence barrier at the construction site as a contingency measure;
- where possible, riparian vegetation should be maintained to the greatest extent possible;
- stabilize and revegetate exposed surfaces as soon as possible following completion of the culvert installation;
- visually inspect rehabilitated area immediately following restoration and on a periodic basis thereafter to ensure revegetation and stabilization measures are successful.

Compensatory measures, if required, should be developed in consultation with the MNR and DFO to offset any loss or degradation of fish habitat.

Utilization of appropriate stormwater BMP's can minimize groundwater contamination while maximizing infiltration.

Net Effects

As compensatory measures can be effectively developed and implemented to offset any potential loss or degradation of fish habitat remaining following the implementation of the other mitigation measures, no net loss of fish habitat is anticipated. No net effect to the groundwater regime is anticipated.

County Road 34 Interchange

Description of Aquatic Resources

The proposed interchange at the intersection of the Hanlon Expressway and County Road 34 would entail the construction of a grade separation offset slightly north of the existing County Road 34 alignment, and on ramps and offramps in the southeast and northwest quadrants of the intersection (see Figure 7).

Two coldwater tributaries to Galt/Mill Creek would be affected by the proposed interchange and are illustrated on Figure 7. Field observations conducted in November/December 1992 confirmed the presence of coldwater fish species in both quadrants and the presence of spawning areas (redds) in the southeast quadrant. According to MNR unpublished data, spawning has also been confirmed in the northeast quadrant. Figure 7 summarizes fish habitat characteristics in the vicinity of the proposed interchange.

The proposed interchange is located in an area primarily mapped as a groundwater discharge area.

Potential Impacts

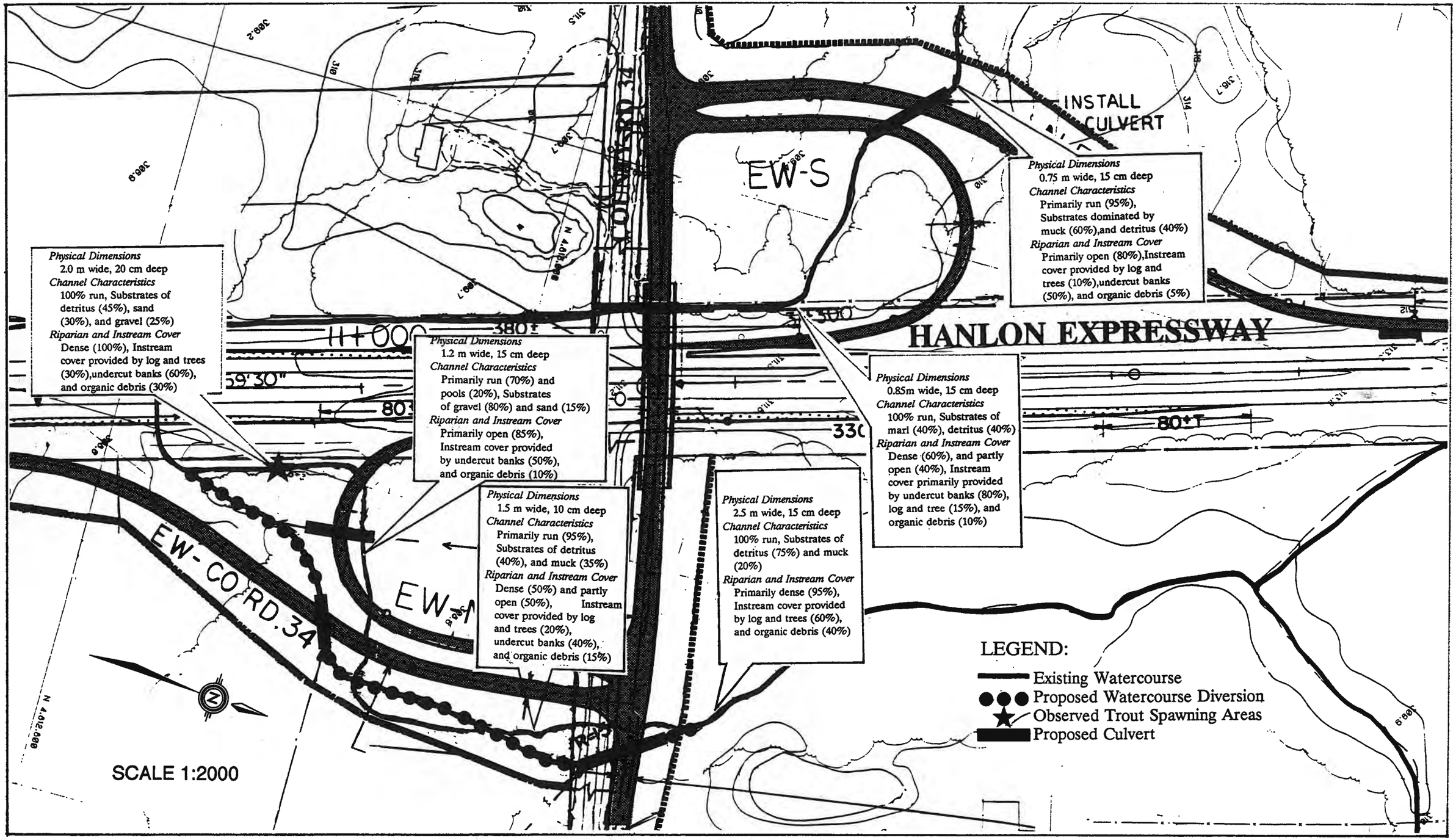
Potential impacts on aquatic resources of this area are associated with construction and operational phases of the project. Potential construction impacts may include (refer to Figure 7):

Northwest Quadrant

- new culvert requirements beneath County Road 34 and southbound Hanlon Expressway offramp and onramp
- removal of riparian vegetation
- sedimentation and erosion
- changes in groundwater discharge regime

Southeast Quadrant

- realignment of approximately 390 metres of coldwater stream
- new culvert requirements beneath County Road 34 and northbound Hanlon Expressway offramp
- removal of riparian vegetation



ALTERNATIVE 7

PROPOSED HANLON EXPRESSWAY ROAD 34 INTERCHANGE

(Fish Habitat Assessment Information in Boxes)

Figure 7.

- sedimentation and erosion
- changes in groundwater discharge regime
- changes in surface water regime.

The Hanlon Expressway-County Road 34 interchange ramps and road widenings are located to a large degree in mapped areas of high potential upwelling, potentially impacting an area of approximately 8.9 ha.

Areas of groundwater upwelling (or discharging) are important because they provide cold water base flow for streams flowing through such areas. However, potential impacts due to road construction in such areas will generally manifest themselves in the surface water regime rather than in the groundwater regime. Since upwelling occurs over a fairly large area, a road would act as a dam to groundwater upwelling upstream of the road, requiring the channelling of normally free flowing water to nearby culverts beneath the roadway.

The potential for groundwater contamination in these areas is low since groundwater discharge is occurring rather than recharge. Dewatering of these areas during road construction is a major issue since this would probably require significant effort to accomplish and could have significant impacts in the wetland areas, by loss of baseflow

Operational impacts would most importantly be associated with contamination effects of sediment, salt, automotive oils, and other deleterious compounds on the coldwater fisheries resources of the two high quality coldwater systems affected by the proposed interchange.

Mitigation

Given the significance and sensitivity of the coldwater fishery streams affected, extensive mitigation would be required to offset the harmful alteration and destruction of productive coldwater fish habitat affected by this interchange alternative. A variety of mitigation measures are recommended for implementation during construction to reduce potential effects on aquatic resources.

The period during which instream work is permitted should be scheduled to avoid primary salmonid spawning period (i.e., construction limited to period between June 1 and September 1). Instream work should be conducted, as much as possible, during low flow conditions (i.e., construction should be scheduled with favourable long range forecasts). In addition, the local MNR office should be notified prior to commencement of instream work. Removal of riparian vegetation should be minimized as much as possible; vegetation which must be removed should be maintained as long as possible. Standard and special

erosion/sediment control measures should be developed to provide maximum protection of downstream resources (e.g. sediment barriers, traps, check dams and, as a contingency, surplus silt fence barrier available on-site during instream work). Areas for storage, disposal, refuelling and maintenance should be clearly identified and removed from the watercourse. Stabilization and revegetation of disturbed areas should be carried out as soon as possible following completion of instream work. The new channel alignments must include design features and mitigation measures to enhance its fish habitat potential, for example, through "natural" channel design, composition of the streambed and the characteristics of the streambank.

It is expected that a fisheries habitat compensation package will be required by DFO to offset the net loss of productive coldwater fisheries habitat anticipated from the development of an interchange at this location.

Net Effects

Considering the potential for considerable loss and degradation of sensitive coldwater fish habitat associated with the realignment of stream segments and the installation of the new culverts, it is anticipated that the net loss of fisheries habitat would be difficult to compensate for. Fish habitat compensation upstream, downstream or on another watercourse in the vicinity of the highway improvement could be a component of a compensation agreement developed in consultation with DFO and MNR.

2.5.2 Alternative 5 - Modified

From an aquatic resources perspective, there are two areas of potential impacts associated with this alternative. They are:

- County Road 34 grade separation; and
- Concession Road 7.

County Road 34 Grade Separation at Hanlon Expressway

The proposed grade separation at County Road 34 differs somewhat from Alternative 7 in that the alignment of the road will follow the existing road alignment. The alignment of Alternative 7 is offset to the north.

Description of Aquatic Resources

Existing fish habitat characteristics in the vicinity of the proposed grade separation are the same as those described for Alternative 7 (See Figure 8).

Potential Impacts

Potential impacts of the proposed grade separation on the aquatic resources of two coldwater tributaries are primarily related to sedimentation and erosion impacts of construction. Potential impacts of fill requirements for the grade separation on adjacent low lying areas may indirectly offset the aquatic resources of the area through changes to groundwater and surface water regime (e.g., interception and redistribution of subsurface flows). With this interchange alternative there are no requirements for new culverts or channel realignment. The potential impacts to the groundwater regime are similar to those associated with Alternative 7.

Concession Road 7

Road improvements, most notably cut and fill requirements, will be necessary on Concession Road 7 if Alternative 5 - Modified is selected as the preferred alternative. One culvert may require replacement based on its existing poor state of repair.

Description of Aquatic Resources

Concession Road 7 crosses one defined watercourse between County Road 34 and Puslinch Road 15. This watercourse drains an area to the north and east of Concession Road 7 and is part of the Galt/Mill Creek headwaters. At Concession Road 7 the watercourse is small (<1.0 m wide) and seasonally conveys low flows. Field observations indicated that the significance of this watercourse in supporting coldwater fisheries was well below that of areas downstream (i.e., trickle flow, minimal fish habitat characteristics). The watercourse is expected, however, to contribute coldwater flows to downstream areas.

Potential Impacts

Potential impacts of Concession Road 7 improvements would be associated primarily with sedimentation and erosion impacts on downstream areas but can be mitigated to a large extent by implementation of standard control measures such as sediment traps, and rock flow check dams.

Alternative 5-Modified encroaches on relatively little of the mapped high potential upwelling area (approximately 2.2 ha). These areas occur along County Road 34 and a small portion of Concession 7. Potential impacts on groundwater upwelling areas in the vicinity of proposed interchange were described for route alternative 7, above. Potential impacts on groundwater upwelling for Alternative 5 - Modified are greatly reduced as no development is proposed for the northwest and southwest quadrants which were both mapped as discharge areas.

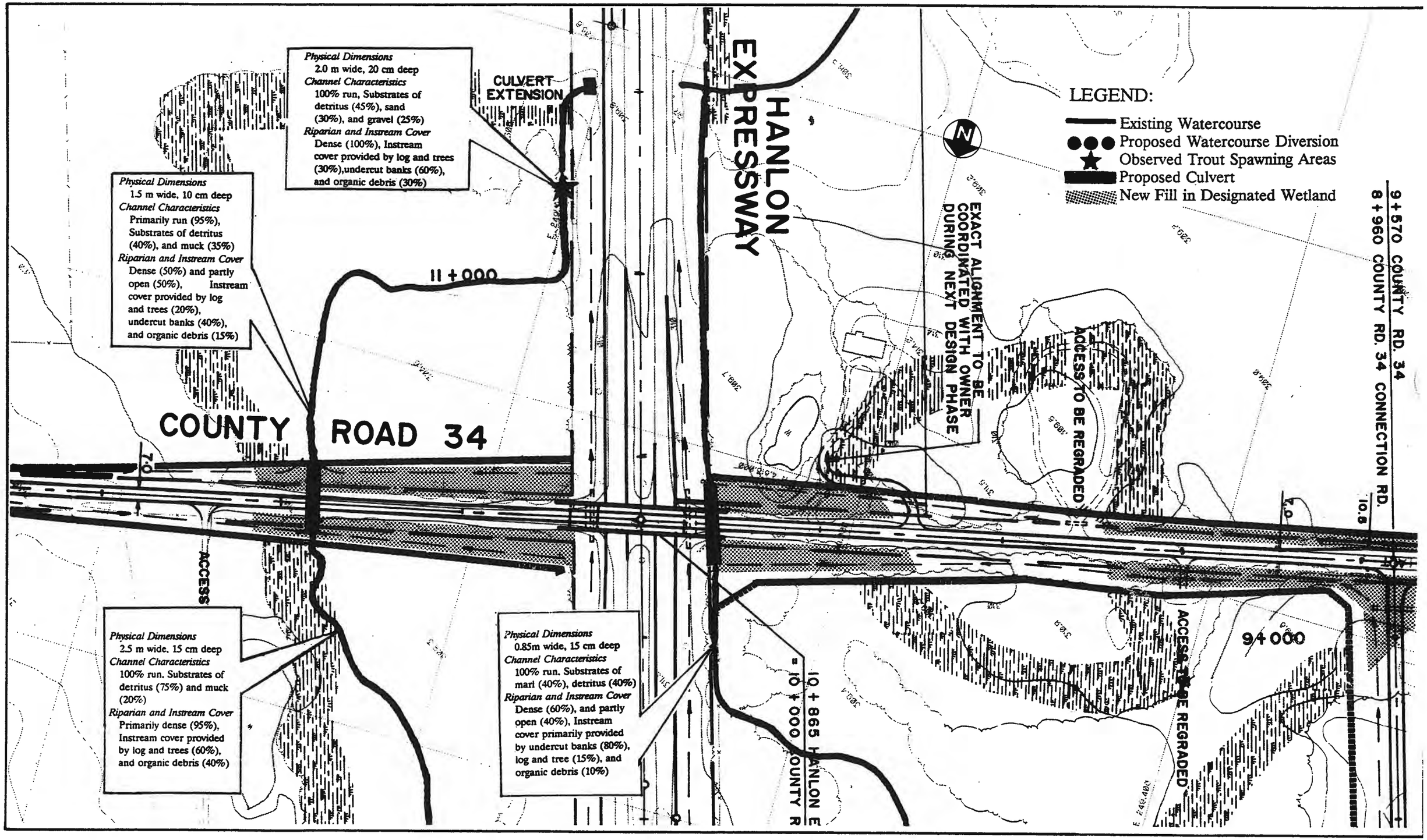
An area of approximately 3.9 ha of mapped high potential recharge area is potentially impacted by Alternative 5 - Modified. These areas are primarily found north of the Hanlon Expressway-County Road 34 interchange, along the County Road 34 connection, and along the southern portion of Concession 7. This area is also considered a sand and gravel resource of tertiary (low) significance. Potential impacts to these areas would consist of degrading the quantity and/or quality of the recharging (infiltrating) water. Reduced infiltration could result due to the placement of an impermeable layer (the paved roadway) over portions of the recharge area. Impact on groundwater quality could occur by contamination of infiltrating surface water with road salt or other chemicals associated with the roadway. Significant road cuts into high potential recharge areas occur along the E-N ramp (up to 8 m deep, from Station 1+540 to 1+220) and the connecting road (up to 6 m deep, from Station 9+020 to 9+380). The potential effects of road cuts in recharge areas was described in Section 2.3.1

No water wells appear to be directly affected by this alternative.

Mitigation

The level of required mitigation for Alternative 5-Modified is significantly less than that required for Alternative 7 modified since this alternative affects significantly less amounts of sensitive aquatic resources. Mitigation measures recommended for implementation for this alternative include: notification of MNR prior to instream work; rescheduling of instream work to avoid primary salmonid spawning period; restriction of duration of instream work; maintenance of riparian vegetation areas; implementation of standard erosion/sediment control measures; storage, disposal, refuelling and maintenance areas to be removed from the study area following construction; and expeditious stabilization and re-establishment of vegetation on exposed surfaces.

Groundwater contamination in high potential recharge areas, as well as baseflow reduction, can be minimized by the use of appropriate stormwater BMP's.



ALTERNATIVE 5 (MODIFIED)
PROPOSED HANLON EXPRESSWAY/COUNTY ROAD 34 GRADE SEPARATION
(Fish Habitat Assessment Information in Boxes)

Figure 8

Net Effects

Impacts to fish habitat are not expected for this alternative following the implementation of mitigation measures. No net effects are anticipated on the groundwater regime.

2.5.3 Comparison of Alternatives

Table 3 provides a comparison of the two alternatives proposed for Highway 6 in the area between Highway 401 and the northerly study limit along the Hanlon Expressway based on a number of indicators.

From an aquatic resources perspective, Alternative 5 - Modified is preferred over Alternative 7 for the following reasons:

- no construction is proposed in the immediate vicinity of the existing Hanlon Expressway/County Road 34 intersection where high quality coldwater fish habitat including spawning areas, and riparian vegetation occur in association with the Class 1 wetland area
- minimal encroachment of fill area on adjacent low lying (wetland) areas required for County Road 34 grade separation as proposed alignment utilizes existing road alignment
- no realignment of watercourses is required
- loss of riparian vegetation is minimal
- potential impacts to sand and gravel resources of primary significance is reduced
- potential impacts to groundwater discharge and surface water movement which could affect aquatic resources are substantially reduced, as are potential impacts produced by dewatering effects.

3.0 CONCLUSIONS

Table 4 summarizes the results of this impact assessment. Route alternatives are ranked for aquatic biological and hydrogeological sensitivities combined.

For the section of Highway 6 between Crieff Road and Highway 401 (highway section 5), route Alternative 3 was marginally better than Alternatives 1 and 2 based on the quantity of sand and gravel resources/amount of recharge area potentially affected. As there were no watercourses or ponds associated with any of the three alternatives, ranking was determined based on hydrogeological characteristics only.

For the section of Highway 6 north of Highway 401 (highway section 7), Alternative 5 - Modified was concluded to have far less impact on the aquatic resources of the area than Alternative 7. This was particularly due to the avoidance of construction within the northwest and southeast quadrants of the Hanlon Expressway - County Road 34 intersection which is, biologically and hydrogeologically, very sensitive.

TABLE 3

HIGHWAY 6 - FREELTON TO GUELPH
WP 65-76-05

Evaluation of Interchange Alternatives
Hanlon Expressway-County Road 34 Interchange

Factor: Aquatic Resources	Alternative #5 - Modified	Alternative #7
Indicator • number of coldwater stream crossings	• one coldwater tributary crossing on Concession Road 7	• six coldwater tributary crossings located in northwest and southeast quadrants of Hanlon Expressway-County Road 34 intersection
• number of other watercourse crossings	Total of 1 • Concession Road 7	Total of 6 • County Road 34 (east of Hanlon) • County Road 34 (west of Hanlon) • northbound Hanlon offramp to County Rd 34 • northbound Hanlon onramp from County Rd 34 • southbound Hanlon onramp from County Rd 34 • southbound Hanlon offramp to County Rd 34
• length of stream diversion required	none	390 m of undesignated coldwater stream
• number of spawning/nursery areas affected	none	1 area in southeast quadrant of Hanlon-County Road 34 interchange

TABLE 3

HIGHWAY 6 - FREELTON TO GUELPH
WP 65-76-05

Evaluation of Interchange Alternatives
Hanlon Expressway-County Road 34 Interchange
(Continued)

Factor: Aquatic Resources	Alternative #5 - Modified	Alternative #7
Mitigation Measures	• notify OMNR prior to instream work • restrict instream work to avoid primary salmonid spawning period and carry out instream work during low flow periods. • maintain riparian vegetation as much as and as long as possible • implement standard erosion/sediment control measures • keep surplus silt fence barrier on-site throughout construction as a contingency measure • storage, disposal, refuelling and maintenance areas to be removed from watercourses • ensure expeditious stabilization and revegetation of disturbed areas	• channel realignment to include design features and mitigation to enhance fisheries potential (i.e., stream deflectors, planting along stream) • notify OMNR prior to instream work • restrict instream work to avoid primary salmonid spawning period and carry out instream work during low flow periods. The current regional construction window (June 1 to September 1) established by OMNR will be observed unless otherwise indicated by OMNR • maintain riparian vegetation as much as and as long as possible • implement erosion/sediment control measures to avoid entry of sediment laden discharge into the watercourse (e.g. sediment barriers, traps and check dams) • keep surplus silt fence barrier on-site throughout construction as a contingency measure • storage, disposal, refuelling and maintenance areas to be removed from watercourses • ensure expeditious re-establishment of vegetation on removal areas and application of temporary (mulching) and permanent (rip-rap, geotextile) erosion control measure to minimize soil exposure • compensation package most likely required to offset loss and disruption of fish habitat
Net Effects	• no net effects anticipated	• no net effects anticipated

TABLE 3

HIGHWAY 6 - FREELTON TO GUELPH
WP 65-76-05

Evaluation of Interchange Alternatives
Hanlon Expressway-County Road 34 Interchange
(Continued)

Factor: Geology/Hydrogeology	Alternative #5 - Modified	Alternative #7
Indicator: • area of sand and gravel resources affected	primary = 0 secondary = 0 tertiary - 3.9 ha	primary = 1.8 ha secondary = 0 tertiary = 0
• area of bedrock resources affected	0	0
• number of Earth Science ANSIs affected	0	0
• area of high potential upwelling areas affected	2.2 ha	8.9 ha
• area of high potential recharge areas affected	3.9 ha	1.8 ha
• number of wells potentially affected - directly - within 150 m of R.O.W.	 1 0	 1 0
Mitigation Measures	• use of BMP's to promote infiltration while maintaining groundwater quality • reduce effects of dewatering in upwelling areas by maintaining shallow operations and minimizing affected area	• use of BMP's to promote infiltration while maintaining groundwater quality • reduce effects of dewatering in upwelling areas by maintaining shallow operations and minimizing affected area
Net Effects	• no reduction in recharge volume or quality anticipated • loss of a small amount of sand and gravel resources of low significance • one water well may require replacement	• no reduction in recharge volume or quality anticipated • loss of a very small amount of sand and gravel resource of primary significance • one water well may require replacement

TABLE 4

HIGHWAY 6 - FREELTON TO GUELPH
WP 65-76-05

Ranking of Highway 6 Route Alternatives

Highway Section 5	Alternative 1	Alternative 2	Alternative 3
Ranking	2	2	1
Sensitivity	More Sensitive	More Sensitive	Least Sensitive
Comments	This alternative was ranked second as it traverses a greater amount of sand and gravel resources/recharge areas than the least sensitive route alternative. The significance of the aggregate resource, however, is considered to be low. The overall relative impact of this alternative is low-moderate.	This alternative was ranked second as it traverses a greater amount of sand and gravel resources/recharge areas than the least sensitive route alternative. The significance of the aggregate resource, however, is considered to be low. The overall relative impact of this alternative is low-moderate.	This route alternative was selected as the least sensitive as it has the potential to impact the least amount of sand and gravel resource/recharge area of the three alternatives. Potential road cut depths are also significantly reduced. No areas of exposed bedrock are encountered, no earth science ANSIs are affected, and no potential areas of groundwater discharge are impacted. Impacts of construction and operation are therefore expected to have minimal effect on aquatic resources.

Highway Section 7	Alternative 7	Alternative 5 - Modified
Ranking	2	1
Sensitivity	Most Sensitive	Least Sensitive
Comments	This route alternative was ranked as the most sensitive due to significant encroachment requirements for the interchange on very sensitive and high quality aquatic resources including: • significant groundwater discharge area • significant coldwater fishery • significant fish spawning and nursery area	This route alternative marginally affects the sensitive aquatic resources of the Hanlon Expressway-County Road 34 interchange, and a tributary crossing of Concession 7. Impacts to groundwater recharge areas traversed by this alternative are expected to be more mitigable than potential impacts to groundwater discharge areas.

Environmental Technical Paper No.10

Background Terrestrial Biology Information
and
Impact Assessment

Highway 6
Freelton to Guelph
Update and Supplementary Investigations for Route Location and Preliminary Design
W.P. 65-76-05

DRAFT TECHNICAL PAPER

PLANNING & DESIGN SECTION

Fenco MacLaren Inc.

1.0 DATA SOURCES, RELIABILITY AND INFORMATION GAPS

Information regarding terrestrial ecological features was obtained from literature and map sources, personal communication with Ontario Ministry Natural Resources (OMNR) and Grand River Conservation Authority (GRCA) personnel, and from field reconnaissance.

Literature sources include 1) OMNR documents regarding Life Science Areas of Natural and Scientific Interest (ANSIs) (Klinkenberg, 1984), 2) Environmentally Significant Areas (ESAs) studies in South Wellington County (Eagles et al, 1979) and Hamilton Wentworth Region (Ecologistics, 1976), and 3) a report of a previous field study carried out by Fenco Engineers (Fenco, 1987). The status of rare and endangered species was addressed by review of several documents including ESA reports (Ecologistics, 1976; Eagles et al, 1979), OMNR Central Region documents on the distribution and status of vascular plants (Riley, 1989) and herpetofauna (Plourde et al, 1989), the Atlas of the Breeding Birds of Ontario (Cadman et al, 1987), lists of rare species compiled by Cambridge District OMNR for areas of concern (OMNR, undated), and the list determined by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 1992).

In addition to the literature sources cited the following map sources have been consulted.

- OMNR (1978) Forest Resources Inventory;
- OMNR (1980) Puslinch Forestry Resources;
- OMNR (1989) Puslinch Fish and Wildlife Resources;
- OMNR (1989) Puslinch Natural Area;
- OMNR (1980) Flamborough Forest Resources;
- OMNR (1989) Flamborough Fish and Wildlife Resources;
- OMNR (1989) Flamborough Natural Areas; and
- GRCA in-house maps of pertinent features undated.

Considerable reliance has been placed in the earlier Fenco (1987) report which was based on field surveys carried out in July-October 1987, thereby providing seasonal data not directly available in this study. While much information has been excerpted from this report, as a matter of convenience, it will not cited again.

Field work was undertaken to verify and complement information from other sources. Field observations were carried out in the present study during November and December, 1992, with some check studies in January 1993. Some information contained herein was derived from a one-day unscheduled, unreported field visit to the woodland-wetland systems at the intersection of the Hanlon Highway and County Road 34 in May, 1988.

The data sources are considered generally reliable, but some information gaps may exist, e.g. ESA reports and forest resources mapping may be outdated; also OMNR and Conservation Authority personnel, naturalist groups and local residents likely could provide additional anecdotal information about wildlife, especially birds, and perhaps rare and otherwise unique plants. A systematic and intensive year-round floristic survey does not appear to have been done. Such a survey while yielding a larger inventory than compiled in, say, Fenco (1987) and the various ESA studies probably would not add to an appreciation of system sensitivity. In brief, additional information of this sort is not likely to alter the basic conclusions of the completed study.

2.0 DESCRIPTION

The study area is at the border of the Niagara Section of the Deciduous Forest Region and the Huron-Ontario Section of the Great Lakes-St. Lawrence Forest Region (Rowe, 1972). Forest systems include: 1) mature red and silver maple wetland forest, primarily south of Maddaugh Road where it is proposed to widen the present Highway 6, 2) lowland and wetland successional forest dominated by white cedar, trembling aspen, and balsam poplar south of Crieff Road in the Fletcher Creek and Bronte Creek systems, and in the north associated with the Galt and Aberfoyle Creek systems, and 3) upland mature deciduous woods dominated by sugar maple on the higher better drained areas between Crieff Road and Highway 401, and in other well-drained areas north of Highway 401 in the general vicinity of the Hanlon Highway. The upland deciduous woods exist mainly as remnants of a vast deciduous forest that once dominated much of the entire area.

The area between the Fletcher Creek wetland system northward to Highway 401 is primarily old-fields, shrubland, and agricultural fields bordered by hedgerows.

Three Class 1 wetlands, and several small unclassified wetlands are in the study area. One Provincial ANSI, one Regional ANSI, and fours ESAs are also in the study area. ANSIs, ESAs, wetlands and woodlands in the vicinities of the selected alignment and areas of potential modification will be described in some detail. Generally, agricultural land, old-fields, shrubland, hedgerows and small parcels of sucessional woods will not be addressed, with some exceptions. Most of these features are described in terms of the dominant vegetation which, in addition to being the most obvious natural feature, is wildlife habitat, and is reflective of edaphic and hydrological conditions and of land use. These features are mapped and identified by number in Appendix A.

A list of common and scientific names of species mentioned in this report is provided in Appendix B.

2.1 Provincial ANSI

Beverly Swamp (Map Site 1)

The Beverly Swamp Provincial ANSI is considerably west of the proposed alignment, but is part of the wetland system that extends eastward to the present Highway 6 near the junction with Concession Road 10W. Klinkenberg (1984) indicates that Beverly Swamp is one of the largest swamps remaining in southern Ontario, and is a large (1950 ha) continuous wetland. The site contains a deer yard, coldwater streams, a heronry, and a

number of provincially and regionally rare plants and animals including Virginia chain fern, oak fern, and green violet.

Swamp forest communities are mosaics of white cedar, white birch, poplar and red-silver maple, with some sugar maple, white ash, beech, and eastern hemlock on better drained sites.

2.2 Regional ANSIs

- *Fletcher Creek Swamp Forest (Map Site 2)*

The Fletcher Creek Regional ANSI, though not delineated on the map in Appendix A, has roughly the same configuration as the Fletcher Creek Swamp Class 1 Wetland. See Fletcher Creek Swamp Forest ESA (Section 2.3) for description.

- *Galt Creek and Forest*

The Galt Creek and Forest Regional ANSI, though within the greater boundaries of the Galt Creek and Forest ESA, is not within the study area, so will not receive further attention.

2.3 ESAs

- *Beverly Swamp (Map Site 3)*

Ecologistics (1976) emphasize the high diversity of biological communities present in the ESA. In addition to providing the same essential information as Klingenberg (1984), they identify a number of rare and uncommon plant and animal species found in the swamp communities.

- *Fletcher Creek Swamp Forest (Map Sites 4-5)*

The eastern extremity of this lowland white cedar swamp forest is located largely to the west of the selected route, but overlapping it for short a distance immediately south of Fielding Lane. Eagles et al (1979) and Ecologistics (176) emphasize that a large number of regionally rare plants are found in the ESA, along with the snowshoe hare (*Lepus americanus*) which reaches its southern limit here and in Beverly Swamp, and that the diversity of bird species is high. The area where the eastward extension of the ESA overlaps the selected alignment (Map Site 5) is wetland which is quite open, but with mosaics of white cedar, trembling aspen and some balsam poplar. Sedges and bulrushes predominate

in this area. Scattered individuals and clumps of red-osier dogwood, chokecherry, spotted Joe-Pye weed, and boneset are throughout. Cattails form solid mosaics in the wettest places, and goldenrods and asters of several species are in the drier areas. Close to Fielding Lane the route crosses Fletcher Creek which is attended by cattail marsh on both sides and a white cedar grove to the north.

- ***Crieff Old Field Complex (Map Site 6)***

This open, hilly area is populated by typical old-field vegetation such as asters and goldenrods. Regionally rare marsh hawk (*Circus cyaneus*), grasshopper sparrow (*Ammodramus savannarum*), and Henslow's sparrow (*A. henslowii*), (also threatened in Canada - Cosewic, 1992), and the provincially rare (Cadman et al, 1987) dickcissel (*Spiza americana*) are probable breeders in the area.

- ***Galt Creek and Forest (Map Site 7)***

Within the study area, the northern end of the Galt Creek and Forest ESA abuts the south side of Highway 401, and occupies the northwest corner of the intersection of Highway 401 and the Hanlon Highway. Eagles et al (1979) describes this as an area with "a high diversity of biological communities such as: lowland and cedar swamp; upland maple-beech forest; old fields, shrub flood plains, pine plantation; deciduous swamp and flowing water". In the study area the dominant vegetation is wetland forest dominated by white cedar with mixes and mosaics of trembling aspen, balsam poplar, white birch, white elm, tamarack, and white and black ash among others. Eagles et al (1979) indicate that eight species of regionally rare plants are in the system, which is also an area of considerable wildlife potential.

2.4 Wetlands

Six classified wetlands are in the study area, and several unclassified wetlands are on or near the selected alignment and areas of potential modification.

- ***Beverly Swamp - Class 1 (Maps Sites 8 & 9)***

Map Site 8 at the northwest corner of existing Highway 6 and Concession Road 10W is a lowland forest with some upland species; i.e. sugar maple 30%, hemlock 30%, white cedar 20%, white ash 10%, and ironwood 10% (OMNR-FRI, 1978). Field observations corroborate this description. The site is wetter to the west where a hydro corridor runs in a generally northern direction. Map Site 9 is a cattail marsh, surrounded by successional lowland forest dominated by white cedar, and, to a progressively lesser extent, white birch and willow.

- ***Wetland 213-1 - Class 6 (Map Site 10)***

This wetland is a red-silver maple wetland forest with occasional small cattail marshes parallel to existing Highway 6. Some sugar maple and white ash are in better drained areas to the north, where white cedar also becomes more abundant.

- ***Wetland 218-1 - Class 6 (Map Sites 10-13)***

Map Sites 10 and 11 are wetland white cedar woods, with some white and yellow birch, adjacent to Bronte Creek. Occasional tall white pine are here as well. Old-fields, shrublands and patches of conifer plantations are adjacent to the east side of existing Highway 6. Map Site 12 is a small cattail marsh attended by trembling aspen and balsam poplar, with white cedar (Map Site 13) to the east. White birch and red maple are prominent in the southern part of Map Site 13.

- ***Fletcher Creek Swamp - Class 1 (Map Sites 14-17)***

Map Site 14, at the northwest corner of the intersection of Maddaugh Road and existing Highway 6 is a cattail marsh-swamp with red maple, trembling aspen, white elm, white cedar, and willows scattered throughout. Water plantain, water-arum, bulrush, and bur-reed are among the more strictly wetland plants, tall and rough-stemmed golden rods, and New England and purple-stemmed asters characterize the less wet places. Sensitive and marsh ferns are abundant and spinulose wood and marginal wood ferns are in association with the cedar woods at the west edge.

Map Site 15 has been described earlier as Map Site 5 (Fletcher Creek Swamp Forest - ESA). Map Site 16 is on the north side of Fielding Lane, just east and north of a residence. A wetland comprises an open pool adjacent to Fielding Lane, a swamp with diverse flora, and to the north a wet old-field area which grades into drier old field immediately south of the CN rail tracks. Woody vegetation in the swamp includes white cedar, willows, balsam poplar, trembling aspen, apple, red-osier dogwood, chokecherry, and riverbank grape. Herbaceous vegetation includes goldenrods, asters, grasses, sedges, rushes, jewel-weed, spotted Joe-pye weed, boneset, bedstraw, lady fern, and sensitive fern. The wet old field is dominated by sedges, bulrushes, tall goldenrod, and purple-stemmed, New England and heath asters.

The wetland forest (Map Site 17) north from the CP Rail line, parallel to the selected alignment, is dominated by white cedar with elements of white birch, yellow birch, red maple, and black ash.

- ***Unclassified Wetland (Map Site 18)***

A small wetland just north between the woodlands at Map Sites 40 and 41 is directly on the selected alignment. This wetland is attended by willows and riverbank grape on one side and by forage grasses on the perimeter. This small wetland is surrounded almost entirely by corn fields. Two other similar small wetlands are 100 m to the west and 200 m to the east, respectively.

- ***Unclassified Wetland (Map Site 19)***

This small wetland is located in a depression in an old field immediately north of Calfass Road. Bladderwort, spikerush, pondweed, water plantain, and arrowhead are among the strictly aquatic plants found in this pond. The pond is surrounded by a diverse mix of wetland and old field species including sedges, bulrush, bulbous water hemlock, swamp milkweed, spotted Joe-pye weed, boneset, willows, thimbleweed, hairy beardtongue, red-osier dogwood, and several species of forage grasses, goldenrods, and asters.

- ***Unclassified Wetland (Map Site 20)***

This small wetland adjacent to the woodland at Map Site 43 is a small open pool with borders of cattail, willow, and red-osier, grey, and alternate leaved dogwoods, small white pines (maximum 20 cm diameter), and trembling aspen. Beyond and partially forming the south end of the woodland edge are staghorn sumac, raspberries, and blackberries. Riverbank grape and Virginia creeper both are abundant on the taller vegetation here.

- ***Unclassified Wetland (Map Site 21)***

A small wetland spring is located on the selected alignment between woodlands at Map Sites 43 and 44. This spring is surrounded by willows, white elm saplings, and red-osier dogwood. Woolgrass is in the wettest area, and white vervain is here.

- ***Wetland 223-2 - Class 7 (Map Sites 22-24)***

This wetland complex has three components; i.e. a small pond in open fields, 400 m south of Morristown and west of existing Highway 6 (Map Site 22), a large pond 200 m west of Morristown on Calfass Road in association with a small pond north of Calfass Road (Map Site 23), and a more complex wetland immediately southwest of the existing Highway 6 and Highway 401 interchange (Map Site 24). This open pond with islands of vegetation is surrounded by white cedars, particularly to the south and west, with trembling aspen, white birch, and large weeping willows on the north. Additionally, areas of old field vegetation,

including goldenrods, asters, and forage grasses, along with hairy beard tongue, white vervain, and jewel-weed are here. Red-osier dogwood and honeysuckles are among the shrub species at or near the water's edge, and buttonbush, white birch, willows, and red-osier dogwood are on the islands in this wetland. Arrowhead, pond weed, cattails, and duckweed are among the strictly aquatic species observed. A short laneway from the present Highway 6 to the height of land is immediately north of the wetland. The lane is attended by sugar maples (45-70 cm diameter), and a variety of planted and natural hedgerow species.

- ***Unclassified Wetland (Map Site 25)***

The wetland at Map Site 25 contains an expanse of open water with a fish population and cattail and spikerush growing aquatically. Several species of willows, red ash, hawthorns, trembling aspen, red-osier dogwood, red and sugar maples, and the climbers, Virginia creeper and riverbank grape, are along the shore. This wetland is surrounded by old-field on the north and east, and by successional woody vegetation to the south and west.

- ***Galt Mill Creek Wetland Complex - Class 1 (Map Sites 26-36)***

This wetland complex is distributed over a wide area. Only those features in the study area associated primarily with locations near the intersections of Hanlon Highway, Highway 401, and County Road 34 are addressed.

The wetland forest vegetation attending Aberfoyle Creek (Map Site 26) is predominantly white cedar with mixtures and mosaics of trembling aspen, balsam poplar, white and yellow birches, red and silver maple, and black ash. At the southwestern end of this system, east of Concession Road 7, red-silver maple are abundant (OMNR-FRI, 1978). The creekside woods between Concession Road 7 and Highway 401 (Map Site 27) are predominantly white cedar, red maple, and trembling aspen, a characteristic streamside assemblage in this area.

The forested area at Map Site 28 is mostly deciduous except adjacent to the creek where white cedar is more abundant. Various mixes and mosaics occur here including red and silver maple, white birch, willow, trembling aspen, white elm, black ash, and an occasional white pine.

A small segment of immature woodland containing white cedar, trembling aspen, white birch and white elm is in the triangle formed by the interchange ramp at Map Site 29. A small remnant wood containing trembling aspen, white birch, red ash, and blue beech is at Map Site 30. The wetland forest block at Map Site 31 contains white cedar, white elm, red maple, trembling aspen, and numerous white birch, especially on the north edge.

The area immediately north of Map Site 32 is conifer plantation, containing white spruce, and Scots' and white pines. The natural areas in this woodland block are variously populated by white cedar, white birch, and trembling aspen. The regionally rare pickerel frog (*Rana palustris*) has been observed in the drainage channel, parallel and adjacent to the Hanlon Highway (OMNR Cambridge, pers. comm.).

A cedar wetland that drains east then south along Wellington Road 34 is at Map Site 33. In the midst of this semi-circular wetland is an area of raised old field with white cedar regeneration. Mature white cedar bordering a cattail swamp is north of the old field. The southern portion of this area is a relatively open wetland with a diverse flora. Tree species are tamarack, white cedar, white birch, and white elm. Shrubs include red-osier dogwood and several species of willow. A wet old field area borders on the west and is dominated by tall, gray, and narrow-leaf goldenrods, and at least three species of aster. Herbaceous species in the wetter areas include bulrushes, cattail, Joe-pye weed, several species of violets, marsh fern, crested wood fern, begger's ticks, several sedges, tall meadow rue, turtle head and New England aster. As well, there are several species of goldenrod including tall, rough-stemmed, bog, and rough-leaved goldenrod.

The woodland on the southeast corner of the intersection of Wellington County Road 34 and the Hanlon Highway (Map Site 34) is a wet forested area dominated by trembling aspen, some white birch and white elm, and with speckled alder forming a subdominant stratum in places. Some black ash, white cedar and the occasional balsam fir are here. The ground flora is mainly of sedges with false nettle, spinulose wood fern, sensitive fern, purple-stemmed aster, raspberry, Jack-in-the-pulpit, tall meadow-rue, and regionally rare (Eagles et al, 1977) showy lady slipper.

The woodland at Map Site 35 is a wet coniferous woods with a number of more boreal species. White cedar predominates with red maple, some large white pines (60 cm diameter), white birch and much balsam fir,especially in the wetter areas toward the east. Shrubs include winterberry holly, red-osier dogwood, and speckled alder. Herbaceous species include sensitive fern, crested wood fern, cinnamon fern, marsh fern, hay-scented fern, sarsaparilla, Canadian mayflower, showy lady slipper, partridge berry, early meadow-rue, foam flower, false-nettle, jewel-weed, fireweed, bluebeard lily, checkerberry, gold thread, twinflower, and fringed polygala. A farm pond is at the east edges of this woodland. A new-born white-tailed deer (*Odocoileus virginiana*) fawn was observed here in May, 1988.

A mature wetland forest is at Map Site 36. The dominant trees are silver and red maple with some hemlock, white elm, and large basswood. The eastern extension of this woodland is upland where sugar maple predominates. The northwest corner of this wetland is cattail

marsh which drains northward, thence westward and south into the woodland at Map Site 35.

2.5 Woodlands

Woodlands described in the study area those identified by OMNR (1980) (with one exception) and plantation blocks arbitrarily deemed significant. Forest characteristics were used to describe ANSIs, ESAs, and wetlands where relevant, and, for the most part, these descriptions will not be repeated in this section.

- ***Conifer Plantation (Map Site 37)***

This plantation, located at the southwest corner of Maddaugh Road and existing Highway 6 has been planted in varying densities with red pine, white pine, white spruce and larch. In the southern part of this 60 ha block, small areas of natural shrubland and one small area of wetland woods is located adjacent to the west side of Highway 6.

- ***Wetland Forest (Map Site 38)***

This wetland forest is described in Section 2.4 under Fletcher Creek Swamp - Class 1 Wetland at Map Site 17. OMNR (1980b) considers this low-productivity forest.

- ***Remnant Upland Deciduous Woodland (Map Site 39)***

This small remnant (approx. 2 ha) upland woods is adjacent to the selected alignment. It contains white ash, sugar maple, and a large beech specimen toward the north end. OMNR (1978; 1980b) did not identify this rather low quality woodlot. White spruce and scot's pine have been planted extensively to the north and west.

- ***Mature Upland Deciduous Woodland (Map Site 40)***

This 5 ha, Class 1 woodland is primarily a sugar maple - white ash community of moderate maturity, with most maples and ashes in the 25-45 cm diameter classes. Some larger specimens are at the edges of this woodland, e.g., 50-60 cm diameter white ashes along the south edge, and 50-75 cm diameter maples at the north edge. Other tree species at various places in this woodland are beech, basswood, ironwood, white pine, black cherry, black walnut and bitternut hickory. Saplings of sugar maple and white ash are found more or less throughout the woodland, and the herbaceous flora is very diverse including wild ginger, bloodroot, common trillium, sharp-lobed hepatica, early meadow rue, white baneberry, blue cohosh, downy yellow violet, may apple, jack-in-the-pulpit, Canadian mayflower, Solomon's

seal, enchanter's night shade, zigzag and blue-stem goldenrods, spinulose wood fern, lady fern, and Christmas fern. A small knoll adjacent to the west edge has a successional community of trembling aspen and white pine.

- ***Mature Upland Deciduous Woodland (Map Site 41)***

This 7 ha, Class 1 mature woodland contains large ironwoods (23-38 cm diameter) on the south edge, and large beeches (35-60 cm diameter), sugar maples (25-45 cm diameter), and white ash (20-30 cm diameter). This is a more open deciduous forest than the woodland at Map Site 40, due to some cutting in past years. A well developed sugar maple sapling stratum exists in much of the area. The herbaceous vegetation comprises many of the same species listed for the woodland at Map Site 40. This is, in historical fact, two adjacent woodlands, with beech more abundant in southwestern portion (50%) and sugar maple more abundant (70%) in the northeastern portion (OMNR, 1978).

- ***Mature Upland Deciduous Woodland (Map Site 42)***

This small open grove of mature sugar maple and some basswood, in the midst of a pasture, is well grazed with virtually no woodland herbaceous plants. OMNR (1978; 1980b) did not identify this woodlot.

- ***Mature Upland Deciduous Woodland (Map Site 43)***

The greater portion of this 4 ha, Class 1 woodland is a relatively immature sugar maple (10-30 cm diameter) and beech (15-25 cm diameter) community with a surprisingly large number of black cherry (30 cm diameter) specimens scattered throughout, but especially toward the west. Large individual specimens of ironwood (30 cm diameter), white pine (20-28 cm diameter), yellow birch (25 cm diameter), sugar maple 60-70 cm diameter), basswood (65 cm diameter), and beech (60-90 cm diameter) are found, especially in the extreme south end and northwest corner of the woodland. A grove of about six hemlocks (30-45 cm diameter) is located in the west central area of this woodland. The woodland grades from a high well-drained area on the east to a wet area on the west edge. Herbaceous vegetation in this woodland is much as described for the woodland at Map Site 40, but not as rich in terms of number of species or abundance. An area of white pine regeneration is due east of the north end of the woodland.

- ***Mature Upland Deciduous Woodland (Map Site 44)***

The mid-portion of this 11 ha, Class 1 woodland is somewhat open sugar maple (15-35 cm diameter) with scattered large specimens of beech (40-75 cm diameter). Additionally, there

are occasional specimens of basswood and bitternut hickory (25-35 cm diameter). There are mosaics of white ash, sugar maple, and red-berried elder in the lower strata, and mixtures of white ash, sugar maple, and beech seedlings and saplings. The ground and shrub flora are much the same as described for the woodland at Map site 40 with the addition of maple-leaved viburnum, red baneberry and maiden-hair fern. There is considerable relief within these woods with sylvan wetlands in the northern portions. The eastern one-third of this woodland is much more open and less mature; nonetheless near the northern edge are some large beeches and sugar maples. Sugar maple and large-toothed aspen (35 cm diameter) are the taller species with a sub-dominant layer (3-4 m high) of smaller sugar maple, white ash, beech, and black cherry. This area, too, has a great deal of relief in the form of scattered depressions. Some very large specimens of beech, sugar maple, white ash and white pine are in the northernmost extension.

- ***Conifer Plantation (Map Site 45)***

This is a red pine plantation on Crown Land approximately 40 ha in size (OMNR, 1978; 1980b).

- ***Mixed Upland Woodland (Map Site 46)***

This is an area of successional woody vegetation with some large specimens of sugar maple (75-90 cm diameter). Other species include white pine, apples, hop hornbeam (one is very large, 45 cm diameter), hawthorn, white elm, red-osier dogwood, and staghorn sumach. A mature white pine, white and Norway spruce plantation makes up a significant proportion of this mixed woodland.

- ***Lowland Successional Forest (Map Site 47)***

This 5 ha piece of lowland forest was not encompassed in the Galt Mill Creek Wetland Complex (OMNR, 1989b), so is dealt with separately here. An immature trembling aspen population located south and centrally, is surrounded by larger specimens of red maple, white elm, and some white birch. White cedar is to the north in the immediate vicinity of Aberfoyle Creek.

- ***Upland Mixed Forest (Map Site 48)***

A moderately mature sugar maple forest is in combination with a white pine conifer plantation forms this 7 ha mixed woodland. A southern extension is more successional with white cedar, trembling aspen and silver maple.

- ***Wetland Forest (Map Site 49)***

See description for ESA (Map Site 7 - Section 2.3) and Wetland (Map Site 28 - Section 2.4). OMNR (1980b) considers this a high productivity lowland forest.

- ***Wetland Forest (Map Site 50)***

See description for ESA (Map Site 7 - Section 2.3) and Wetland (Map Site 32 - Section 2.4). OMNR (1980b) considers this a high productivity lowland forest.

- ***Wetland Forest (Map Site 51)***

See description for Wetland (Map Site 35 - Section 2.4). OMNR (1980b) considered this a high productivity lowland forest.

- ***Upland Mature Deciduous Forest (Map site 52)***

This approximately 5 ha woodland has been bisected by the Hanlon Highway. It contains mostly large (up to 120 cm diameter) widely separated sugar maple and beech with a lower canopy of large saplings of white ash and sugar maple. This woodland was identified by OMNR (1980b) but not by OMNR (1978).

- ***Conifer Plantation (Map Site 53)***

This is a small (2 ha) white pine, larch plantation approximately 30 years of age (OMNR, 1978).

- ***Mature Upland Deciduous Forest (Map Site 53)***

This is a 6 ha 50 year old sugar maple community (OMNR, 1978), in conjunction with a 2 ha white cedar woodland in the southeast corner.

2.6 Other Features

- ***Mixed Habitat (Map Site 61)***

This general area has considerable relief, with many small knolls and numerous wetland pockets. The old field, shrubland matrix is dotted with wetland depressions of various sizes, which are attended by tree and shrub vegetation of some variety. The threatened

(COSEWIC, 1992) Henslow's sparrow has been observed here (OMNR Cambridge, pers. comm.).

3.0 WILDLIFE

The study area overall is topographically and floristically diverse providing a concommittant diversity of wildlife habitats. The various ESA and ANSI studies provide evidence of the presence of species considered rare at various jurisdictional levels, and by implication attest to the wide variety of wildlife forms. It serves no higher purpose to list all the vertebrate forms that may be in the study area. The vertebrate species known to be in the general area are expected to occur in the study area. Eagles et al (1977) and Ecologistics (1976) provide lists of vertebrate fauna and their status with regard to presence and abundance, and OMNR and naturalist club records also provide evidence of the presence of many species from the common to the rare.

Locations of wildlife resources deemed important to OMNR (1989a; b), and their relationship to the selected alignment are presented below.

3.1 Waterfowl Areas

- ***Map Site 56***

Most of Beverly Swamp is a waterfowl area, the easternmost extension of which comes within 100 m of the existing Highway 6 near Map Site 56 (OMNR, 1989a).

- ***Map Site 58***

Most of the Fletcher Creek Swamp is a waterfowl area, the eastern most extension of which is approximately 100 m from the selected alignment, near Fielding Lane (OMNR, 1989a; b).

- ***Map Site 60***

A large area of Galt Creek Swamp southwest of the intersection of the Hanlon Highway and Highway 401 is a waterfowl area (OMNR, 1989b). The northern most limit of this waterfowl area is at this intersection.

3.2 Deer Winter Range

- ***Map Site 55***

Most of Beverly Swamp is deer winter range, the eastern most extension of which is adjacent to the existing Highway 6 (OMNR, 1989a).

- ***Map Site 57***

Most of Fletcher Creek Swamp is deer wintering range, the northern extension of which is approximately 200-400 meters from the proposed alignment near Fielding Lane (OMNR, 1989a; b).

- ***Map Site 59***

Nearly all the area immediately south of Galt Creek Swamp and the wetland forest attendant to the Hanlon Highway are deer wintering areas (OMNR, 1989b).

3.3 West Virginia White Butterfly Sites

- ***Map Site 62***

The West Virginia White Butterfly was collected from the woodlot at Map Site 43 (D. Coulson, OMNR Cambridge, pers. comm.). This butterfly was previously considered rare in Ontario under the Endangered Species Act, but was removed from that status, and is now considered "rare/threatened" by Cambridge District OMNR, but is not protected by law [letter from M. Wilson, dated 26 Oct 1993]. It is quite likely present in all of the mature upland deciduous forest units in the study area, as its host plants, toothworts, are relatively abundant in these systems.

4.0 ENVIRONMENTALLY SENSITIVE AREAS/ISSUES

The Beverly Swamp, Fletcher Creek Swamp, and the Galt Mill Creek are highly sensitive systems and valuable resources. All are designated Class 1 wetlands and ESAs, and Fletcher Creek Swamp and Beverly Swamp have been assigned regional and provincial ANSI status, respectively. These designations reflect the cognisance of their value and sensitivity.

There are four general categories of sensitive terrestrial features in the study area: wetlands, woodlands, wildlife, and in general rare or otherwise unique species, assemblages or specimens including large trees.

Wetlands in addition to being important hydrogeological resources are among the most productive natural systems. They have characteristic vegetation, often with rare species and/or unique assemblages, and they provide habitat for a variety of wildlife including waterfowl, songbirds, furbearing mammals, and white-tailed deer. It is important to bear in mind that wetlands on a global scale are decreasing rapidly.

Woodlands represent an enormous investment in resources and time that a less three-dimensional system does not. To replace large tree specimens can take 100-200 years or more - to cut one down takes seconds. Woodlands properly managed represent a constantly renewable economic resource. Woodlands provide habitat for an array of wildlife species. The water-retaining and thermo-regulatory effects of woodlands on wetlands and streams is considerable. Woodlands also play an important role as wildlife movement corridors; this is especially important along stream courses.

With respect to proximity to the selected alignment, the most sensitive features of the study area would appear to be the upland deciduous woodlots between Crieff Road and Highway 401, and the entire complex area in the vicinity of the intersections of the Hanlon Highway with Highway 401 and County Road 34 where floristic and faunistic diversity is probably the highest in the study area, and where the relationship between aquatic and terrestrial systems is especially complex and highly interdependent.

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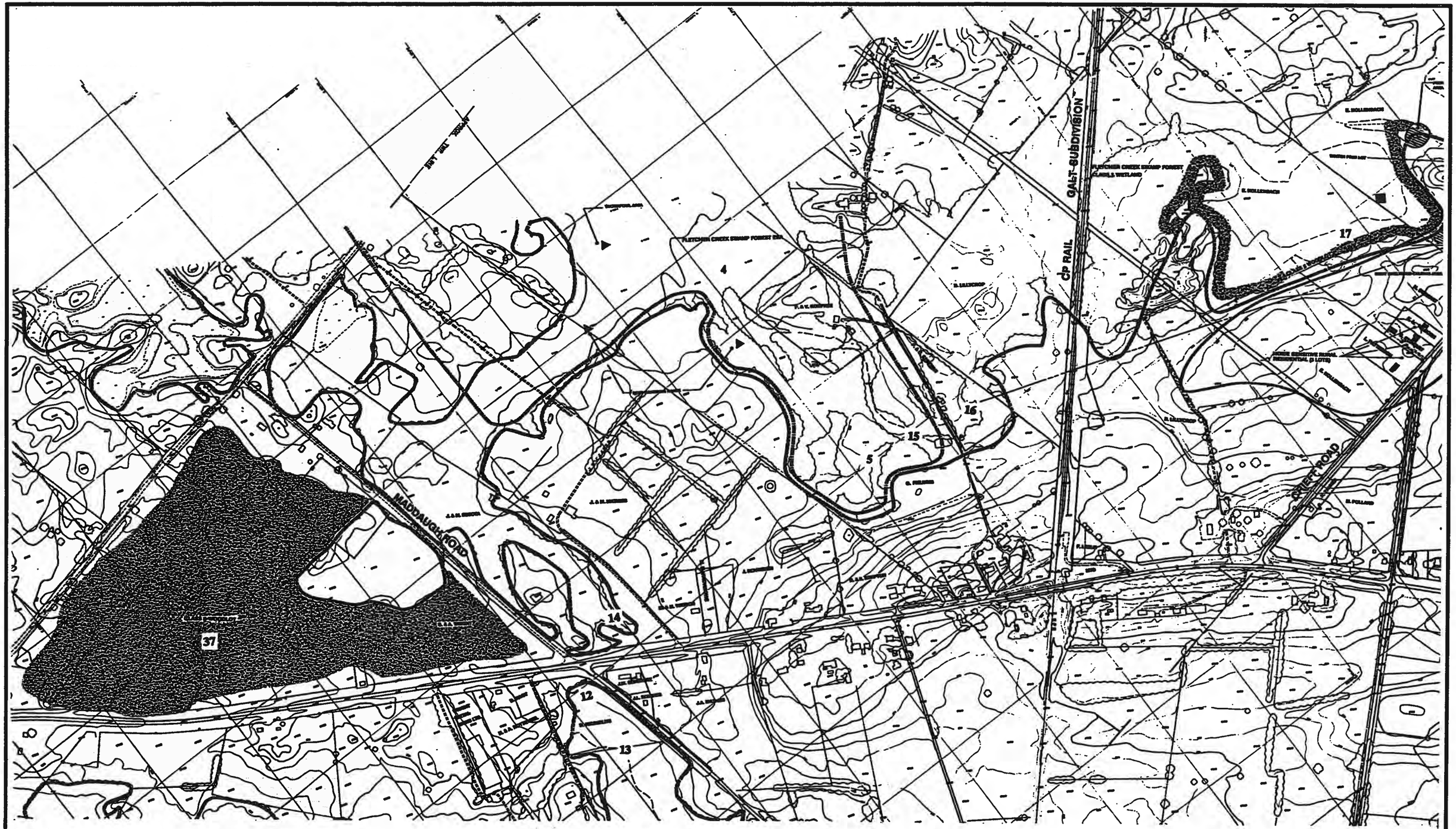


HIGHWAY 6

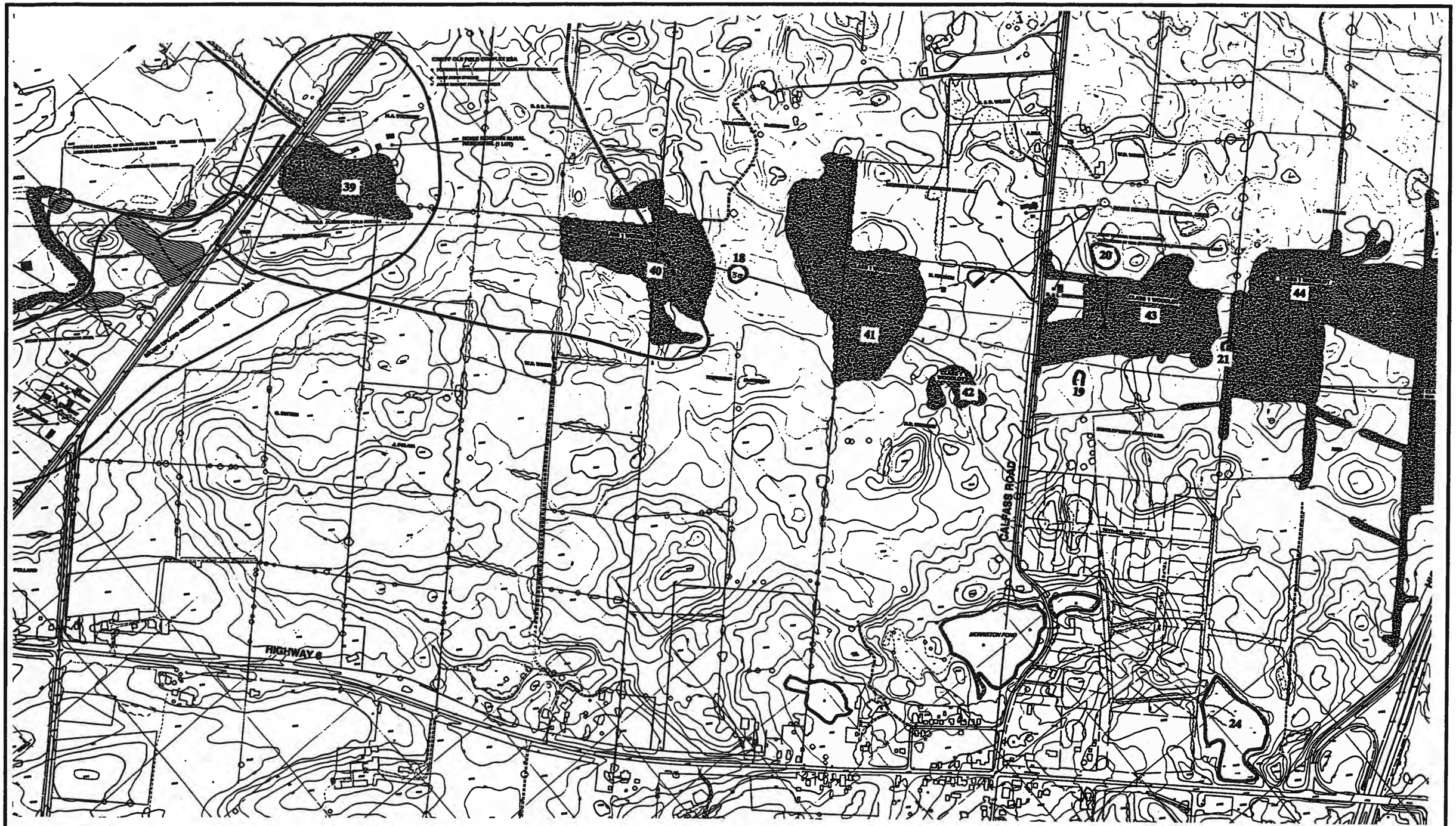
FREELTON TO GUELPH
Environmental Assessment
& Preliminary Design Report

LEGEND

- ENVIRONMENTALLY SIGNIFICANT AREAS (ESA's)
- WETLANDS
- WOODLOTS
- WILDLIFE HABITAT
- CALVING AREAS
- NOISE SENSITIVE USE

APPENDIX A

KEY PLAN TO SENSITIVE NATURAL AREAS



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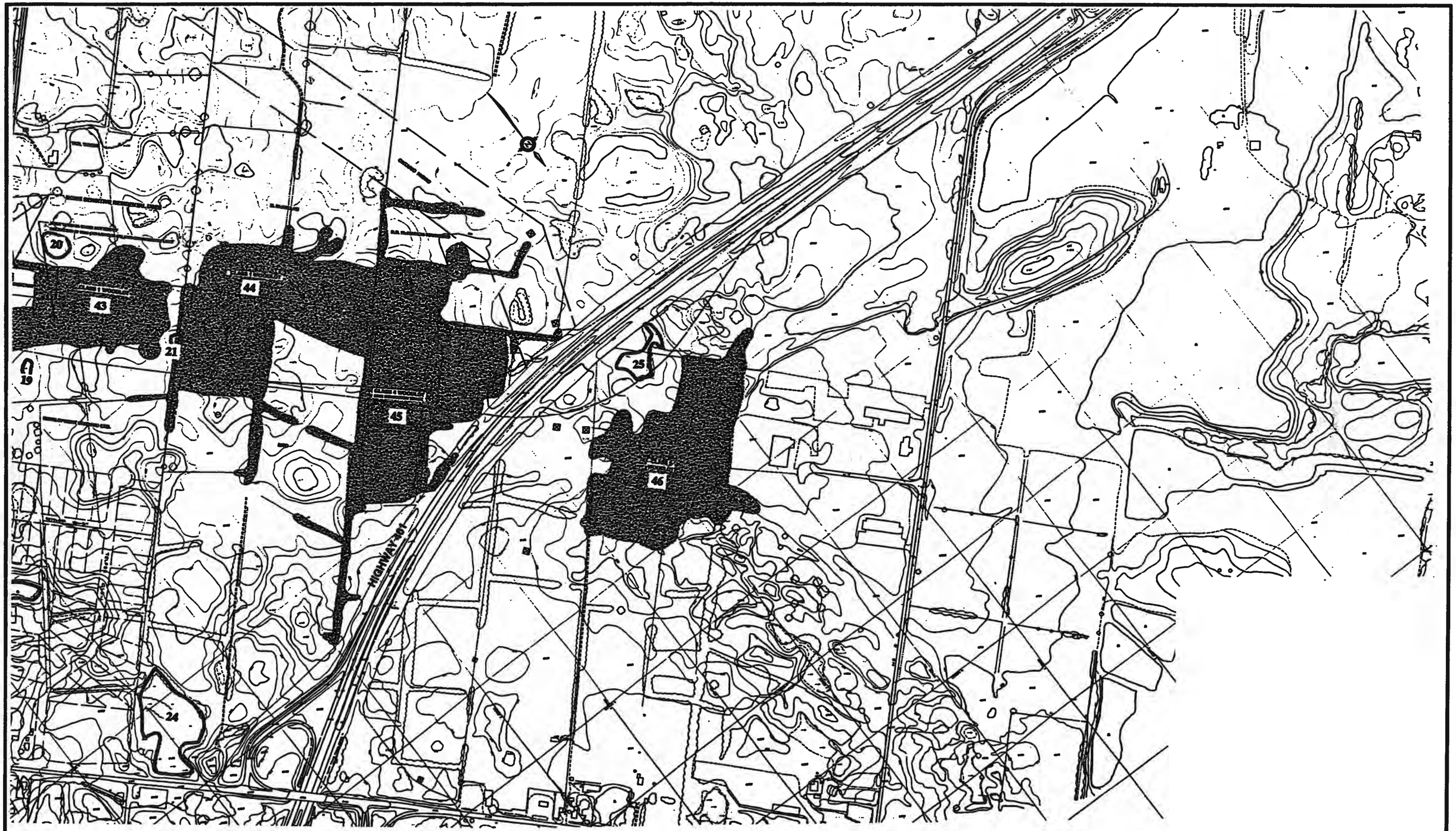

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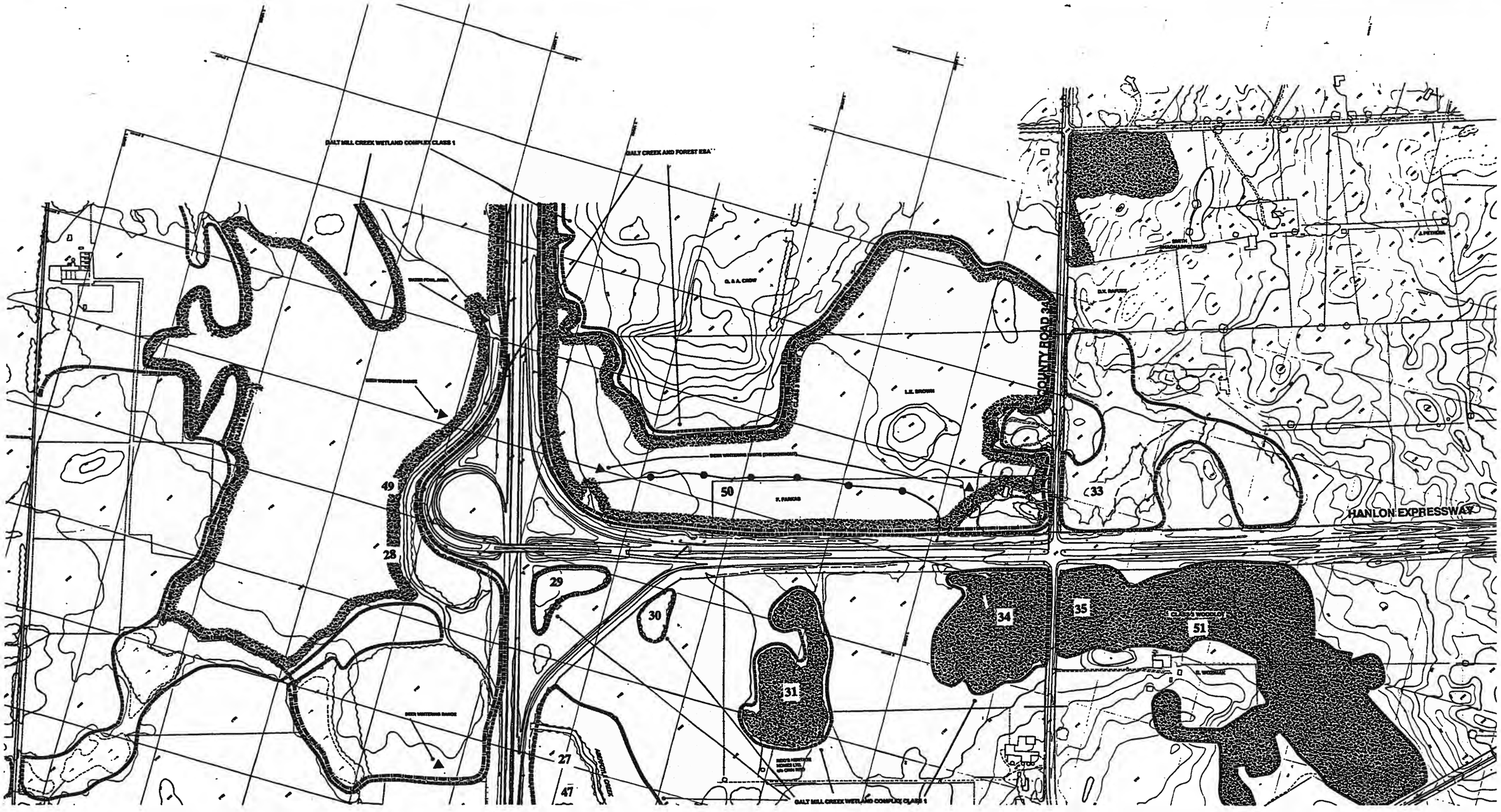

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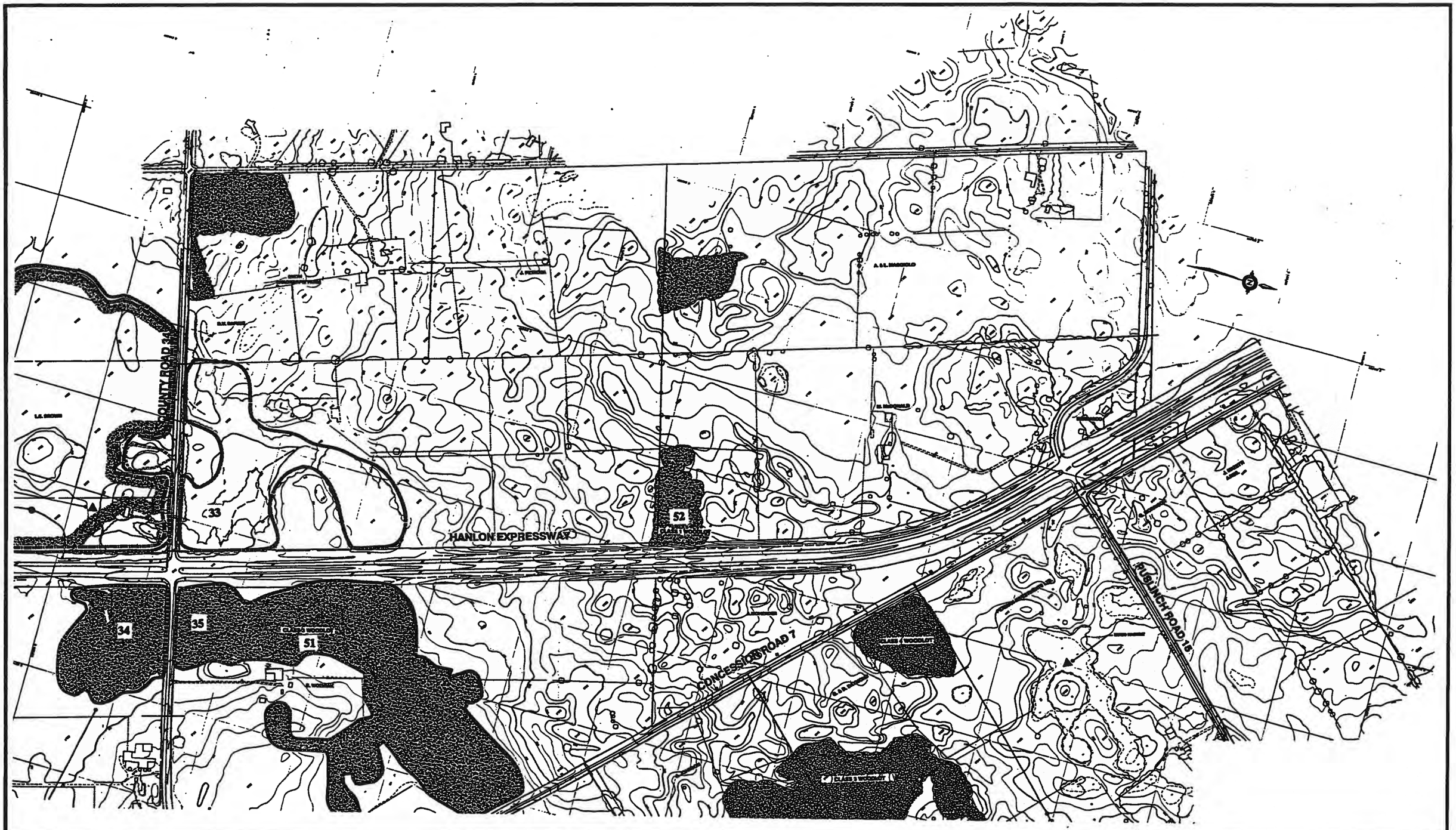

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FENCO MacLAREN INC.
2235 Sheppard Avenue East
Willowdale, Ontario
M2J 5A6
Telephone (416) 756-3400
Fax (416) 756-2266

MEMORANDUM

TO: Ian Upjohn

DATE: December 18, 1993

FROM: D.M. Cameron

PROJECT No.: 005796

RE: Highway 6

Comments regarding two elements of the Highway 6 project follow:

1. Proposed Highway 6S - Highway 401E Directional Ramp

The proposed ramp, proceeding from where it would depart from existing Highway 6 north then east to where it would join the eastbound lane of Highway 401 is in old-field vegetation for the most part (see Figure 1). Old-field vegetation at Map Site (1) is composed of introduced forage grasses and various pioneer forbs such as goldenrods (*Solidago* spp.), Queen Anne's lace (*Daucus carota*), and sweet white clover (*Melilotus alba*). Near Highway 6 at Map Site (2), are some scattered shrubs and small trees, including apple (*Malus domesticus*), hawthorns (*Crataegus* spp); and Manitoba maple (*Acer negundo*). A small grove of cottonwoods (*Populus deltoides*) is located at Map Site (3), some of which may have to be removed during construction. These have been planted and are 13-15 m in height and most are 20-40 cm in diameter (dbh). Construction also would require the removal of at least half of another cottonwood grove at Map Site (4) (mostly 40-55 cm dbh,; 16-20 m in height) near Highway 401 where the proposed ramp would join the eastbound lane. Some Manitoba maples would be removed at Map Site (5).

None of the vegetation removed, including woody species, would represent a significant loss. total loss of woody vegetative cover would be an approximate maximum of 0.2 ha. All the cottonwoods (or cottonwood hybrids) were planted and the other woody species are common and most show significant morphological effects from auto emissions and/or road salt spray. In general, the proposed impacts are insignificant.

2. Slovenski Park Property

The rural section line is 7.5 m north of the urban section property line at the southeast corner of the Slovenski property at Map Site (1) (Sta. 20+325), decreasing to 3.5 m at Map Site (2) (Sta. 20+200), and joining it at Map Site (3) near Sta. 19+975 see Figure 2).

A berm exists for approximately 160 m between Map Sites (1) and (2). In this area, the segment north of the urban line to the rural line, north of the present property line, includes a shallow gully with old-field vegetation south of the aforementioned berm.

Rather typical old-field vegetation is north of the existing property line on the south face of the berm, with approximately ten planted cottonwoods up to 17 cm dbh and 9 m in height and several planted small silver maple (*Acer saccharinum*) and small black walnut (*Juglans nigra*) saplings, all rather widely spaced. Small white spruce (*Picea glauca*) from less than 1.0 m to 2.5 m tall are in three irregular rows on the top and north face of the berm. Several widely spaced small cottonwoods are scattered along the north base of the berm. Some naturally occurring white cedars (*Thuja occidentalis*) (up to 10 cm dbh and 7 m high) are scattered along the west end, and more or less on top of the berm. These grade into dense white cedar growth to the west.

The urban section line, for all practical purposes, would not result in the removal of woody vegetation, with the exception of some of the small silver maple and black walnut saplings. The rural property line would remove the cottonwoods on the south-facing slope of the berm, about two-thirds of the white spruce at or near the top of the berm, and virtually all of the white cedars at the west end of the berm. Obviously the impact of removal to the rural section line is greater than removal to the urban property line. This may be significant in the perception of the owners of the Slovenski property, but from an ecological perspective the difference is slight, with removal to either line not representing a significant impact.

The remaining area of concern is from the end of the berm at Map Site (2) to a point at Map Site (3) near a drainage which flows from north to south through a culvert under Highway 401. This is a distance of approximately 220 m and involves a strip which is 3.5 m wide at Map Site (2), with urban and rural property lines joining at Map Site (3). For the most part, the vegetation is dense white cedar with a closed canopy. The top of this canopy slopes sharply upward from near ground level at the existing property line fence to approximately 9 m in height a short distance to the north.

There are some gaps in the otherwise solid cedar vegetation, notably at the east end of this section near the berm and the large building on the property. Hawthorns, the occasional white elm (*Ulmus americana*), and some other deciduous shrubs and saplings occur in a sporadic pattern along this edge.

The difference in impact between the urban and rural section lines is related to the removal of a narrow triangle (3.5 m at the east end, converging at the west end) of white cedar. This would occur within the removal area of a larger strip of cedar woods, 10 m wide at the east end near the berm and 20.5 m wide near Sta. 19+975. Both options would result in a south-face exposure of now shaded cedar woods, the impact of which would be slightly greater with removal to the rural section line.

The projected loss of vegetative cover is indicated in the following table:

Loss of Vegetative Cover (sq.m)

Segment	to urban section line	to rural section line	increase, urban to rural	% increase urban to rural
A	920	1800	880	96
B	2970	3355	385	13

Segment A is from the end of the berm east of Station 20+235, west to Station 20+200. The loss in this area would be of vegetation of relatively low value, involving mostly old-field vegetation and scattered planted trees.

Segment B is from Station 20+200, west to Station 19+975. The vegetative cover that would be lost in this area mostly comprises moderately mature white cedar trees with a closed canopy.

The loss of vegetation in Segment A is not significant from an ecological perspective. The loss in Segment B involves more mature woody vegetation, but the area of loss is relatively small, and the species involved are common in the area.

APPENDIX B

LIST OF PLANT SPECIES

Common and scientific names of plant species mentioned in the text are presented herewith. Nomenclature is in general accordance with Riley (1989).

Common Name	Scientific Name
Cinnamon Fern	*Osmunda cinnamomea*
Sensitive Fern	*Onoclea sensibilis*
Marsh Fern	*Dryopteris thelypteris*
Spinulose Wood Fern	*D. spinulosa*
Crested Wood Fern	*D. cristata*
Marginal Wood Fern	*D. marginalis*
Christmas Fern	*Polystichum acrosticoides*
Hay-Scented Fern	*Dennstaedtia punctilobula*
Lady Fern	*Athyrium felix-femina*
Maidenhair Fern	*Adiantum pedatum*
Virginia Chain-Fern	*Woodwardia virginica*
Oak Fern	*Gymnocarpium dryopteris*
Balsam Fir	*Abies balsamea*
Eastern Hemlock	*Tsuga canadensis*
White Spruce	*Picea glauca*
Norway Spruce	*P. abies*
Larch (Tamarack)	*Larix laricina*
Scot's Pine	*Pinus sylvestris*
White Pine	*P. strobus*
White Cedar	*Thuja occidentalis*
Common Cattail	*Typha latifolia*
Bur-Reed	*Sparganium* sp.
Pond Weeds	*Potomogeton* spp.
Water Plantain	*Alisma triviale*
Arrowhead	*Sagittaria* sp.
Grasses	*Family: Poaceae*
Spike Rush	*Eleocharis palustris*
Bulrushes	*Scirpus* spp.
Woolgrass	*S. cyperinus*
Sedges	*Carex* spp.
Jack-in-the-pulpit	*Arisaema atrorubens*
Water Arum	*Calla palustris*
Duckweed	*Lemna minor*
Bluebead-Lily	*Clintonia borealis*
Canadian Mayflower	*Maianthemum canadense*
Solomon's Seal	*Polygonatum pubescens*
Common Trillium	*Trillium grandiflorum*
Showy Lady's Slipper	*Cypripedium reginae*
Willows	*Salix* spp.
Weeping Willow	*Salix babylonica*
Trembling Aspen	*Populus tremuloides*
Large-Toothed Aspen	*P. grandidentata*
Balsam Poplar	*P. balsamifera*
Black Walnut	*J. nigra*
Bitternut Hickory	*Carya cordiformis*
Blue Beech	*Carpinus caroliniana*
Ironwood	*Ostrya virginiana*
Yellow Birch	*Betula alleghaniensis*
White Birch	*B. papyrifera*
Speckled Alder	*Alnus rugosa*
Beech	*Fagus grandifolia*
White Elm	*Ulmus americana*
False Nettle	*Boehmeria cylindrica*
Wild Ginger	*Asarum canadense*
Early Meadow-rue	*Thalictrum dioicum*
Tall Meadow-rue	*T. polygamum*
Sharp-lobed Hepatica	*Heptica acutiloba*
Thimbleweed	*Amemone virginiana*
Goldthread	*Coptis groenlandica*
Red Baneberry	*Actaea rubra*
White Baneberry	*A. pachypoda*
May Apple	*Podophyllum peltatum*
Blue Cohosh	*Caulophyllum thalictroides*
Bloodroot	*Sanguinaria canadensis*
Foamflower	*Tiarella cordifolia*
Hawthorne	*Crataegus* spp.
Apple	*Malus domesticus*

Common Name	Scientific Name
Raspberry	*Rubus* spp.
Blackberry	*R. allegheniensis*
Black Cherry	*P. serotina*
Chokecherry	*P. virginiana*
Fringed Polygala	*Polygala paucifolia*
Staghorn Sumac	*Rhus typhina*
Winterberry Holly	*Ilex verticillata*
Sugar Maple	*Acer saccharinum*
Red Maple	*A. rubrum*
Silver Maple	*A. saccharum*
Jewel-weed	*Impatiens capensis*
Virginia Creeper	*Parthenocissus inserta*
Riverbank Grape	*Vitis riparia*
Basswood	*Tilia americana*
Violets	*Viola* spp.
Downy Yellow Violet	*V. pubescens*
Green Violet	*Hybanthus concolor*
Fireweed	*Epilobium augustifolium*
Enchanter's Nightshade	*Circaea quadrisulcata*
Sarsparilla	*Aralia nudicaulis*
Bulbous Water-Hemlock	*Cicuta bulbifera*
Red-osier Dogwood	*Cornus stolonifera*
Grey Dogwood	*C. racemosa*
Alternate-leaved Dogwood	*C. alternifolia*
Checkerberry	*Gaultheria procumbens*
White Ash	*Fraxinus americana*
Red Ash	*F. pennsylvanica*
Black Ash	*F. nigra*
Swamp Milkweed	*Asclepias incarnata*
White Vervain	*Verbena urticifolia*
Turtlehead	*Chelone glabra*
Hairy Beard-tongue	*Penstemon hirsutus*
Bladderwort	*Utricularia* sp.
Bedstraw	*Galium* spp.
Partridge Berry	*Mitchella repens*

Common Name	Scientific Name
Buttonbush	*Cephalanthus occidentalis*
Twinflower	*Linnaea borealis*
Honeysuckles	*Lonicera* spp.
Maple-Leaved Viburnum	*Viburnum acerifolium*
Red-Berried Elder	*S. pubens*
Spotted Joe-Pye Weed	*Eupatorium maculatum*
Boneset	*E. perfoliatum*
Goldenrods	*Solidago* spp.
Blue-Stem Goldenrod	*S. caesia*
Narrow-leaf Goldenrod	*S. graminifolia*
Zigzag Goldenrod	*S. flexicaulis*
Bog Goldenrod	*S. uliginosa*
Rough-Leaved Goldenrod	*S. patula*
Gray Goldenrod	*S. nemoralis*
Rough-Stemmed Goldenrod	*S. rugosa*
Tall Goldenrod	*S. altissima*
Asters	*Aster* spp.
New England Aster	*A. nova-angliae*
Purple-stemmed Aster	*A. puniceus*
Heath Aster	*A. ericoides*
Beggar's Ticks	*Bidens cernua*

IMPACT ASSESSMENT OF HIGHWAY 6 IMPROVEMENTS

TERRESTRIAL BIOLOGY

1.0 INTRODUCTION

The proposed highway corridor, from the area south of Maddaugh Road north to Highway 401, west to the Hanlon Expressway, thence north to the area of Puslinch Road 15, is located variously in areas of low human density development, quarry areas for gravel extraction, farmland, upland and lowland plant communities and wetlands. Natural ecological systems potentially affected by the proposed construction, operation, and maintenance of the highway, road widenings, and interchanges include:

1) wetlands
2) upland and lowland mature forests
3) upland and lowland successional forests
4) areas of old-field and shrub vegetation
5) some hedgerow vegetation

The corridor severs or encroaches upon one regionally significant Life Science Area of Natural and Scientific Interest (ANSI), three Environmentally Sensitive Areas (ESAs), two Ontario Ministry of Natural Resources (OMNR) Class 1 (Provincially Significant) wetlands, and two OMNR Class 4-7 wetlands. Several small undesignated wetland areas have been considered where deemed appropriate.

More detailed descriptions of study area features can be found in the Data Sources, Reliability, and Information Gaps report for this study and in Fenco Engineers Inc. (1987).

The corridor has been divided into five segments (see Figure 1.0) for purposes of this discussion. These segments are as follows:

Segment 1 - from station 24+200 at the south end of the proposed construction, north to Match Line station 26+300, including the relocation of Maddaugh Road.

Segment 2 - includes three route alternatives from Match Line station 26+300, north to Match Line station 29+450 and 10+300 for Alternative 1, and to Match Line stations 29+500 and 10+300 for Alternatives 3 and 2.

Segment 3 - east from Match Line station 10+300 to present Highway 6 near intersection with Highway 401.

Segment 4 - north from Match Line station 29+450 for Alternative 1, and from Match Line station 29+500 for Alternatives 2 and 3, thence west along both sides of present Highway 401 to Map Site 30 adjacent to the Hanlon Expressway.

Segment 5 - from Map Site 30 adjacent to the Hanlon Expressway north to the limits of the project for Alternatives 5 (modified) and 7, respectively.

See Appendix A for Map Site locations.

2.0 IMPACT ASSESSMENT

2.1 Segment 1 (See Table 1)

The proposed construction in the area of Maddaugh Road would result in the removal of 0.24 ha of plantation (Map Site 37) in the southeast corner of this intersection and 0.34 ha of mixed woods (Map Site 13) near a small area of wetland in the southeast corner of the intersection. Small wetlands (total 1.0 ha) which are part of Fletcher Creek Swamp - Class I Wetland (Map Site 14) and OMNR Class 4 Wetland 218-1 (Map Site 12), respectively, would be encroached upon, as would a larger area of wetland (3.9) at Map Sites 15 and 16. Another small area of woodland formed by the joining of hedgerows is in the corridor about 200 m north of Maddaugh Road. Old-field and shrub areas are located in the Maddaugh Road area, with another between Map Site 16 and the CP Rail Line for a total area of 4.2 ha. North of the rail line, the corridor is mainly in agricultural fields and a small farm pond is immediately west of the proposed corridor, about 100 m north of the rail line.

Severance of Fletcher Creek Swamp Forest ESA (also Fletcher Creek Swamp Forest Regional ANSI, and Fletcher Creek Swamp - Class I Wetland) would remove 2.2 ha at Map Site 5.

Sensitivity in this area is related mainly to impact on wetlands, especially at Map sites 5 and 15. There is a diversity of habitats in this area including a pond, creek, forest and open marsh vegetation. Also, this area is deemed the most likely in this segment to have interesting, if not rare, breeding birds (see Eagles, 1979). Removal of habitat, alteration of drainage patterns, and toxic effects from road salt and automotive emissions are all expected to have negative impacts.

2.2 Segment 2 (See Table 2)

Three route alternatives are proposed in the area of Segment 2.

2.2.1 Alternative 1

Alternative 1 would sever and/or encroach upon four Class 1 mature deciduous woodlands. Woodlands at Map Sites 40 and 41 are severed by the route with losses of 3.0 (52%) and 1.8 (23%) ha, respectively. In addition, two edges of the woodlot will be exposed to more intense sun and wind patterns, as well as salt and automotive emissions. The areal loss due to encroachment in the woodlands at Map Sites 43 and 44 would be 2.5 (52%) and 4.0 (34%) ha, respectively, with single edges of the woodlots exposed. While no rare plant species were observed in these woods, these mature woodland communities are floristically interesting and are distinctly three-dimensional structures which provide habitat for a number of wildlife forms. The woodland at Map Site 44 is topographically diverse, with a reasonable likelihood of containing rare and otherwise interesting plant and animal species. Additionally 2.4 ha of plantation in the OMNR Morriston Tract (Map Site 45) would be removed by construction.

This route alternative encroaches upon the Fletcher Creek Swamp Forest ANSI slightly (less than 0.1 ha); this is also the Fletcher Creek Swamp Class I Wetland, but the encroachment is not in wetland, *per se*.

Alternative 1 encroaches on approximately 7 ha of the Crieff Old Field Complex Environmentally Significant Area (ESA). This area contains typical old-field vegetation, including various grasses, asters, and golden-rods, and the regionally rare marsh hawk and grasshopper sparrow, threatened Henslow's sparrow, and provincially rare dicksissel are possible breeders here (Eagles *et al*, 1979). This alternative also would remove approximately 5.4 ha of old-field and shrub vegetation north of Calfass Road near Map Sites 19 and 43.

Four small unclassified wetlands (Map Sites 18-21) are within the Alternative 1 right-of-way. Most are less than 0.1 ha in size, with the one at Map Site 20 at 0.4 ha. Construction would result in the removal of these small wetlands.

The impacts of Alternative 1 on wildlife would be greater than either Alternative 2 or 3. Removal of woodland would result in a disproportionate loss of wildlife relative to the area of habitat removed because of the reduction in size of isolated woodlands. Small blocks of woodland are unlikely to maintain the number of species that larger blocks do. Deer use these woodland areas,

especially during the warmer seasons, in conjunction with nearby old-field and agricultural areas. Any route alternative would impede east-west movement to some degree, but Alternative 1 would have the greatest impact due to removal of significant blocks of woodland habitat. Also of note is that the woodland at Map Site 43 is a known site for the West Virginia white butterfly, previously considered endangered until 1990, then rare/threatened by Cambridge OMNR, but not protected by law.

2.2.2 Alternative 2

Alternative 2 is essentially the same as Alternative 1 in the area south of Crieff Road, with the same potential impacts.

The amount of Class 1 upland mature deciduous forest removed by construction would be relatively little; i.e., 0.9 (16%), less than 0.1 (1%), and 1.8 (36%) ha at Map Sites 40, 41 and 43, respectively. Additionally, 0.2 (10%) ha would be removed from the edge of the low quality woods at Map Site 39, 0.2 ha from a small mature, but heavily pastured woods at Map Site 42, and 3.4 ha from the plantation at Map Site 45. The likelihood of negative impact on rare or otherwise interesting woodland species is reduced considerably by the relatively small area of woodland removal.

Alternative 2 overlaps 8.4 ha of the Crieff Old-Field Complex ESA, and it would remove a single wetland less than 0.1 ha in size at Map Site 19. Approximately 10.5 ha of old-field and shrub vegetation would be encroached upon by the proposed interchange area north of Calfass Road.

The amount of both upland and wetland wildlife habitat removed by this alternative is significantly less than with Alternative 1. This is especially true in the case of woodlands where encroachment would be mainly on the margins of woods.

2.2.3 Alternative 3

The impacts of Alternative 3 are essentially the same as Alternative 2 with slightly less woodland area removed, and 5.4 ha of the Crieff Old-Field Complex ESA lost to construction.

Alternatives 2 and 3 have the least impact on natural terrestrial systems with Alternative 3 marginally better. Alternative 1 has a much greater negative impact overall. The major concerns with Alternative 1 are the greater removal of mature forest areas, number of wetlands removed, fragmentation of woodlands, and concomitant losses of wildlife habitat.

2.3 Segment 3 (See Table 3)

The corridor from Match Line station 10+300 to Highway 6 connection roads would remove 0.7 ha of woodland (mostly hedgerow) and 1.0 ha of old-field and shrub vegetation west of Class 7 Wetland 223-2. Further, the 2.3 ha wetland (Map Site 24), *per se*, would effectively be lost as severance would remove 1.6 ha from the centre of the wetland. Approximately 0.6 ha of woodland and 2.3 ha of old-field and shrubland would be encroached upon in the area immediately southeast of the wetland, and northwest in the ramp area.

A Highway 6S - Highway 401E directinoal ramp is proposed for the southeast quadrant of the Highway 6/Highway 401 intersection from existing Highway 6 north to the eastbound lane of Highway 401. This would result in the removal of some old-field vegetation and approximately 0.2 ha of woody vegetation of low value. None of the vegetation removed, including woody species, represents a significant loss, and, in general, the proposed impacts are insignificant. Technically, this area is outside that desginated as Segment 3, and is not included in Table 3.

The major concern here is with the loss of a wetland, which has value for waterfowl, reptiles and amphibians, and other attributes associated with wetland function. While the vegetation associated with the wetland is "interesting", no rare or endangered species were observed.

2.4 Segment 4 (See Table 4)

This segment includes all of the widening of Highway 401, running east-west, a short south-running section that connects with either Alternative 1 or Alternatives 3 and 2, at the north end of Segment 2, and a short area at the very south end of the Hanlon Expressway. Table 4 includes quantified impacts for each of the Alternative 1 and Alternative 3 and 2 options.

Alternative 1 would result in the removal of 4.9 ha of the OMNR Morriston Tract plantation south of Highway 401 and 0.8 ha of old-field north of Highway 401 up to the point when all alternatives would become common (at about station 30+100). Accordingly, Alternative 2 or 3 options would result in the removal of 6.8 ha of plantation and 0.7 ha of old-field.

The undesignated wetland at Map Site 25 is approximately 0.5 ha in size and would be almost totally encroached upon. Five to six small functioning wetlands, about 0.2 ha in size occur on both sides of the present Highway 401, but would be lost to widening and 2.4 ha of the Galt/Mill Creek - Class 1 Wetland would be encroached upon north of Highway 401 (Map Site 47) as would 0.3 ha south of Highway 401 (Map Site 28). These represent a total loss of 3.4 ha of wetland.

Upland forest communities, in addition to those given for Alternatives 1 and for Alternatives 2 and 3, include 1.1 ha at Map Site 46 immediately west of the wetland at Map Site 25, a small clump (<0.1 ha) of white cedar, sugar maple, and basswood where McLean Road abuts Highway 401 on the north side, 1.3 ha of wide white spruce hedgerow on the south side of Highway 401 running west from Concession Road 7, and a 0.2 ha community of mixed forest growth near station 52+500.

Old-field and shrub communities, with occasional and small scattered clumps of trees attend much of both sides of Highway 401 involving an additional 8.1 ha of this community type. Agricultural fields are on both sides of Highway 401 east of the Concession Road 7 overpass.

Features which abut the proposed impact zone along Highway 401 include quarrying activities between station 52+500 and the Concession Road 7 overpass. A berm has been constructed on the south side of Highway 401 in this area with some minor tree plantings, i.e., two groups, including a total of seven white pines up to 2 m in height, and 33 spruce mostly under 1 m in height. Berms are also on the north side of Highway 401 in the area of McLean Road and Concession Road 7, where they contain quarry ponds, and in these areas mostly old-field and shrub vegetation would be encroached upon.

The Slovensky Park property abutting the north side of existing Highway 401 immediately west of Concession Road 7 was reviewed with regard to the respective impacts of urban and rural cross-sections. At the east end of this interface (approximately from Station 20+235 west to Station 20+200), the rural cross-section would involve some removal of an existing berm and concomitant loss of old-field vegetation and scattered planted trees. From a strictly biological perspective this would not be a significant loss. West of this, to Station 19+975, there would be a loss of an additional 13% of woody vegetation comprising mostly white cedars.

The Galt/Mill Creek Class 1 Wetland Complex areas on both sides of the Highway have mixed lowland forests (Map Site 47) which for these purposes are considered part of the wetland. The 0.3 ha of wetland south of Highway 401 near Galt Creek (Map Site 28) is also part of the Galt Creek and Forest ESA.

The primary sensitivities in Segment 4 relate to wetland and wetland function. Alteration of drainage patterns, due to construction, could have significant impact on the quality and function of Galt/Mill Creek Class 1 Wetland Complex in this area.

Some terrestrial wildlife habitat would be encroached upon but the long term effects are likely to be few. The major impact has already occurred with the earlier construction of Highway 401 and

the Hanlon Expressway. It should be noted that there is deer wintering range associated with the wetland forests in this general area.

2.5 Segment 5 (See Table 5)

Two route alternatives are proposed in the area of Segment 5.

2.5.1 Alternative 5 (Modified)

Alternative 5 encroaches on 1.2 ha of upland woods (Map Site 52), and on 17.6 ha of old-field and shrub vegetation; i.e., 17.0 of old-field/shrub on both sides of the highway between Map Sites 33 and 52, and 0.6 ha between Map Site 52 and Concession Road 7.

The only encroachment on wetlands (Galt/Mill Creek Class 1 Wetland Complex) would occur with some placement of fill for grade separation at the intersection of County Road 34 and the Hanlon Expressway and on Concession Road 7 for a total of 0.3 ha, and immediately north of County Road 34 (0.6 ha) where the proposed north-south intersection road would be located. The area in the southwest corner of this intersection is also Galt Creek and Forest ESA.

The major impact on wildlife would be with respect to old-field habitats. The threatened Henslow's sparrow has been observed north of the proposed construction in the southeast corner of the intersection of Concession Road 7 and Puslinch Road 15. The proposed construction is not likely to have an impact on Henslow's sparrow should it, in fact, breed here.

2.5.2 Alternative 7

Alternative 7 would result in removal of a total of 3.9 ha of old-field/shrub along the east edge of the Hanlon Expressway between Highway 401 and County Road 34 and in the northwest corner of the Hanlon Expressway and County Road 34, and it would involve the removal of 8.1 ha of wetland, all part of the Galt/Mill Creek Class 1 Wetland Complex.

Map Sites 33-35 are floristically interesting with a high probability of containing rare plant species. The regionally rare pickerel frog has been observed in this area (OMNR *pers. comm.*), and a newborn fawn was observed at Map Site 35. The general area is known to be a deer wintering area.

Alternative 5 (Modified) would have significantly less impact on natural terrestrial systems. The main impact would be the removal of a considerable area of old-field/shrub habitat, which while

valuable, is not deemed as important as wetland. Alternative 7 would involve the removal of a significant amount of wetland and wetland forest, probably rare or otherwise interesting plant species, and concomitant losses of wildlife habitat.

3.0 SUMMARY OF IMPACTS AND MITIGATION

A list of anticipated impacts and recommendations for mitigation follows:

	Anticipated Impact	Recommended Mitigation
	General	
1.	Loss of wetland function due to encroachment, alteration of drainage patterns, and loss or reduction of plant and animal species	• avoid wetlands if possible • design to maintain present hydrologic patterns by such considerations as not altering drainage, effective stormwater management, appropriate fill disposal and distribution
2.	Loss of wildlife habitat by encroachment, altered drainage patterns, and exposure of cross-sectional areas of three-dimensional biological communities such as mature forests; this is especially of concern in wetlands	• avoid areas of important habitat if possible • see comments above regarding general wetland mitigation
	Specific Locations of Potential Impact	
1.	Fletcher Creek Swamp - Class 1 Wetland (Map Site 15)	• move alignment to east of wetland
2.	Woodlands (Map Sites 40, 41, 43, 44)	• use route alternative 3 or 2, in that order
3.	Small unclassified wetlands (Map Sites 18, 19, 20,'21)	• use route alternative 3 or 2 in that order
4.	Undesignated wetland (Map Site 25)	• could be mitigated only by route alignment relocation

	Anticipated Impact	Recommended Mitigation
5.	Galt/Mill Creek Wetland Complex - Class 1 Wetland (Map Sites 27, 29, 30, 47)	• see comments above regarding general wetland mitigation
6.	Galt/Mill Creek Wetland Complex - Class 1 (Map Sites 31, 33, 34, 35)	• use route alternative 5 (Modified) • see comments above regarding general wetland mitigation
7.	Wetland 223-2 - Class 7 (Map Site 24)	• attempt to redesign to avoid wetland • see comments above regarding general wetland mitigation

TABLE 1

IMPACTS - SEGMENT 1

Forestry Resources	
• Severance (SE)/encroachment (EN) on Class 1 & 2 Woodlots (ha)	nil
• Severance (SE)/encroachment (EN) on Other Forested Areas (type/ha)	0.8
Ecosystem Integrity	
• SE/EN Upland Ecosystems (ha)	5.0
• SE/EN Wetland Ecosystems (ha)	4.9[1]
Vegetation	
• Access, SE/EN, on Identified ESAs/ANSIs (ha)	2.2
• Other Vegetation (ha)	old-field/shrub/4.2
• Effects on Unique/Rare Herbaceous Species or Communities (type/ha)[2]	no rare species observed in areas of severance or encroachment
Wildlife	
• Effects on Wildlife (Qual.)	moderate - low
• Barrier Effects on Travel Corridors (Qual.)	moderate - low
• Displaced Wildlife Habitat (type/ha)	upland forest 0.8 old-field/shrub 4.2 wetland 4.9
• Effects on Rare/Endangered Wildlife Species (No.)	none known

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[1] Includes 4.6 ha in Fletcher Swamp - Class 1 Wetland at Map Sites 14-16, and 0.3 ha of unclassified wetland at Map Site 13

[2] Riley (1979) is used as the authority for rare plant species throughout this report

TABLE 2

IMPACTS - SEGMENT 2

	Alternative 1	Alternative 2	Alternative 3
Forestry Resources			
• Severance (SE)/encroachment (EN) on Class 1 & 2 Woodlots (ha)	11.3	2.7	2.3
• Severance (SE)/encroachment (EN) on Other Forested Areas (type/ha)	2.4	3.8	3.6
Ecosystem Integrity			
• SE/EN Upland Ecosystems (ha)	26.1	25.4	21.8
• SE/EN Wetland Ecosystems (ha)	0.5[1]	<0.1[1]	<0.1[1]
Vegetation			
• Access, SE/EN, on Identified ESAs/ANSIs (ha)	7.0	8.4	5.4
• Other Vegetation (ha)	old-field/shrub 12.4	old-field/shrub 18.9	old-field/shrub 15.9
• Effects on Unique/Rare Herbaceous Species or Communities (type/ha)	no rare species observed in areas of severance or encroachment[2]	no rare species observed in areas of severance or encroachment[2]	no rare species observed in areas of severance or encroachment[2]
Wildlife			
• Effects on Wildlife (Qual.)	high	moderate	moderate
• Barrier Effects on Travel Corridors (Qual.)	high	moderate	moderate
• Displaced Wildlife Habitat (type/ha)	upland forest 13.7 old-field/shrub 12.4 wetland 0.5	upland forest/6.5 old-field/shrub 18.9 wetland <0.1	upland forest 5.9 old-field/shrub 15.9 wetland <0.1
• Effects on Rare/Endangered Wildlife Species (No.)	4[3]	4[3]	4[3]

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1 All are small unclassified wetlands, except Fletchers Creek Swamp - Class 1 Wetland (Map Site 17) which is encroached upon to the extent of less than 1.0 ha, if at all

2 Fletcher Creek Swamp Forest (Map Sites 4-5) is known to have several rare species (Eagles *et al*, 1979), but these are not likely to be present at the edge near the proposed alternative. Forests (Map Sites 40, 41, 43, 44) have mature upland forest assemblages, with greatest likelihood of rare species in the woodland at Map Site 44.

3 Woodland at Map Site 43 is a known site for the West Virginia white butterfly, previously considered rare in Ontario. Four rare or endangered bird species may breed in the Crieff Old-Field Complex ESA (Eagles *et al*, 1979)

TABLE 3

IMPACTS - SEGMENT 3

<u>Forestry Resources</u>	
• Severance (SE)/encroachment (EN) on Class 1 & 2 Woodlots (ha)	nil
• Severance (SE)/encroachment (EN) on Other Forested Areas (type/ha)	1.3
<u>Ecosystem Integrity</u>	
• SE/EN Upland Ecosystems (ha)	4.6
• SE/EN Wetland Ecosystems (ha)	1.6[1]
<u>Vegetation</u>	
• Access, SE/EN, on Identified ESAs/ANSIs (ha)	nil
• Other Vegetation (ha)	old-field/shrub 3.3
• Effects on Unique/Rare Herbaceous Species or Communities (type/ha)	no rare species observed in areas of severance or encroachment
<u>Wildlife</u>	
• Effects on Wildlife (Qual.)	high[2]
• Barrier Effects on Travel Corridors (Qual.)	moderate
• Displaced Wildlife Habitat (type/ha)	upland forest 1.3 old-field/shrub 3.3 wetland[3] 1.6
• Effects on Rare/Endangered Wildlife Species (No.)	none known

1 Class 7 Wetland total area 2.4 ha (Map Site 24)

2 Effects deemed high due to wetland habitat loss

3 Entire wetland area of 2.4 ha likely to be lost as wildlife habitat

TABLE 4

IMPACTS - SEGMENT 4

<u>Forestry Resources</u>[1]	With Alternative 1	With Alternatives 2 & 3
• Severance (SE)/encroachment (EN) on Class 1 & 2 Woodlots (ha)	nil	nil
• Severance (SE)/encroachment (EN) on Other Forested Areas (type/ha)	7.5	9.4
<u>Ecosystem Integrity</u>		
• SE/EN Upland Ecosystems (ha)	16.3	18.3
• SE/EN Wetland Ecosystems (ha)	3.4	3.4
<u>Vegetation</u>		
• Access, SE/EN, on Identified ESAs/ANSIs (ha)	0.3[2]	0.3[2]
• Other Vegetation (ha)	old-field/shrub 8.8	old-field/shrub 8.9
• Effects on Unique/Rare Herbaceous Species or Communities (type/ha)[3]	no rare species observed in areas of severance or encroachment	no rare species observed in areas of severance or encroachment
<u>Wildlife</u>		
• Effects on Wildlife (Qual.)	Low	Low
• Barrier Effects on Travel Corridors (Qual.)	Low	Low
• Displaced Wildlife Habitat (type/ha)	upland forest 7.5 old-field/shrub 8.8 wetland 3.4	upland forest 9.4 old-field/shrub 8.9 wetland 3.4
• Effects on Rare/Endangered Wildlife Species (No.)	none known	none known

1 Those forested areas which are part of Galt/Mill Creek Wetland Complex - Class 1, are considered as part of the wetland and are not scored under Forestry Resources, as their primary value is deemed to be in wetland function

2 Galt/Mill Creek Wetland Complex - Class 1

3 Eagles *et al* (1979) report eight species of regionally rare plants in the Galt Creek and Forest ESA, but none were observed in these areas during the present study

TABLE 5

IMPACTS - SEGMENT 5

	Alternative 5 (modified)	Alternatives 7
Forestry Resources[1]		
• Severance (SE)/encroachment (EN) on Class 1 & 2 Woodlots (ha)	nil	nil
• Severance (SE)/encroachment (EN) on Other Forested Areas (type/ha)	1.2	nil
Ecosystem Integrity		
• SE/EN Upland Ecosystems (ha)	18.8[2]	3.9
• SE/EN Wetland Ecosystems (ha)	0.9[3]	8.1[3]
Vegetation		
• Access, SE/EN, on Identified ESAs/ANSIs (ha)	<0.1	<0.1
• Other Vegetation (ha)	old-field/shrub 17.6	old-field/shrub 3.9
• Effects on Unique/Rare Herbaceous Species or Communities (type/ha)[4]	no rare species observed in areas of severance or encroachment	no rare species observed in areas of severance or encroachment
Wildlife		
• Effects on Wildlife (Qual.)	moderate	high
• Barrier Effects on Travel Corridors (Qual.)[5]	moderate	moderate
• Displaced Wildlife Habitat (type/ha)	upland forest 1.2 old-field/shrub 17.6 wetland 0.9	upland forest nil old-field/shrub 3.9 wetland 8.1
• Effects on Rare/Endangered Wildlife Species (No.)	none known	1[6]

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1 Those forested areas which are part of Galt/Mill Creek Wetland Complex - Class 1, are considered as part of the wetland and are not scored under Forestry Resources, as their primary value is in wetland function

2 Upland area are mostly old-field/shrub with woodland comprising 1.2 ha

3 Galt/Mill Creek Wetland Complex - Class 1

4 Eagles *et al* (1979) report eight species of regionally rare plants in the Galt Creek and Forest ESA, but none were observed in these areas during the present study

5 The impact is not so much related to travel corridors as it is to habitat, *per se*. These areas, especially Map Sites 49-51, are deer wintering areas.

6 Regionally rare pickerel frog has been reported in ditches in the area of the intersection of County Road 34 and the Hanlon Expressway

TABLE 6
SUMMARY OF IMPACTS FOR ENTIRE STUDY AREA FOR ALL ROUTE OPTIONS

	1 & 5 (Mod)	2 & 5 (Mod)	3 & 5 (Mod)	1 & 7	2 & 7	3 & 7
<u>Forestry Resources</u>						
• Severance/encroachment (SE/EN) on Class 1 & 2 Woodlots (ha)	11.3	2.7	2.3	11.3	2.7	2.3
• Severance/encroachment (SE/EN) on Other Forested Areas (type/ha)	13.2	16.5	16.3	12.0	15.3	15.1
<u>Ecosystem Integrity</u>						
• SE/EN Upland Ecosystems (ha)	70.8	72.1	68.5	55.9	57.2	53.6
• SE/EN Wetland Ecosystems (ha)	11.3	10.8	10.8	18.5	18.0	18.0
<u>Vegetation</u>						
• Access, SE/EN, on Identified ESAs/ANSIs (ha)	9.5	10.9	7.9	9.5	10.9	7.9
• Other Vegetation (ha)	46.3	52.9	49.9	32.6	39.2	36.2
• Effects on Unique/Rare Herbaceous Species or Communities (type/ha)	no rare species observed in areas of severance or encroachment[1]	no rare species observed in areas of severance or encroachment	no rare species observed in areas of severance or encroachment	no rare species observed in areas of severance or encroachment	no rare species observed in areas of severance or encroachment	no rare species observed in areas of severance or encroachment
<u>Wildlife</u>						
• Effects on Wildlife (Qual.)[2]	moderate	moderate	moderate	moderate	moderate	moderate
• Barrier Effects on Travel Corridors (Qual.)[2]	moderate	moderate-low	moderate-low	moderate-low	moderate-low	moderate-low
• Displaced Wildlife Habitat (type/ha)	upland forest 24.5	upland forest 19.2	upland forest 18.6	upland forest 23.3	upland forest 18.0	upland forest 17.4
	old-field/shrub 46.3	old-field/shrub 52.9	old-field/shrub 49.9	old-field/shrub 32.6	old-field/shrub 39.2	old-field/shrub 36.2
	wetland 11.3	wetland 10.8	wetland 10.8	wetland 18.5	wetland 18.0	wetland 18.0
• Effects on Rare/Endangered Wildlife Species (No.)[3]	4	4	4	1	1	1

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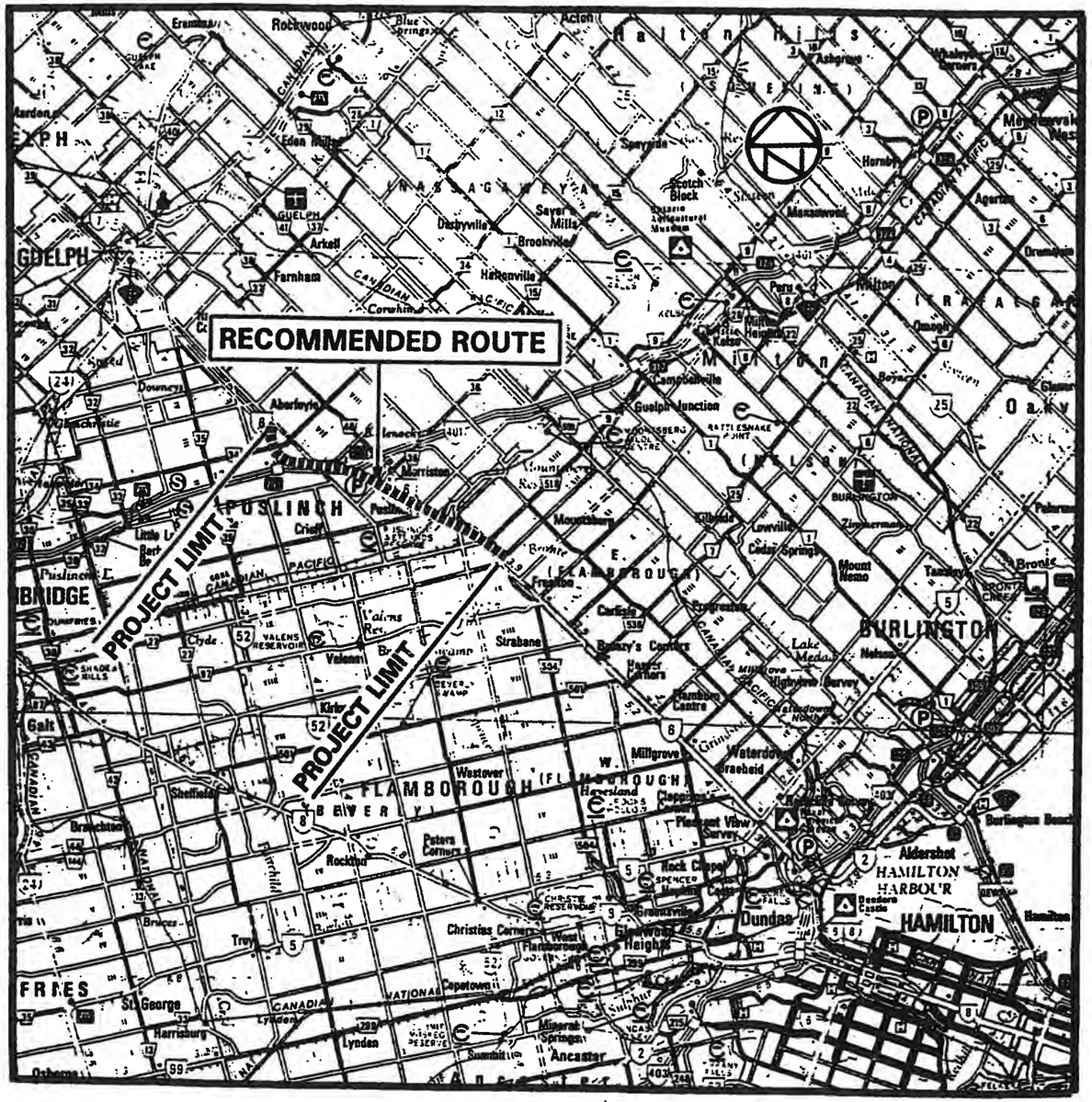
1 Rarity of plants is as per Riley (1979). Other documents (eg. Eagles *et al*, 1979, and Fenco MacLaren, 1987, recognize various jurisdictional levels of uncommonness and rarity in the general area of the study

2 Based on an average for all relevant segments

3 See text and Tables 1-5

APPENDIX G

DESIGN CRITERIA



SCALE 1:250,000 *Échelle*

kilometres 5 0 5 *kilomètres*

Miles 5 0 5 *Milles*

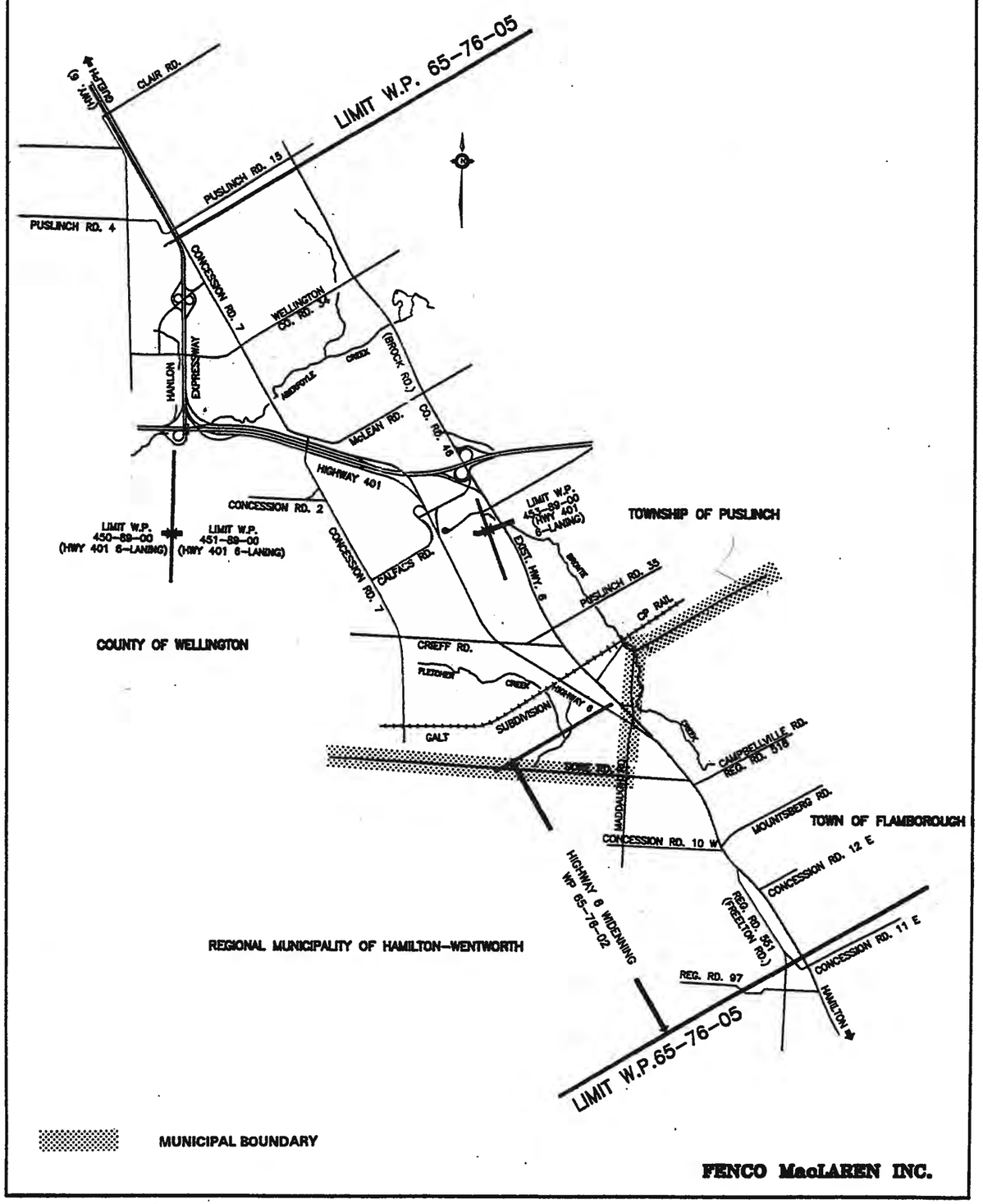
MAP TO ACCOMPANY DESIGN CRITERIA

W.P.65-76-05

HIGHWAY 6

FROM FREELTON NORTHERLY TO SOUTH OF GUELPH

KEY PLAN



FENCO MacLAREN INC.

Ministry of Transportation
Ontario

PRELIMINARY

DESIGN CRITERIA

Date: 21 June 1994
Reg. Rev. Date: _____

31/20(new)
(old)

WORK PROJECT GWP. 65-76-05 DIST. NO. 3 & 4 HWY. NO. 6 TYPE OF PROJECT G.D.GB.P.STR.

LOCATION Freelton Northerly to Guelph LENGTH 16.9 km

LIMITS FROM STA. 20+275 (Hwy 6) PLAN 42471-B-15 TO STA. 9+000 (Hanlon Expressway) PLAN 42471-B-6

HIGHWAY 6
EXISTING ALIGNMENT
FREELTON TO MADDAUGH ROAD (Sta 20+275 to Sta 24+620)

TOWN OF FLAMBOROUGH
REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH

	PRESENT CONDITIONS	DESIGN STANDARDS	PROPOSED STANDARDS
HIGHWAY CLASSIFICATION	RAU 80	RAU 100	RAU 100
MINIMUM STOPPING SIGHT DISTANCE	215	185	215
EQUIVALENT MINIMUM "K" FACTOR	90	70	90 (a)
GRADES MAXIMUM	2.7 %	6 %	2.7 %
MINIMUM RADIUS	575	420	575
PAVEMENT WIDTH	2 x 3.66	4 x 3.75	4 x 3.75(b)
SHOULDER WIDTH	3.0	3.0	3.0 (c)
SHOULDER ROUNDING	0.6	0.5	0.5
MEDIAN WIDTH	-	1.0 min	4.0 (d)
R.O.W. WIDTH	45	45	45 (e)
POSTED SPEED	80	80	80
MISCELLANEOUS			

MANAGER, ENGINEERING

REGIONAL DIRECTOR,
PLANNING, ENGINEERING & CONSTRUCTION

REGIONAL DIRECTOR,
OPERATIONS

D.C. COMMITTEE

28 May 94.
DATE OF APPROVAL

NOTES:

(a) The existing vertical alignment is to be retained.

(b) Typical cross-sections are as shown on Page 15.

(c) The shoulder will be partial paved 0.5 m.

(d) From Concession Road 11 (Freelton) to Concession Road 12, there will be a 1.0m flush painted median to match the existing cross-section south of the project limits. There are no existing entrances on this section of Controlled Access Highway.

From Concession Road 12 to Maddaugh Road, the proposed median width is 4.0 m to allow for a continuous two-way left-turn lane.

(e) Additional widenings up to 12 m required in some areas to meet local grading requirements.

Ministry of Transportation
Ontario

DESIGN CRITERIA

Date: 21 June 1994
Reg. Rev. Date: _____

GROUP W.P. NO. 65-76-05 DIST. NO. 2 & 4 HWY. NO. 6

HIGHWAY 6
NEW ALIGNMENT
MADDAUGH ROAD TO HIGHWAY 401 (Sta 24+620 to Sta 29+450)

TOWNSHIP OF PUSLINCH
COUNTY OF WELLINGTON

	PRESENT CONDITIONS	DESIGN STANDARDS	PROPOSED STANDARDS
HIGHWAY CLASSIFICATION	N/A	RAD 100	RAD 100
MINIMUM STOPPING SIGHT DISTANCE		185	185
EQUIVALENT MINIMUM "K" FACTOR		70	70
GRADES MAXIMUM		6 %	3 %
MINIMUM RADIUS		420	1200
PAVEMENT WIDTH		4 x 3.75	4 x 3.75
SHOULDER WIDTH		3.0	3.0 (f)
SHOULDER ROUNDING		0.5	0.5
MEDIAN WIDTH		-	6.0 (g)
R.O.W. WIDTH		45	50 (h)
POSTED SPEED		80	90 (i)
MISCELLANEOUS			

NOTES:

(f) The shoulder will be partially paved 0.5 m.

(g) From Maddaugh Road to Crieff Road, the median is narrowed to 1.0 m in order to minimize construction costs of the CPR Structure. This section also serves as a transition to C.A.H. north of Crieff Road.

From Crieff Road to Highway 401, the median is widened to 6.0 m to provide for a 0.6 m concrete median barrier and 2.7 m left shoulders.

(h) The minimum R.O.W. width is 50 m, however the average R.O.W. width is 70 m with sections up to 90 m in order to accommodate deep cuts and fills.

(i) It is intended to post the new route at 90 km/h and designate it CAH as it provides a transition between a 100 km/h freeway and an undivided 80 km/h rural arterial.

GROUP W.P. NO. 65 - 76 - 05 DIST. NO. 2 & 4 HWY. NO. 6

HIGHWAY 6
ALONG HIGHWAY 401
HWY 6S TO HWY 6N (From Sta 29+450 (Highway 6) To Sta 11+200 (Hanlon Expressway))
TOWNSHIP OF PUSLINCH
COUNTY OF WELLINGTON

	PRESENT CONDITIONS	DESIGN STANDARDS	PROPOSED STANDARDS
HIGHWAY CLASSIFICATION	RFD 120	RFD 120	RFD 120
MINIMUM STOPPING SIGHT DISTANCE	245	245	245
EQUIVALENT MINIMUM "K" FACTOR	120	120	120
GRADES MAXIMUM	2 %	3 %	2 %
MINIMUM RADIUS	1750	650	1750 (j)
PAVEMENT WIDTH	3 x 3.66	3 x 3.75	(3+3) x 3.75 (k)
SHOULDER WIDTH	R-3.0,L-2.5	3.0	R-3.0, L-2.5 (l)
SHOULDER ROUNDING	1.0	1.0	1.0
MEDIAN WIDTH	15.0	7.5	16.25 (m)
R.O.W. WIDTH	92	100	150 (n)
POSTED SPEED	100	100	100
MISCELLANEOUS			
OUTER SEPARATORS	N/A	8.5	16.25

NOTES:

(j) The radius on the S-W Directional Ramp is 450 m and the N-W Ramp 600 m which exceed the minimum radius for a 100 km/h design speed.

(k) Three through lanes for Hwy 401 plus two through lanes and one continuous auxiliary lane for Hwy 6 for each direction. The outside lane will be maintained at 3.75 m as it will serve as a through lane for Hwy 401 truck traffic.

(l) The width of the left shoulder on the N-E Directional Ramp will be 2.0 m. The width of the left shoulder on the S-W Directional Ramp and Structure will be widened to 3.0 m to provide additional clearance for stopping sight distance. The left shoulder widths on the N-E and S-W Directional Ramps meet the stopping sight distance requirements for 80 km/h which is the posted speed.

(m) Existing C/L of Hwy 401 E/B and W/B lanes is maintained. The outer separators width between the Hwy 401 core and Hwy 6 extended ramps is 16.25m including 3.0m Rt Shoulders, 2.5m Lt Shoulders, with a rural cross-section. This cross-section was adopted so as not to preclude the potential utlitmate widening of Hwy 401 to an 8-lane cross-section.

(n) Proposed R.O.W. includes both Hwy 401 core and Hwy 6 parallel lanes.

(o) Typical Sections for Hwy 6, Hwy 401 and the sideroads are shown on Page 15 to 17. Structural sections and profiles are shown on Page 18 to 21.

GROUP W.P. NO. 65 - 76 - 05 DIST. NO. 2 & 4 HWY. NO. 6

CALFASS ROAD CONNECTION TO HWY 6S
AND BROCK ROAD (COUNTY RD 46)
TOWNSHIP OF PUSLINCH
COUNTY OF WELLINGTON

	PRESENT CONDITIONS	DESIGN STANDARDS	PROPOSED STANDARDS
HIGHWAY CLASSIFICATION	N/A	RCU 70	RCU 70
MINIMUM STOPPING SIGHT DISTANCE		135	185
EQUIVALENT MINIMUM "K" FACTOR		35	70
GRADES MAXIMUM		6 - 8 %	0.6
MINIMUM RADIUS		190	190
PAVEMENT WIDTH		2 x 3.5	2 x 3.5
SHOULDER WIDTH		2.5	2.5
SHOULDER ROUNDING		0.5	0.5
MEDIAN WIDTH		-	-
R.O.W. WIDTH		30	30
POSTED SPEED		70	70
MISCELLANEOUS			

GROUP W.P. NO. 65 - 76 - 05 DIST. NO. 2 & 4 HWY. NO. 6

CONNECTION ROAD HWY 6N TO COUNTY ROAD 34

TOWNSHIP OF PUSLINCH
COUNTY OF WELLINGTON

	PRESENT CONDITIONS	DESIGN STANDARDS	PROPOSED STANDARDS
HIGHWAY CLASSIFICATION	N/A	RCU 80	RCU 80
MINIMUM STOPPING SIGHT DISTANCE		135	145
EQUIVALENT MINIMUM "K" FACTOR		35	50 (CREST)
GRADES MAXIMUM		6 - 8 %	3.3
MINIMUM RADIUS		250	250
PAVEMENT WIDTH		2 x 3.5	2 x 3.5
SHOULDER WIDTH		2.5	2.5
SHOULDER ROUNDING		0.5	0.5
MEDIAN WIDTH		-	-
R.O.W. WIDTH		30	30
POSTED SPEED		70	70
MISCELLANEOUS			

GROUP W.P. NO. 65 - 76 - 05 DIST. NO. 2 & 4 HWY. NO. 6

PUSLINCH CONCESSION ROAD 7 (North of County Road 34)

TOWNSHIP OF PUSLINCH
COUNTY OF WELLINGTON

	PRESENT CONDITIONS	DESIGN STANDARDS	PROPOSED STANDARDS
HIGHWAY CLASSIFICATION	RLU 50	RCU 80	RCU 80
MINIMUM STOPPING SIGHT DISTANCE	65	135	145
EQUIVALENT MINIMUM "K" FACTOR	8	35	40
GRADES MAXIMUM	10	6 - 8 %	3.6%
MINIMUM RADIUS	N/A	250	TANGENT
PAVEMENT WIDTH	2 x 3.0	2 x 3.5	2 x 3.5
SHOULDER WIDTH	1.0	2.5	2.5
SHOULDER ROUNDING	0	0.5	0.5
MEDIAN WIDTH	-	-	-
R.O.W. WIDTH	20	30	30
POSTED SPEED	80	70	70
MISCELLANEOUS			

TRAFFIC DATA

Traffic Volumes are as shown on Pages 6 and 7.

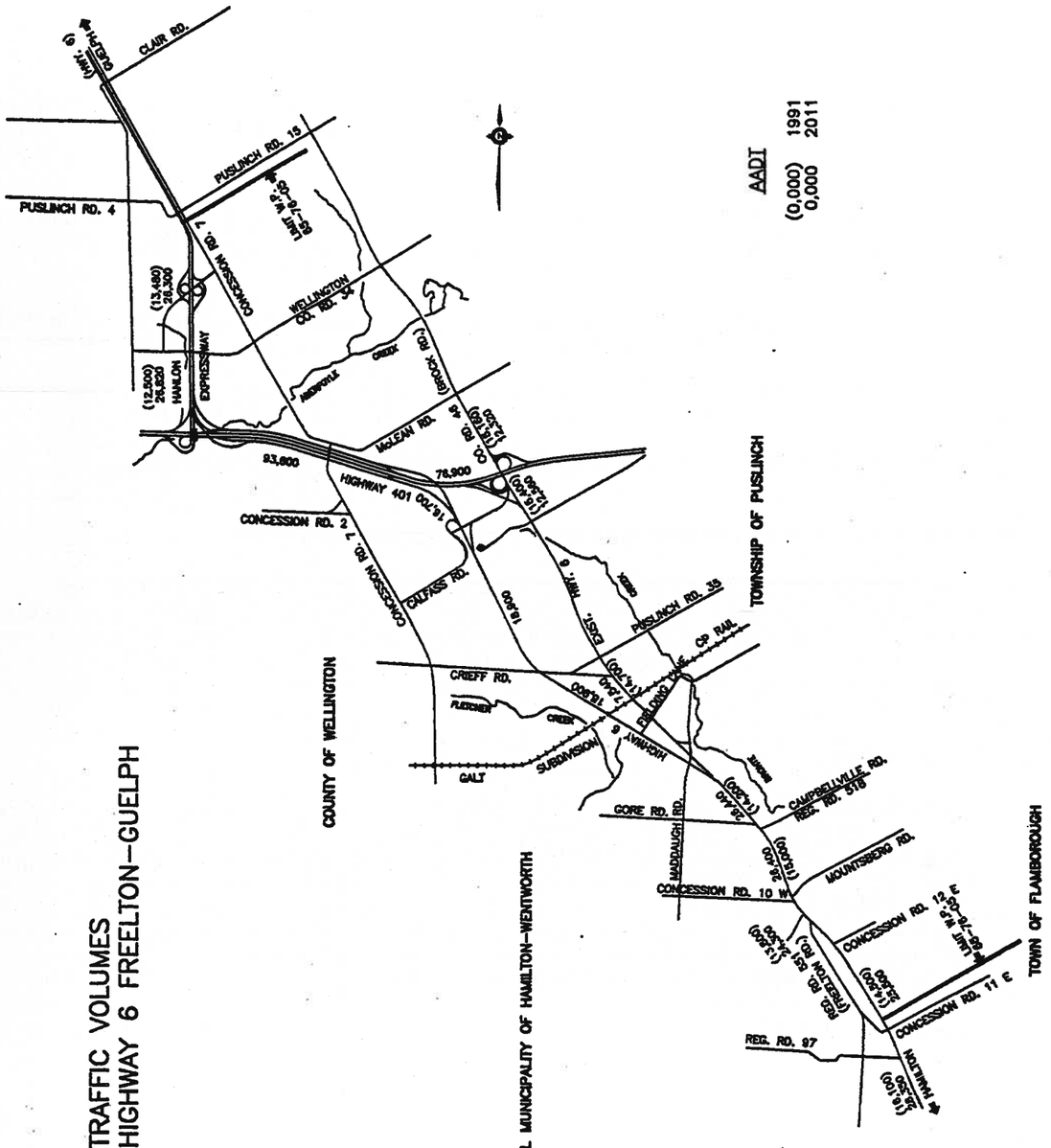
HWY 6 & 401 NETWORK LANE BALANCE

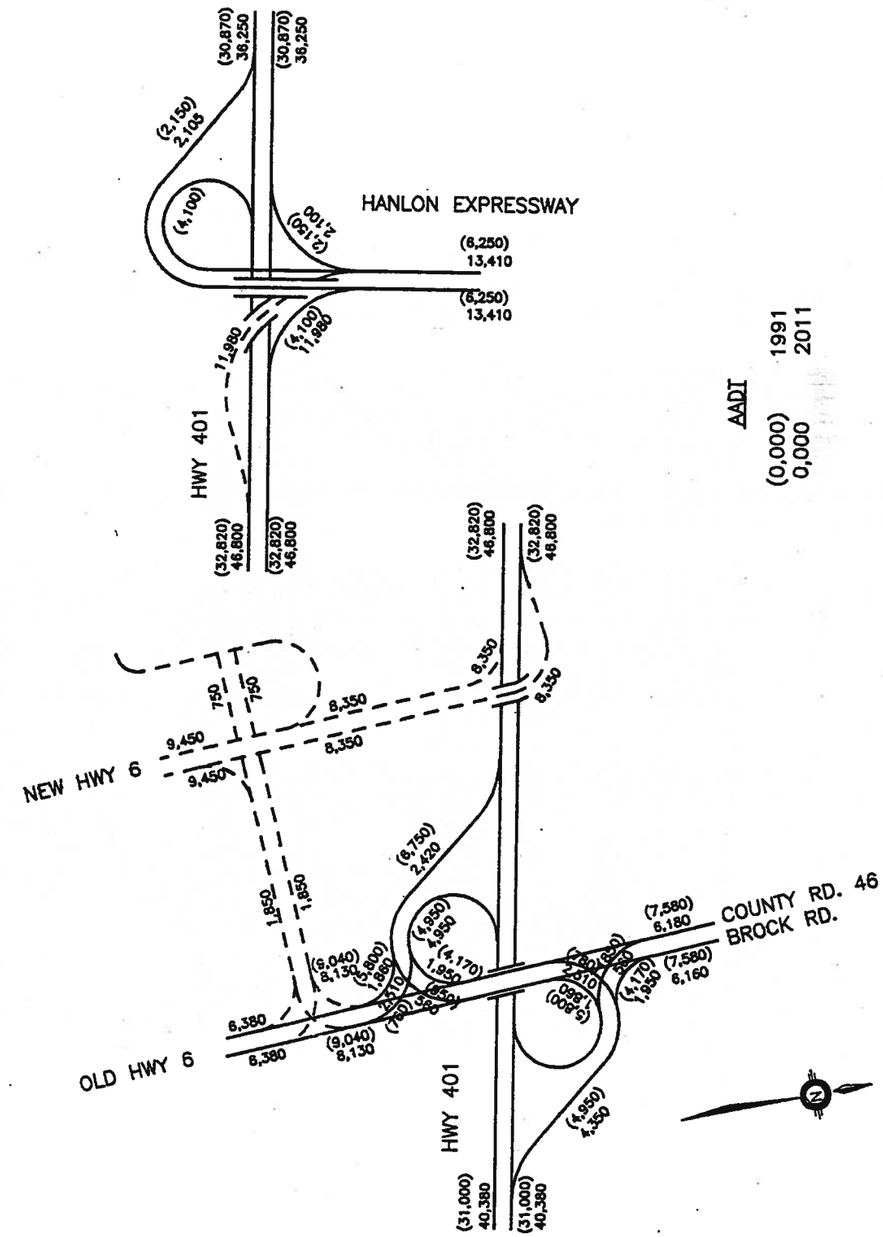
Under existing conditions, Highway 6 is 2 lanes south of Highway 401, and 4 lanes north of Highway 401. Highway 401 is currently scheduled to be reconstructed to a basic 6 lane cross-section throughout the study area by 1996.

Under this project, Highway 6 is proposed to be re-constructed to a basic 4 lane cross-section on a new alignment south of Highway 401. Between Hwy 6S and Hwy 6N, the Highway 6 lanes run parallel to Hwy 401 and will be constructed to a 6 lane cross-section. The proposed 6 lane cross-section includes 4 through lanes plus 2 continuous auxiliary lanes.

The geometric design of Highway 6 under this project will accommodate a potential ultimate widening of Highway 401 to a 10 lane cross-section east of Hwy 6 South, and an 8 lane cross-section west of Hwy 6 South.

TRAFFIC VOLUMES
HIGHWAY 6 FREELTON–GUELPH





GROUP W.P. NO. 65 - 76 - 05 DIST. NO. 2 & 4 HWY. NO. 6

Scope of Work

The purpose of the Route Location and Preliminary Design Study was to improve Highway 6 capacity and continuity and to relieve congestion in residential communities. The Study concluded that Highway 6 should be widened to a basic 4-lane cross-section throughout the study limits. The Scope of Work for the project consists of the following improvements to Highway 6:

1) Freelton to Maddaugh Road (Hamilton-Wentworth/Wellington County Municipal Boundary)
The existing 2-lane cross-section will be widened to 4-lanes from Concession Road 11 to Concession Road 12, including a 1.0 m paved median. From Concession Road 12 to Maddaugh Road the paved median will be widened to 4.0 m to allow for a continuous two-way left-turn lane. The intersection at Maddaugh Road will remain at grade, but will be totally reconstructed (including the installation of traffic signals) to provide improved access to old Highway 6 when Highway 6 north of Maddaugh Road is re-constructed on new alignment.

2) Maddaugh Road to Highway 401
Highway 6 will be constructed on new alignment to bypass the communities of Puslinch and Morriston. Access will be controlled, and the median will be widened to 6.0 m to accomodate a 0.6 m concrete median barrier and 2.7 m left shoulders to provide for a transition to C.A.H. north of Crieff Road. Interchange access to old Highway 6 and Highway 401 will be provided via the construction of a new Connection Road to Calfass Road. The existing interchange at Highway 6 and 401 will be upgraded, including the construction of a new S-E Ramp as well as the installation of traffic signals at the W-N/S Ramp terminal.

3) Hwy 6 and Hwy 401 between the new Hwy 6S Ramps and Hwy 6N (Hanlon Expressway)
Highway 6 parallel lanes will be constructed adjacent to Highway 401 between Hwy 6S and Hwy 6N. The parallel lanes will include 4 through lanes plus 2 continuous auxiliary lanes. In this area Highway 401 is currently being re-constructed and widened to a basic 6-lane cross-section. In the initial stage the separator between Highway 401 and the Highway 6 parallel lanes will be rural and 16.25 m in width, narrowing to 12.5 m at the speed change lanes for the Hwy 6S and Hwy 6N interchanges. If Highway 401 is ultimately widened to a basic 8-lane cross-section, the median width including shoulders would be 12.5 m in width, narrowing to 8.75m at the speed change lanes.

4) From the Hwy 6N/401 Interchange N'ly to the South Limits of the City of Guelph
North of Hwy 401, existing Highway 6 (Hanlon Expressway) is a 4-lane divided rural cross-section with a design speed of 120 km/h. Access is controlled, with at grade access at all major side roads. The existing signalized intersection at Wellington County Road 34 will be replaced with a fly-over, and interchange access provided at a new interchange located 865 m north of County Road 34. The point of existing access is being relocated to minimize the impacts to the Class 1 wetlands at County Road 34. Access to County Road 34 will be provided via the construction of a new Connection Road to County Road 34, as well as upgrading Puslinch Concession Road 7.

Typical cross-sections of all road and structure sections are as shown on Pages 15 through 21.

GROUP W.P. NO. 65 - 76 05 DIST. NO. 2 & 4 HWY. NO. 6

REMARKS

1. **Adjacent Projects**

The MTO will soon conclude a Planning Study on Highway 6 from south of Puslinch Road 15 Northerly to Woodlawn Road (Highway 7) under WP 44-88-00. The completion of this and the Highway 6 Freelton to Guelph project will result in a continuous basic 4-lane undivided cross-section on Hwy 6 from Hwy 403 to the Hamilton-Wentworth/Wellington County municipal boundary and a 4-lane divided freeway northerly to the north limits of Guelph.

Four Work Projects have also been established which will result in the widening of Hwy 401 to 6 lanes from Hwy 25 (Milton) to Hwy 24 (Cambridge). The 3 W.P.'s adjacent to this Route Location and Preliminary Design Study include:

W.P. 450-89-00 Highway 401, From 0.8km East of Townline Road Easterly to 1.2km West of the Hanlon Expressway Interchange, 9.6km

W.P. 451-89-00 Highway 401, From the Hanlon Expressway Interchange Easterly to Brock Road (Old Highway 6) Interchange, 4.3km

W.P. 453-89-00 Highway 401, From Brock Road (Old Highway 6) Easterly to Guelph Line Interchange, 12.1km

Highway 6 from Freelton southerly was widened to 4 lanes under Contract #80-30

"W.P. 65-76-02, From 1.0 km North of Hwy 97, Freelton, Northerly 4.0 km" has been established for the Detail Design of the 4/5 lane widening of Highway 6 at the south end of the study area. Due to the urgency of the work and lack of identified environmental issues, MTO has secured MOEE approval to finalize the planning and design for this section of the project as a separate undertaking and complete the EA work as a Group 'B' undertaking. Separate Design Criteria will be prepared and submitted to the Design Criteria Committee for Work Projects assigned during the Detail Design phase.

2. **Related Studies**

These Preliminary Design Criteria have been prepared in support of the 1993 Update and Supplementary Investigations for the Route Location and Preliminary Design Study on Highway 6 from Freelton to South of Guelph. Preliminary Design Criteria for this project were previously submitted and approved by the D.C. Committee on 1989 - 09 - 27 which were based upon the recommendations of the original Route Location Study concluded in 1989. The 1989 Route Location Study was not submitted to the MOEE for formal approval in accordance with the requirements of the Environmental Assessment Act due to environmental concerns raised by the MNR. The 1993 study has now addressed the concerns raised by the MNR primarily by reviewing the impacts on woodlands, wetlands and fisheries resources. As a result of this review, it has been determined that the Hwy 6 interchange at Wellington County Road 34 should be relocated approximately 850 m north of the originally proposed location which was at the existing at grade intersection.

3. Desirable System

Highway 6 is identified as a desirable link in the Kings highway system in Ontario.

4. Commercial Entrances

Highway 401 and the Hanlon Expressway are both Controlled Access Highways. Where the existing alignment is to be maintained in the south 4.0 km of the study limits, all in the Regional Municipality of Hamilton- Wentworth, there are several existing entrances which will be reconstructed to OPSD standards.

5. Illumination

All major intersections will be illuminated.

6. Drainage

Drainage design will be carried out in Detail Design in accordance with the MTO Drainage Manuals. Storm Water Management will be carried out as detailed in the MTO Drainage Management Technical Guidelines. Storm Water Quality Control will be carried out in accordance with MTO Best Management Practices.

There are no major water crossings located within the project limits. Mill/Galt Creek crosses Hwy 6 at County Road 34. Interchange access to County Road 34 will be located north of County Road 34 and will generally avoid this environmentally sensitive creek.

7. Cross-Section

A rural highway cross-section will be utilized on this project. Curb and gutter will be utilized where required on sideroad turning radii, in the interchange areas, and at a few other isolated locations where required to control storm drainage and/or minimize property impacts. Specific curb and gutter locations will be determined in detail design.

8. Signing

All highway signing will be carried out in accordance with the requirements outlined in the Manual of Uniform Traffic Control Devices.

9. Recycling

A Geotechnical Report will be prepared in Detail Design. Recycled asphalt pavement will be considered in accordance with MTO policies in effect at that time. As much of the existing pavement structure is to remain in place, opportunities to utilize recycled asphalt pavement on this project may be limited.

10. Sidewalks

There are no requirements for sidewalks within the study limits.

11. Traffic Signals

Traffic Signals are warranted and will be installed at the south ramp terminal of the Highway 401/Brock Road Interchange. Traffic Signals will also be warranted at the at grade intersection of Highway 6 and Maddaugh Road as this intersection will provide access to old Hwy 6.

12. Safety Features

The warrants for Concrete Barrier Wall and Steel Beam Guide Rail will be reviewed in accordance with the requirements outlined in the Roadside Safety Manual, and installed at all appropriate locations.

13. Landscaping

Landscaping requirements will be determined in Detail Design. It is expected that replacement tree planting will be carried out in compensation for clearing which will be required to complete this project.

14. Structures

Grade separations will be constructed at the locations detailed on the typical structural sections on Pages 18 to 21 of these Design Criteria. There is also a triple concrete box culvert crossing Hwy 401 at Aberfoyle Creek which will be extended.

15. Construction Staging

The 4/5-lane widening of Highway 6 from Freelton northerly 4.0 km to Maddaugh Road is a northerly extension of the existing 4-lane cross-section, and the existing alignment is to be maintained. As this project does not involve any outstanding unresolved environmental issues, and is a stand alone project, it is proposed as a priority project.

Highway 6 from Maddaugh Road to Hwy 6N is on new alignment. Separate advance structures and Grading and Paving contracts are proposed.

The existing County Road 34 / Hwy 6N at grade intersection is a lower priority and is recommended to be placed on the Ministry's 6-10 year construction program.

16. Public Involvement

Three Public Information Centres were held for this project during the 1989 Route Location and Preliminary Design Study. A fourth Public Information Centre for the 1993 Route Location and Preliminary Design Study was held on June 15, 1993. A fifth P.I.C. was held on January 18, 1994 to present the technically preferred preliminary design. Additional Public Information Centres will be held as required during Detail Design for each of the assigned contracts.

17. Assumptions, Designations, Transfers, Road Closings

The County of Wellington has agreed by Resolution in Council to assume the by-passed section of existing Highway 6 after completion of the new Highway. Existing Highway 6 (4.5km) will be resurfaced and the existing C.P.R. structure rehabilitated or replaced prior to the transfer.

The County of Wellington has also agreed by Resolution in Council to assume Puslinch Concession Road 7 between Wellington County Road 34 and the new Connection Road after construction.

Roads to be assumed for sideroad and intersection improvements will be transferred back to the appropriate road authority after construction.

Highway 6 (New) between Maddaugh Road and Highway 401 will be designated as Controlled Access Highway.

No permanent road closings are required on this project. West of Highway 6, Calfass Road will be re-aligned to tie into the Connection Road to Highway 6. East of Highway 6, a turning basin will be constructed in accordance with OPSD standards. Puslinch Concession Road 7 will be closed temporarily during construction of the new structure over Hwy 401.

18. Environmental Assessment

This project is classified as a Group "A" project, Category "Aa - New Routes". An individual "Environmental Assessment Report - One Stage Submission" will be prepared and submitted to the Ministry of the Environment and Energy for review and approval under the formal requirements of the Environmental Assessment Act. Subsequent to planning approvals and prior to the construction of individual contracts "Design and Construction Reports" documenting Detail Design and construction information will be submitted to the M.O.E.E. for information and monitoring purposes.

The section of the project involving the widening of existing Highway 6 from Freelton Northerly 4.0 km to Maddaugh Road (W.P. 65-76-02) has been separated from the remainder of the project for the purposes of the Environmental Assessment. The MOEE has agreed to the separation. An Environmental Study Report will be prepared for the widening of this section of Highway 6 in accordance with its status as a Group 'Bb' undertaking.

19. Agreements

The 5 Municipalities located within the study limits have actively participated in the study process through the establishment of both Technical and Steering Committees, and have endorsed the revised study recommendations. No legal agreements are required for this project.

20. Property Requirements

Property will be required throughout the project limits. A Property Request will be issued in Detail Design.

The new Highway 6 alignment between Maddaugh Road and Hwy 401 was located along the rear lot line of farm properties where practical in order to minimize the property impacts as much as was possible.

21. Railway Crossings

The existing grade separated CP Rail Galt Subdivision crossing of Highway 6 located 1.0km N of Maddaugh Road will remain in place. Responsibility for this section of Hwy 6 will be transferred to Wellington County after new Highway 6 is constructed.

A 4-lane structure will be constructed to grade separate new Highway 6 at the CP Rail Galt Subdivision crossing. An NTA Board Order will be required. Application will be made in Detail Design.

22. Utilities

Union Gas, Ontario Hydro and Bell Canada utility pole and/or buried plant relocations will be required throughout the project limits.

23. Intersections/Interchanges

A new Parclo A-4 interchange will be constructed on Highway 6 south of Hwy 401 at the Connection Road to provide access to Highway 401 East, Wellington County Road 46 (Brock Road), and Calfass Road.

Directional Freeway Ramps will be constructed to carry traffic from Hwy 6S to Hwy 401W and Hwy 6N, and from Hwy 6N to Hwy 401E and Hwy 6S. The design speed of the directional ramps will be 100 km/h, but they will be posted at 80 km/h.

A grade separation will be constructed at Wellington County Road 34. Access from Hwy 6 to County Road 34 will be provided via a new Parclo A-4 interchange located 865m North of County Road 34.

The existing at grade Crieff Road intersection will remain when this section of Highway 6 is transferred to Wellington County. A flyover will be constructed at new Highway 6. Interchange access to new Highway 6 will not be provided at this location.

The existing Maddaugh Road intersection will remain at grade but will be reconstructed to intersect the new Highway 6 alignment at 90°.

24. Preliminary Design

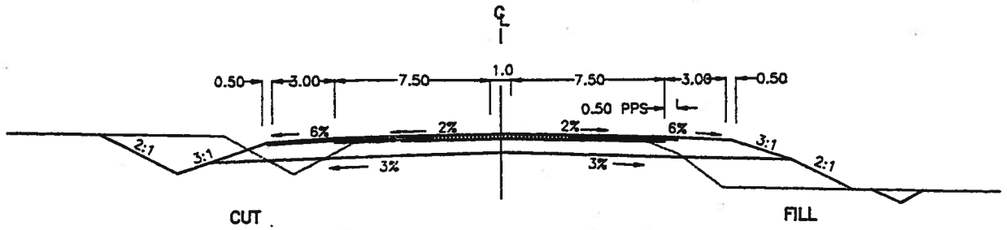
A Preliminary Design Study is scheduled to be completed in 1994.

25. Miscellaneous

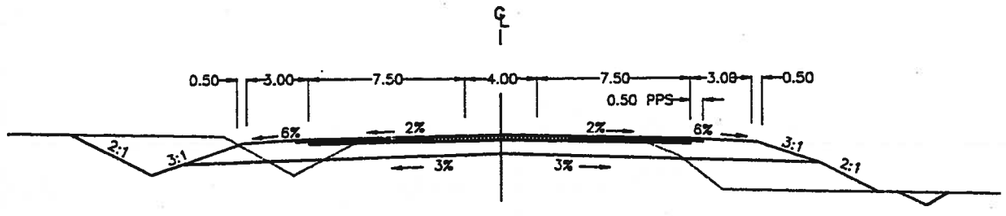
Access to the existing commuter parking lot located in the southeast quadrant of the Hwy 401/Hwy 6S Interchange will be maintained. There is no existing or proposed GO or Municipal transit service utilizing Highway 6 in the study area and therefore provisions for direct ramp to ramp freeway connections, bus bays and/or HOV lanes will not be provided. Provisions for FTMS are not a requirement on this project.

GROUP W.P.NO. 65-76-05 DIST.NO. 2 & 4 HWY.NO 6

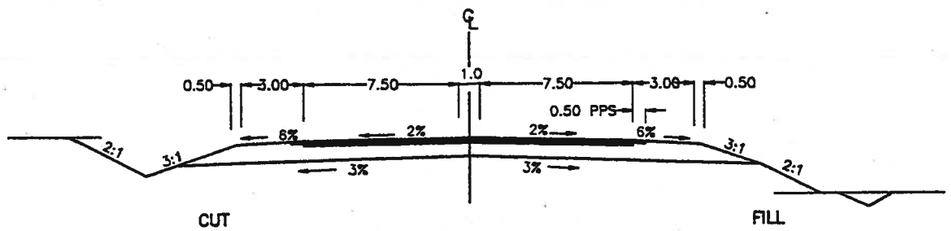
HIGHWAY 6



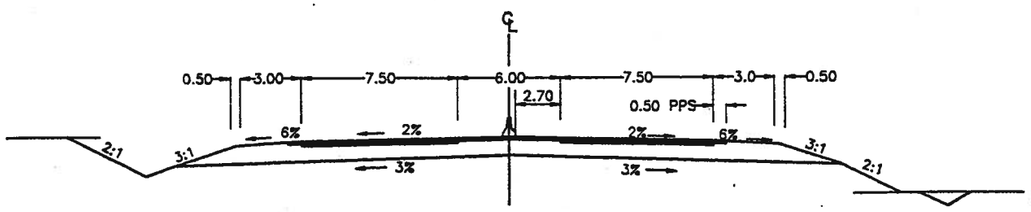
FROM CONCESSION ROAD 11 TO CONCESSION ROAD 12



FROM CONCESSION ROAD 12 TO MADDAUGH ROAD



FROM MADDAUGH ROAD TO CRIEFF ROAD



FROM CRIEFF ROAD TO HIGHWAY 401

N.T.S.

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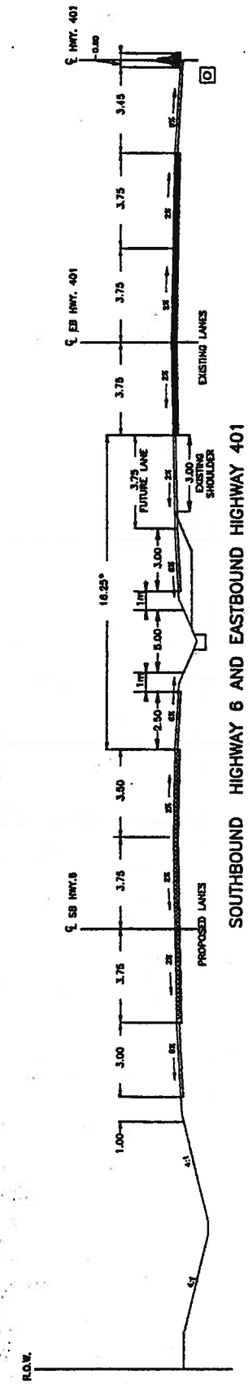
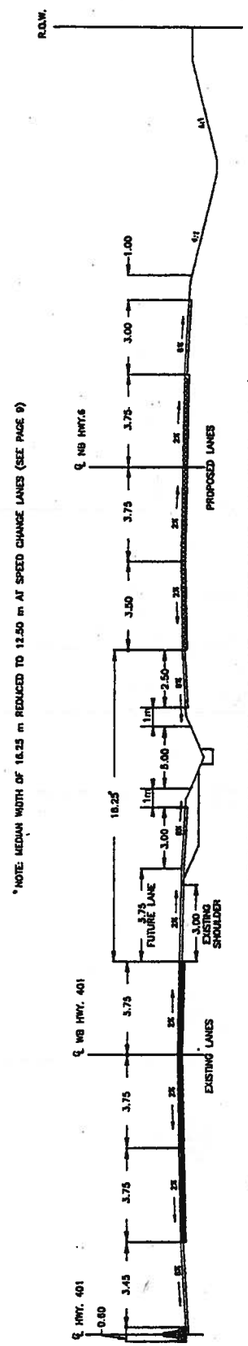
GROUP W.P.NO. 65-76-05 DIST.NO. 2 & 4 HWY.NO 6

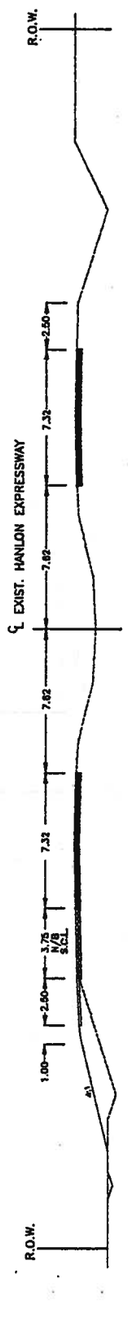


SOUTHBOUND HIGHWAY 6 AND EASTBOUND HIGHWAY 401



*NOTE: MEDIAN WIDTH OF 16.25 m REDUCED TO 12.50 m AT SPEED CHANGE LANES (SEE PAGE 9)

NORTHBOUND HIGHWAY 6 AND WESTBOUND HIGHWAY 401



HANLON EXPRESSWAY

N.T.S.

LEGEND

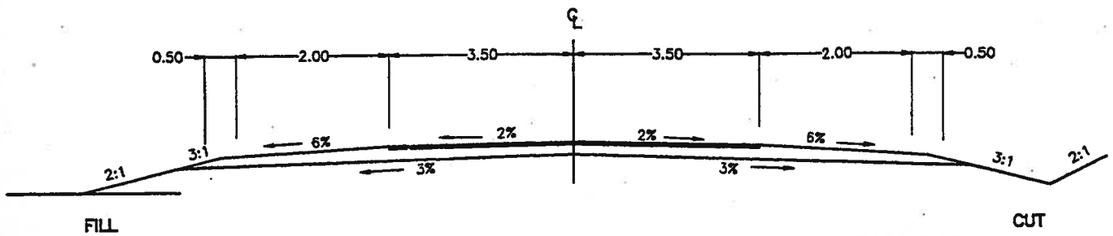
EXISTING PAVEMENT

PROPOSED PAVEMENT

FUTURE PAVEMENT

GROUP W.P.NO. 65-76-05 DIST.NO. 2 & 4 HWY.NO 6

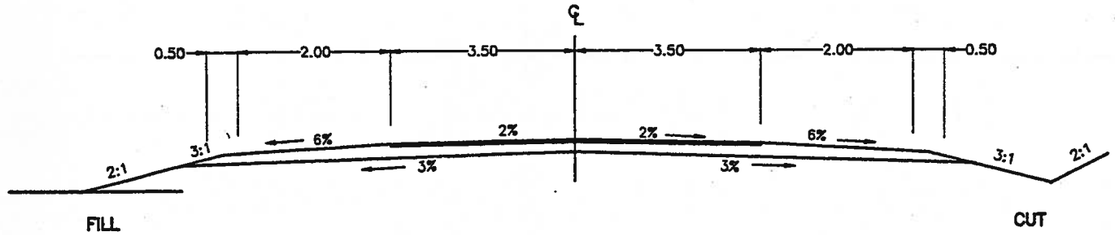
CROSS ROADS



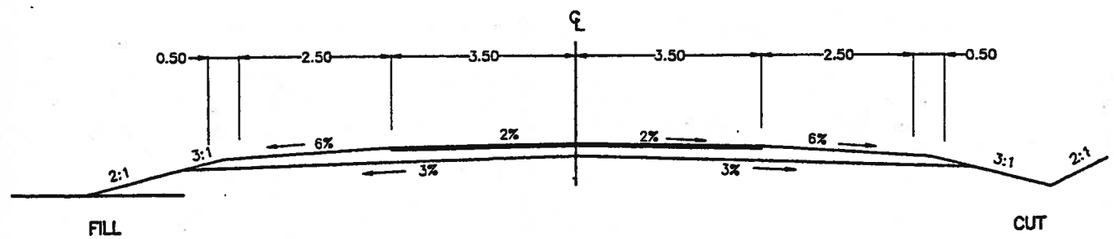
CONCESSION ROAD 7 (SOUTH OF COUNTY ROAD 34)

CRIEFF ROAD

PUSLINCH TOWNSHIP



WELLINGTON COUNTY ROAD 34



CONNECTION ROADS

1) INTERCHANGE HWY 6N TO COUNTY ROAD 34
2) CALFASS ROAD TO HWY 401/BROCK ROAD INTERCHANGE
3) CONCESSION ROAD 7 (NORTH OF COUNTY ROAD 34)

N.T.S.

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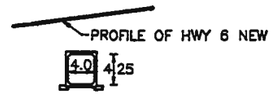
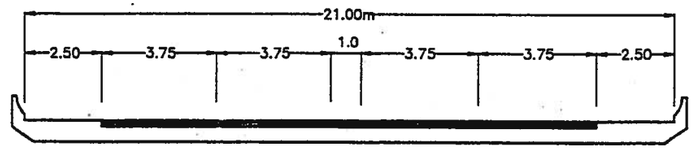
GROUP W.P.NO. 65-76-05 DIST.NO. 2 & 4 HWY.NO 6

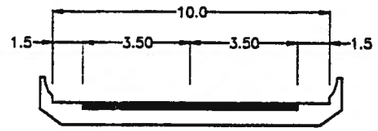
1) NEW HWY 6 OVER FIELDING LANE



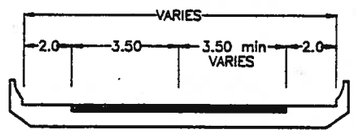
2) CP RAIL GALT SUBDIVISION OVERPASS



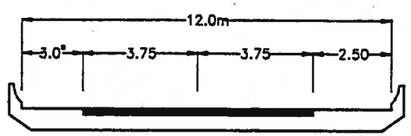
3) CRIEFF ROAD OVER HWY. 6



4) CALFASS ROAD CONNECTION TO COUNTY RD. 46 OVER HWY. 6

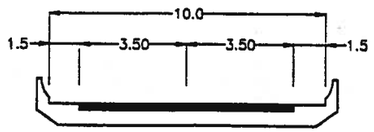


5) HWY 6 NORTHBOUND (S-W DIRECTIONAL RAMP) OVER HWY 401



*NOTE:
SHOULDER WIDENED TO 3.0m TO PROVIDE ADDITIONAL CLEARANCE FOR STOPPING SIGHT DISTANCE.

6) PUSLINCH CONCESSION 7 OVER HWY 401/6



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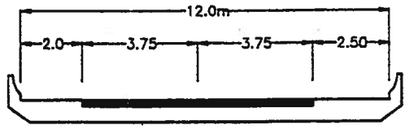
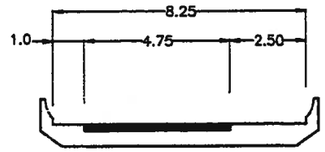
GROUP W.P.NO. 65-76-05 DIST.NO. 2 & 4 HWY.NO 6

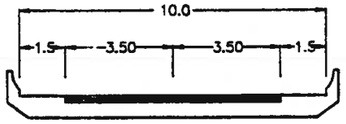
7) HWY 6 (N-E DIRECTIONAL RAMP) OVER HWY. 401



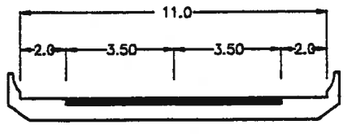
8) RAMP HWY 401W TO HWY 6N OVER RAMP HWY 6N TO HWY 401E



9) WELLINGTON CO. ROAD 34 OVER HANLON EXPWY



10) CONNECTION ROAD HWY 6N TO COUNTY ROAD 34



N.T.S.

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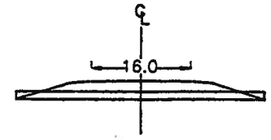
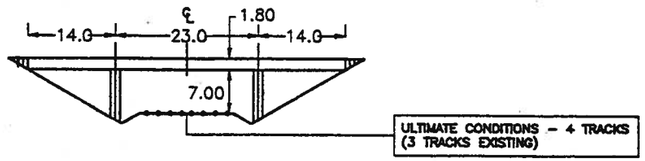
GROUP W.P.NO. 65-76-05 DIST.NO. 2 & 4 HWY.NO 6

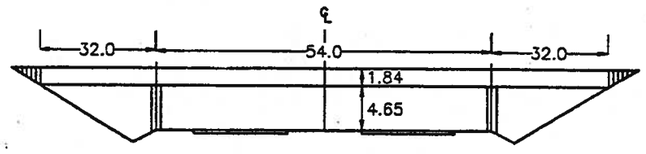
1) NEW HWY 6 OVER FIELDING LANE



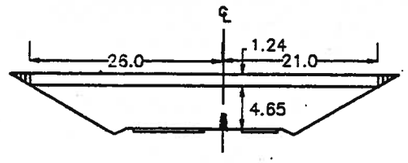
2) CP RAIL GALT SUBDIVISION OVERPASS



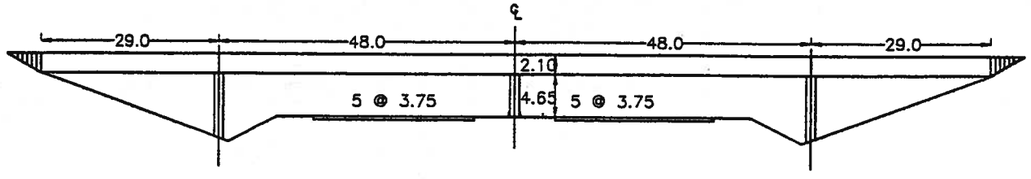
3) CRIEFF ROAD OVER HWY. 6



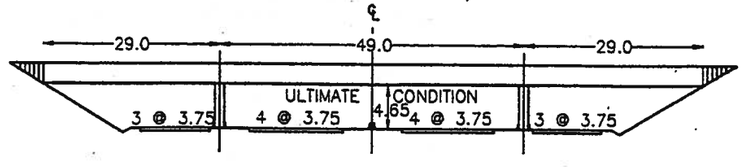
4) CALFASS ROAD CONNECTION TO COUNTY ROAD 46 OVER HWY. 6



5) HWY 6 NORTHBOUND (S-W DIRECTIONAL RAMP) OVER HWY. 401



6) PUSLINCH CONCESSION 7 OVER HWY 401/6



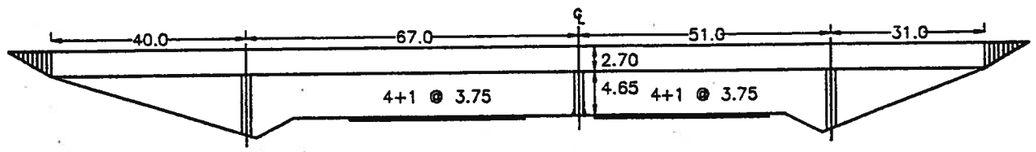
N.T.S.

Ministry of Transportation Ontario

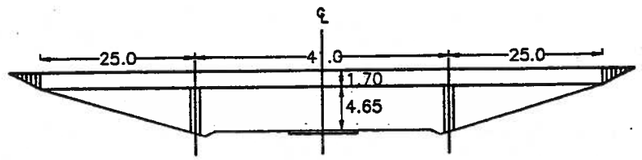
PRELIMINARY DESIGN CRITERIA

GROUP W.P.NO. 65-76-05 DIST.NO. 2 & 4 HWY.NO 6

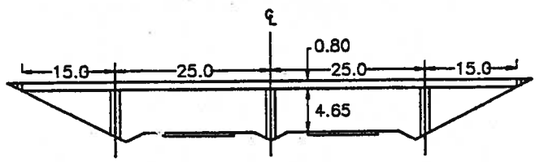
7) HWY 6 SOUTHBOUND (N-E DIRECTIONAL RAMP) OVER HWY. 401



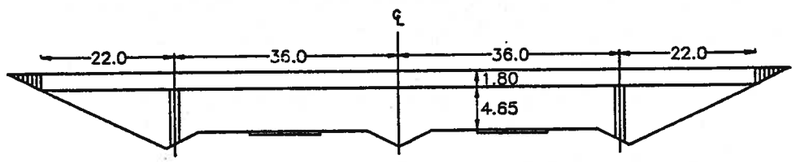
8) RAMP HWY 401W TO HWY 6N OVER RAMP HWY 6N TO HWY 401E



9) WELLINGTON CO. ROAD 34 OVER HANLON EXPWY



10) CONNECTION ROAD/ HWY 6N INTERCHANGE TO COUNTY ROAD 34



NOTE:
THE NEED FOR PROTECTION AT PIER LOCATIONS WILL BE DETERMINED IN DETAIL DESIGN BASED UPON WARRANTS OUTLINED IN THE ROADSIDE SAFETY MANUAL.

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APPENDIX H

HERITAGE FEATURES ANALYSIS AND VISUAL ASSESSMENT

STUDY AREA

BUILT ENVIRONMENT SURVEY

SUMMARY LISTING - BUILT ENVIRONMENT FEATURES
Main Study Area
Highway 6 (Freelton to Guelph) - W.P. 65-76-05

FEATURES			LOCATION			DISTANCE FROM ALTERNATIVES & SELECTED			
Feature I.D. #	Type	Level of Significance	Geographical Township	Lot	Conc.	In R.O.W.	Within 100m of R.O.W.	Metres to Selected	Comments
1	* residence	ordinary	Puslinch	30	VII R	-	-	260	ca 1890-1910
2	farmstead	ordinary	Puslinch	30	VII Fr	-	-	-	ca 1860-70's
3	* farmstead	moderate	Puslinch	31	VII	-	-	-	1851, 1864
4	* residence	moderate	Puslinch	31	VIII	-	-	-	1858?
5	farmstead	ordinary	Puslinch	31	VIII	-	-	-	ca 1840-50 ?
6	* residence	ordinary	Puslinch	32	VII	-	-	-	ca 1854
7	residence	ordinary	Puslinch	32	VII	-	-	-	1909
8	residence	moderate	Puslinch	32	VII R	-	-	-	ca 1910 Duff's Church Manse
9	* farmstead	exceptional	Puslinch	32	VII R	-	-	-	1882 "Stoneleigh"
10	residence	moderate	Puslinch	32	VIII	-	A31, A32, A33	-	1910; former school
11	residence	ordinary	Puslinch	32	VIII Fr	-	A31, A32, A33	-	ca 1850's ?
12	* farmstead	exceptional	Puslinch	33	VII	-	A31, A32, A33	-	1829
13	barns	ordinary	Puslinch	33	VIII	-	-	-	late 19th C ?
14	barns	ordinary	Puslinch	34	VIII	-	A2	-	late 19th C ?
16	farmstead	ordinary	Puslinch	35	VIII	-	A2	-	ca 1890-1910
16	farmstead	ordinary	Puslinch	35	VIII	-	A2	-	ca 1890-1910
17	* farmstead	moderate	Puslinch	35	VII	-	A2	-	ca 1855-65
18	residence	minimal	Puslinch	35	VII R	-	A@	-	late 19th C ?
19	residence	ordinary	Puslinch	36	VII R	-	A2	-	ca 1920-40 ?
20	farmstead	moderate	Puslinch	36	VII	-	A2	-	ca 1840-50
21	farmstead	ordinary	Puslinch	36	VIII	-	A2	-	ca 1900-1910 ?
22	* farmstead	exceptional	Puslinch	36	Gore R	-	A2,D6	-	ca 1850's, "Puslinch View Farm"
23	residence	ordinary	Puslinch	37	Gore R	-	A23	-	ca 1830-50
24	farmstead	ordinary	Puslinch	37	Gore R	-	A23	270	1888-res., 1890-barn
25	barn	ordinary	Puslinch	38	Gore	-	A23	280	mid - late 19th C
26	barn	moderate	Puslinch	38	Gore	-	A23	-	mid - late 19th C
27	residence	ordinary	Puslinch	38	Gore	-	A23	180	ca 1830-50
29	* farmstead	ordinary	Puslinch	22	II Fr	-	-	-	1858
30	barn fndn	minimal	Puslinch	22	I R	-	-	-	mid - late 19th C?
31	* farmstead	moderate	Puslinch	23	I R	-	-	-	ca 1870's
32	* farmstead	moderate	Puslinch	24	II Fr	-	-	-	ca 1850's
33	farmstead	ordinary	Puslinch	24	I R	-	-	-	ca 1830-40's
34	farmstead	ordinary	Puslinch	25	I R	-	-	-	ca 1830-40's
35	* farmstead	moderate	Puslinch	25	II Fr	-	-	-	ca 1850's
36	farmstead	minimal	Puslinch	27	I R	D6	-	-	late 19th C?
37	farmstead	minimal	Puslinch	26	I R	-	-	-	ca 1840-60 ?
38	farmstead	ordinary	Puslinch	26	I Fr	-	-	-	ca 1840's
39	* farmstead	ordinary	Puslinch	26	Gore R	-	-	-	ca 1850's ?
40	farmstead	ordinary	Puslinch	25	Gore	-	-	-	same family since 1835; mid-19th C
41	institutional		Puslinch 23, 24, 25		I Fr	-	-	-	Crieff Hills Community Retreat
(1) *	"House of the Sheppard" (minimal, ca 1940's)								
(2) *	"Dove House" (moderate, 1876)								
(3)	"House of the Prophet" (ordinary, ca 1839-40)								
(4) *	"School Section No. 6"/Conference Centre (moderate, 1874)								
42	* residences	moderate	Puslinch	24	Gore R	-	-	-	ca 1870's;
43	* farmstead	moderate	Puslinch	23	Gore R	-	-	-	ca 1850's; "Tara Farm"
44	barns	minimal	Puslinch	22	Gore R	-	-	-	late 19th C ?
45	residence	ordinary	Puslinch	22	I Fr	-	-	-	mid 19th C ?
46	farmstead	ordinary	Puslingh	28	VII Fr	-	06	-	ca 1910-1920 ?
47	farmstead	ordinary	Puslinch	29	VII Fr	06	-	-	ca 1840-50
48	barns	ordinary	Puslinch	28	I R	-	D6	-	mid - late 19th C?
49	farmstead	ordinary	Puslinch	33	VII Fr	-	C5,06	-	ca 1840-70's ?
50	* farmstead	exceptional	Puslinch	29	Gore R	-	-	-	ca 1850's
51	barn	ordinary	Puslinch	36	Gore Fr	-	C7	-	late 19th C?
52	farmstead	ordinary	Puslinch	35	Gore Fr	C11	-	-	late 19th C ?
53	residence		Beverly	36	X	-	-	-	ca 1870's
54	residence	minimal	W.Flamborough	1	X	-	C1,C7	-	3rd ± 19th C ?
55	res./ruins	minimal	W.Flamborough	2	X	-	-	-	19th C ?
56	residence	minimal	W.Flamborough	1	XI	-	-	-	ca 1840-50's ?
57	residence	ordinary	W.Flamborough	2	XI	A22	-	5	no dating determined on E. side of exist Hwy 6
58	residence	ordinary	W.Flamborough	3	XI	-	A22	25	ca 1910 ?; on E. side of existing Hwy 6
59	residence	ordinary	W.Flamborough	3	X	A22	-	15	20th C ?; on E. side of existing Hwy 6
60	* frmr school	exceptional	W.Flamborough	4	IX/X	A21,	C1	5	1864; on E. side of existing Hwy 6

Note: * indicates stone construction of residence/principal feature

SUMMARY LISTING - BUILT ENVIRONMENT FEATURES (Continued)
Main Study Area
Highway 6 (Freelton to Guelph) - W.P. 65-76-05

FEATURES			LOCATION			DISTANCE FROM ALTERNATIVES & SELECTED			
Feature I.D. #	Type	Level of Significance	Geographical Township	Lot	Conc.	In R.O.W.	Within 100m of R.O.W.	Metres to Selected	Comments
61	residence	ordinary	W.Flamborough	4	X	-	A21	7	mid 19th C ?; small barn
62	* residence	ordinary	W.Flamborough	4	IX	C1,C7	-	25	ca 1840-50's; barn fndn
63	farmstead	ordinary	W.Flamborough	3	IX	C7	C1		ca 1860's
65	farmstead	ordinary	Puslinch	30	VII R	-	-	over 300	ca 1850's ?
66	* residence	moderate	Puslinch	30	VII R	-	-	over 300	ca 1850-60's
67	farmstead	ordinary	Puslinch	26	I Fr	-	-	-	ca 1900-15 ?
68	barn	minimal	Puslinch	27	I Fr	-	-	-	no date determined
69	farmstead	ordinary	Puslinch	27	Gore R	-	-	-	19th C ?; log bldgs
70	* farmhouse	ordinary	Puslinch	27	Gore R	-	-	-	1860
[Note: No features referenced to I.D. 71 - 100 inclusive]									
101	residence	ordinary	E.Flamborough	12	IX	-	-	-	3rd ± 19th C ?
102	farmstead	ordinary	W.Flamborough	46	VIII	-	-	-	ca 1890's ?
103	barns	ordinary	E.Flamborough	13	X	-	-	-	19th C ?; complex
104	residence	ordinary	E.Flamborough	13	X	-	-	-	ca 1850's ?
105	cemetery	exceptional	E.Flamborough	15	X	-	-	-	ca 1860's
106	* residence	exceptional	W.Flamborough	7	VIII	-	-	-	ca 1850 ?
107	barn	moderate	W.Flamborough	6	VIII	-	-	-	19th C; assoc. with #106
108	* residence	moderate	W.Flamborough	7	VIII	-	-	-	ca 1830-40 ?; assoc. with #106
109	farmstead	ordinary	W.Flamborough	4	VIII	-	-	-	19th C?; obstructed view
110	farmstead	ordinary	W.Flamborough	3	VIII	-	-	-	late 19th C; additions
111	residence	minimal	W.Flamborough	2	IX	-	-	-	first ± 20th C ?
112	* farmstead	ordinary	W.Flamborough	2	VIII	-	-	-	ca 1850 ?
113	* farmstead	ordinary	W.Flamborough	2	IX	-	-	-	mid 19th C ?
114	* residence	ordinary	W.Flamborough	2	VIII	-	-	-	ca 1840-50
115	* residence	ordinary	W.Flamborough	1	IX	-	-	-	ca 1850's ?
116	farmstead	ordinary	Beverly	36	IX	-	-	-	ca 1860's
117	farmstead	ordinary	Beverly	36	IX	-	-	-	ca 1850-60's ?
118	residence	exceptional	E.Flamborough	13	X	-	-	-	ca 1860-70
119	farmstead	ordinary	E.Flamborough	12	XI	-	-	-	ca 1900-1915
120	* farmstead	ordinary	Puslinch	10	VIII	-	-	-	ca 1850 ?; Penn.German barn
121	* residence	ordinary	Puslinch	10	VII	-	-	-	ca 1850; barn fndns
122	farmstead	ordinary	Puslinch	11	VII	-	-	-	ca 1860's ?
123	farmstead	ordinary	Puslinch	11	VII	-	-	-	late 19th C?
124	residence	minimal	Puslinch	10	VII	-	-	-	pre-1900; much altered
125	* farmstead	ordinary	Puslinch	12	VII	-	-	-	ca 1860 ?
126	* farmstead	moderate	Puslinch	13	VII	-	-	-	ca 1840-50's ?
127	farmstead	ordinary	Puslinch	14	VII	-	-	-	ca 1900 ?
128	farmstead	ordinary	Puslinch	16	VII	-	-	-	ca 1860-70 ?
129	barn fndn	minimal	Puslinch	15	VII	-	-	-	no dating determined
130	farmstead	moderate	Puslinch	15	VII	-	-	-	late 19th C ?; large barn w/ 2 peaked gables
131	farmstead	ordinary	Puslinch	16	VII	-	-	-	ca 1900 ?
132	farmstead	ordinary	Puslinch	15	VIII	-	-	-	ca 1870's ?
133	* farmstead	moderate	Puslinch	14	VIII	-	-	-	ca 1840 ?; Penn.German.barn
134	*? farmstead	ordinary	Puslinch	14	VIII	-	-	-	ca 1890-1915
135	barn	ordinary	Puslinch	13	VII	-	-	-	no dating determined
136	* farmstead	ordinary	Puslinch	13	VIII	-	-	-	ca 1840-50's ?
137	residence	minimal	Puslinch	12	VII	-	-	-	19th C ?; much altered
138	* farmstead	ordinary	Puslinch	11	VIII	-	-	-	ca 1850's ?
139	farmstead	ordinary	Puslinch	16	VIII	-	-	-	ca 1860; res. altered
140	* farmstead	exceptional	Puslinch	17	VII	-	-	-	ca 1850's ?; barn with central gables
141	* farmstead	ordinary	Puslinch	17	VIII	-	-	-	mid 19th C; res. altered
142	farmstead	ordinary	Puslinch	18	VII	-	-	-	19th C. ?
143	* farmstead	ordinary	Puslinch	18	VIII	-	-	-	mid 19th C. ?
144	* residence	exceptional	Puslinch	19	VII	-	-	-	ca 1850-60 ?
145	* farmstead	ordinary	Puslinch	19	VIII	-	-	-	ca 1870's ?
146	* frmr school	exceptional	Puslinch	19	VII	-	-	-	1872
147	residence	minimal	Puslinch	20	VII	-	-	-	mid 19th C ?
148	* residence	ordinary	Puslinch	20	VII	-	-	-	ca 1850's ?; frmr stable.?
149	residence	ordinary	Puslinch	20	VII	-	-	-	ca 1900 ?
150	* residence	ordinary	Puslinch	20	VII	-	-	-	ca 1860 ?
151	residence	ordinary	Puslinch	21	VII	-	-	-	early 20th C ?; altered
152	residence	ordinary	Puslinch	20	VIII	-	-	-	late 19th C ?
153	residence	minimal	Puslinch	21	VII	-	-	-	no dating determined
154	* farmstead	moderate	Puslinch	21	VII	-	-	-	post 1861; same family since 1832
155	barns	ordinary	Puslinch	20	VII	-	A12	-	early 20th C ?

SUMMARY LISTING - BUILT ENVIRONMENT FEATURES (Continued)
Main Study Area
Highway 6 (Freelton to Guelph) - W.P. 65-76-05

FEATURES			LOCATION			DISTANCE FROM ALTERNATIVES & SELECTED			
Feature I.D. #	Type	Level of Significance	Geographical Township	Lot	Conc.	In R.O.W.	Within 100m of R.O.W.	Metres to Selected	Comments
156	barn fndns	minimal	Puslinch	18	VII Fr	-	-	-	no dating determined
157	residence	ordinary	Puslinch	21	IV	-	-	-	3rd ¼ of 19th C ?
158	shed	minimal	Puslinch	20	IV	-	-	-	no dating determined
159	farmstead	ordinary	Puslinch	14	IV-A	-	-	-	ca 1850's ?
160	farmstead	ordinary	Puslinch	18	IV	-	-	-	screened, no date
161 *	farmstead	ordinary	Puslinch	21	III	-	-	-	ca 1850's ?
162	farmstead	ordinary	Puslinch	20	III	-	-	-	19th C?; res. abandoned
163 *	farmstead	moderate	Puslinch	21	III	-	-	-	-ca 1850's ?
164 *	farmstead	moderate	Puslinch	21	II	-	-	-	ca 1880-90's ?
165	farmstead	ordinary	Puslinch	20	II	-	-	-	ca 1850's; small barn
166 *	frmr school	moderate	Puslinch	18	III	-	-	-	ca 1870's; altered
167	farmstead	ordinary	Puslinch	23q	III	-	-	180 from Hanlon Expressway (screened)	ca 1890-1915
168 *	farmstead	moderate	Puslinch	24	II	-	-	over 300 from Hanlon Expressway (screened)	ca 1850's & later
169 *	farmstead	ordinary	Puslinch	22	III	-	-	-	ca 1870's
170	farmstead	ordinary	Puslinch	21	VII	-	A1	-	ca 1890-1915
171	recreation	minimal	Puslinch	25	II	B3	-	50	modern; "Slovenski Park"
172 A	residence	ordinary	Puslinch	24	VII	-	B3	200	ca 1850 ?; altered
172 B	commercial	ordinary	Puslinch	25	VII	-	-	70	"Schneider's Meats" sign
173	farmstead	ordinary	Puslinch	25	VII	-	-	-	ca 1880's ?
174	farmstead	ordinary	Puslinch	26	VII	-	-	-	ca 1900 ?
175	residence	minimal	Puslinch	21	VII	-	-	-	not dated; altered
176	institutional	moderate	Puslinch	21	VII	-	-	-	cenotaph, community centre
177	residence	ordinary	Puslinch	21	VII	-	-	-	ca 1860's?; frmr store
178	residence	ordinary	Puslinch	22	VII	-	-	-	late 19th C ?
179	church	exceptional	Puslinch	22	VII	-	-	-	1927; Mount Carmel Zion United Church
180	residence	ordinary	Puslinch	22	VII	-	-	-	late 19th C ?
181	residence	ordinary	Puslinch	22	VII	-	-	-	ca 1850's ?
182	residence	ordinary	Puslinch	22	VII	-	-	-	early 20th C ?
183	residence	minimal	Puslinch	22	VII	-	-	-	ca 1920-30's ?
184	residence	ordinary	Puslinch	22	VII	-	-	-	mid 19th C?; altered
185	commercial	ordinary	Puslinch	22	VII	-	-	-	late 19th C?; assoc. outbldgs (relocated ?)
186	residence	ordinary	Puslinch	22	VIII	-	-	-	ca 1910-30's ?
187	residence	ordinary	Puslinch	22	VIII	-	-	-	ca 1870 ?
188	residence	ordinary	Puslinch	22	VIII	-	-	-	late 19th C ?
189 *	residence	ordinary	Puslinch	22	VIII	-	-	-	ca 1840's ?; altered
190 *	residence (demolished ca 1986-7)	moderate	Puslinch	22	VIII	-	-	-	ca 1850's; cobbles
191	residence	ordinary	Puslinch	22	VIII	-	-	-	ca 1840's ?
192 *	residence	moderate	Puslinch	22	VIII	-	-	-	ca 1850 ?
193 *	commercial	ordinary	Puslinch	22	VII	-	-	-	19th C ?
194 *?	residence	ordinary	Puslinch	22	VII	-	-	-	late 19th C ?
195 *	farmstead	exceptional	Puslinch	22	VII	-	A1	-	ca 1870's; "Loch Crune"
196	barn	ordinary	Puslinch	22	VII	-	-	-	20th C ?
197 *	commercial	exceptional	Puslinch	23	VIII	-	-	-	ca 1859; Aberfoyle Mill
198	farmstead	ordinary	Puslinch	23	VII	-	-	-	19th C?; res. may be modern ?
199	residence	moderate	Puslinch	23	VIII	-	-	-	ca 1860-70's ?
200 *	farmstead	ordinary	Puslinch	23	VIII	-	-	-	ca 1860-70's ?
201 *	farmstead	moderate	Puslinch	23	VII	-	A1	-	ca 1850-60 ?
202	residence	ordinary	Puslinch	23	VIII	-	-	-	ca 1860 ?
203	residence	ordinary	Puslinch	23	VIII	-	A1	-	ca 1880's ?; altered
204	farmstead	ordinary	Puslinch	24	VIII	-	-	-	mid 19th C ?
205	farmstead	ordinary	Puslinch	25	VIII	-	-	-	ca 1840-50's?; log
206	farmstead	ordinary	Puslinch	26	VIII	-	-	-	ca 1860's ?
207	residence	moderate	Puslinch	26	VII	-	-	-	ca 1870's ?
208 *	farmstead	exceptional	Puslinch	27	VIII	-	-	-	ca 1840 ?; barn fndns
209 *	farmstead	moderate	Puslinch	27	VII	-	-	-	ca 1850's ?
210	farmstead	ordinary	Puslinch	27	VII	-	-	-	ca 1870's ?
211 *	church	exceptional	Puslinch	28	VII	-	-	-	1854; Ouff's Presbyterian
212	cemetery	exceptional	Puslinch	28	VIII	-	-	-	early 1830's; "Crown Cemetery Puslinch"
213	residence	ordinary	Puslinch	27	VIII	-	-	-	1894
214	residence	ordinary	E.Flamborough	12	XII	-	-	-	ca 1870-80's ?
215	res& outbldgs	minimal	Beverly	36	X	-	-	-	late 19th C ?

SUMMARY LISTING - BUILT ENVIRONMENT FEATURES (Continued)
Main Study Area
Highway 6 (Freelton to Guelph) - W.P. 65-76-05

FEATURES			LOCATION			DISTANCE FROM ALTERNATIVES & SELECTED			
Feature I.D. #	Type	Level of Significance	Geographical Township	Lot	Conc.	In R.O.W.	Within 100m of R.O.W.	Metres to Selected	Comments
216	farmstead	ordinary	Beverly	36	IX	-	-	-	19th C ?;
217	farmstead	ordinary	Beverly	35	IX	-	-	-	ca 1860-70 ?
218	residence	moderate	Beverly	35	X	-	-	-	ca 1850 ?
219	farmstead	ordinary	Beverly	34	IX	-	-	-	ca 1850 or later ?
220 *	farmstead	ordinary	Beverly	34	X	-	-	-	ca 1850-60 ?
221 *	farmstead	moderate	Beverly	33	IX	-	-	-	ca 1860 ?
222	farmstead	ordinary	Beverly	32	IX	-	-	-	no dating determined
223	farmstead	ordinary	Beverly	28	X	-	-	-	3rd ¼ of 19th C?
224	farmstead	minimal	Beverly	29	IX	-	-	-	19th C ?; altered
225	barn	ordinary	Beverly	30	X	-	-	-	small, log; date ?
226	cemetery	exceptional	Puslinch	31	VIII	-	-	-	ca 1884; "Merian Cemetery"
227	residence	ordinary	Puslinch	36	VII	-	D6	-	19th C ?
228 A *	farmstead	moderate	Puslinch	33	Gore R	-	C5	-	ca 1850's ?
228 B	residence	ordinary	Puslinch	33	Gore R	-	-	-	ca 1870's ?
229 *	farmstead	moderate	Puslinch	32	Gore R	-	C5	-	ca 1870's ?
230	farmstead	ordinary	Puslinch	28	I	-	-	-	late 19th C ?
231	residence	ordinary	Puslinch	27	I	-	-	-	-ca 1860-70?
232 *	farmstead	ordinary	Puslinch	28	Gore R	-	-	-	ca 1850-60 ?
233 *	farmstead	moderate	Puslinch	27	Gore R	-	-	-	ca 1855-1875 ?

SITES BY COMMUNITY:

ABERFOYLE: See sites #175 to #194, above

CRIEFF:

C 1	* residence	exceptional	Puslinch	26	I Fr	-	-	-	ca 1850's
C 2	church & cemetery	exceptional	Puslinch	26	I Fr	-	-	-	1882; Knox Church
C 3	residence	ordinary	Puslinch	25	I Fr	-	-	-	ca 1860-70's ?; formerly store/commercial
C 4	* residence	exceptional	Puslinch	26	I Fr	-	-	-	ca 1860's; altered
C 5	institutional excep'l		Puslinch	25	I Fr	-	-	-	now Sunset Villa Assn.

(a) residence (former manse); pre-1856
(b) residence, late 19th C ?
(c) former blacksmith shop; 19th C
(d) former shop

MORRISTON: See sites #1 to #9, above, and the following:

Note: Closest feature to selected alternative is #1 (approximately 260 m to Connection Rd. R.O.W.)
Next closest is barn of #3 (approximately 650 m to new Hwy. 6 R.O.W.)
Closest residential feature in Morriston is approximately 780 m from main R.O.W.

M 1	residence	ordinary	Hwy 6, E. side	-	-	-	1849; former butcher shop
M 2	stone wall	ordinary	Hwy 6, E. side	-	-	-	vacant lot
M 3	* commercial	moderate	Hwy 6, E. side	-	-	-	ca 1850-60 ?; formerly carriage house
M 4	commercial	ordinary	Hwy 6, E. side	-	-	-	ca 1850-60's ?; frame shed
M 5	residence	ordinary	Hwy 6, E. side	-	-	-	ca 1850-60's ?
M 6	* commercial/ residential	ordinary	Hwy 6, E. Side	-	-	-	1856; now apartments
M 7	* frmr hotel	moderate	Hwy 6, E. side	-	-	-	ca 1850-60's
M 8	park	ordinary	Hwy 6, W. side	-	-	-	site of former hall;cairn
M 9	residence	moderate	Hwy 6, E. side	-	-	-	ca 1870's
M 10	residence	ordinary	Hwy 6, W. side	-	-	-	ca 1830-40's ?
M 11	residence	ordinary	Hwy 6, W. side	-	-	-	ca 1830's? (log originally)
M 12	commercial	ordinary	Hwy 6, W. side	-	-	-	1854; former hotel
M 13	* commercial	exceptional	Hwy 6, W. side	-	-	-	1861; frmr hotel & store
M 14	* commercial	exceptional	Hwy 6, W. side at corner	-	-	-	1864; commercial block
M 15	commercial	ordinary	Hwy 6, W. side	-	-	-	date ?; a store originally?
M 16	* residence	moderate	Hwy 6, E. side north of corner	-	-	-	1856; altered
M 17	residence	ordinary	Hwy 6, W. side	-	-	-	ca 1850
M 18	* commercial	moderate	Hwy 6, E. side	-	-	-	ca 1840's; frmr blacksmithy
M 19	residence	ordinary	Hwy 6, E. side	-	-	-	ca 1850's ?; frmr hotel?
M 20	residence	ordinary	W. of Hwy 6	-	-	-	ca 1895-1910 ?
M 21	church	exceptional	Victoria St.	-	-	-	1856; Mount Carmel-Zion United Church
M 22	res./instit.	ordinary	Victoria St.	-	-	-	ca 1894-99; manse
M 23	* residence	ordinary	Victoria St.	-	-	-	ca 1850-60's; altered
M 24	residence	ordinary	Victoria St.	-	-	-	19th C ?
M 24	residence	ordinary	Victoria St.	-	-	-	ca 1850-60's ?

SUMMARY LISTING - BUILT ENVIRONMENT FEATURES (Continued)
Main Study Area
Highway 6 (Freelton to Guelph) - W.P. 65-76-05

FEATURES			LOCATION			DISTANCE FROM ALTERNATIVES & SELECTED			
Feature I.D. #	Type	Level of Significance	Geographical Township	Lot	Conc.	In R.O.W.	Within 100m of R.O.W.	Metres to Selected	Comments
MORRISTON (Continued)									
M 26	residence	minimal	Victoria St.			-	-	-	ca 1850-70 ?; much altered
M 27	*residence	exceptional	Victoria St.			-	-	-	ca 1870's
M 28	*residence	moderate	Victoria St.			-	-	-	ca 1870-74
M 29	residence	minimal	Victoria St.			-	-	-	ca 1860-70's; much altered
M 30	residence	minimal	Victoria St.			-	-	-	mid/late 19th C?;
M 31	residence	ordinary	Victoria St.			-	-	-	part: original toll gate?
M 31	residence	ordinary	Victoria St.			-	-	-	1830-40's ?
M 32	residence	ordinary	Hwy 6, E. side			-	-	-	late 19th C ?
M 33	*industrial	moderate	Hwy 6, E. side			-	-	-	ca 1850's; frmr blacksmithy
M 34	residence	ordinary	Hwy 6, E. side			-	-	-	ca 1830-40's ?
M 35	residence	ordinary	Hwy 6, E. side			-	-	-	ca 1860's ?
PUSLINCH: See sites #23 & #24, above, and the following.									
P 1	commercial	moderate	Puslinch	37	Gore R	-	-A23	-	1837-38; store (closed)
P 2	residence	minimal	Puslinch	37	Gore R	A23	-	-	ca 1860's ?
P 3	residence	minimal	Puslinch	38	Gore R	A23	-	-	ca 1900-40's ?
P 4	residence	ordinary	Puslinch	37	Gore R	-	A23	-	ca 1890-1900 ?
P 5	residence	ordinary	Puslinch	37	Gore R	-	A23	-	ca 1890-1900 ?
P 6 A	residence	ordinary	Puslinch	37	Gore R	A23	-	-	ca 1913-14
P 6 B	cemetery	exceptional	Puslinch	37	Gore R	-	A23	-	date ?

NOTES:

* Residence of stone construction ; other principle building of stone construction

"In R.O.W." and "Within 100 m of R.O.W." refer to distance of feature from various alternative routes as shown by alternative label.

"Metres to Selected" refers to distance from feature to the R.O.W. of the selected alternative, where this distance is 300 m or less.

This table is a summary only. Details are contained in a separate technical support document, prepared for W.P.65-76-05.

Abreviations Used In Table:

C	century
frmr	former/formerly
Fr	Front (of concession)
R	Rear (of concession)
res.	residence/residential

No Built Environment Features in the main Study Area were identified as being designated under the Ontario Heritage Act. The property of B.J. and D.C. McKay [#9] was identified by the owners as being "designated", although jurisdiction for the designation was not provided.

"Level of Significance" indicates an estimated evaluation of the amount of interest or significance, from a historic, architectural or aesthetic heritage perspective. "Exceptional" and "moderate" represent groupings where removal of the feature would result in the loss of an important "consultable record" or heritage resource. "Ordinary" level of interest is commonly applied to widespread and typical examples of features, whose loss, although important in a localized sense, would leave other, similar examples. "Minimal" refers to features with questionable heritage value, or which have been altered to the point where they retain little or no interest. These levels of significance have been assigned for the purposes of highway route planning and should not be applied to features outside of the context of this study.

SELECTED ALIGNMENT ARCHAEOLOGICAL SURVEY

CENTRAL REGION
PLANNING & DESIGN

AN ARCHAEOLOGICAL SURVEY OF THE AREA TO BE IMPACTED BY THE PROPOSED CONSTRUCTION OF HIGHWAY 6, FREELTON TO GUELPH.

(WP #65-76-05)

By: P.A. Lennox & C.R. Murphy
Environmental Unit
Planning & Design Section
Ministry of Transportation & Communications
Southwestern Region - London

July 1987
Licence Number 87-26

INTRODUCTION

In accordance with the requirements of the Ontario Heritage Act (R.S.O. 1980) and the Environmental Assessment Act (R.S.O. 1980), an archaeological survey was undertaken over the area to be impacted by the proposed construction of Highway 6 from Freelton to Guelph, encompassing portions of the Regional Municipality of Hamilton-Wentworth and Wellington County, Ontario.

The project is most easily understood in its two segments, the southern reconstruction and the northern new alignment. At the south end the project proposes to reconstruct the existing two lanes of Highway 6 to four lanes from Freelton northerly to the Maddaugh Road. Within this section of the project little or no new right-of-way is required. From the Maddaugh Road northerly the project proposes a new alignment, paralleling and west of existing Highway 6. To the south of the 401 a connecting road through Lots 29 and 30 joins new Highway 6 with the intersection of old Highway 6 and the 401 while new ramps are required at the 401 and new Highway 6 to the west. (Figure 1)

METHOD

Along the south end of the project where Highway 6 is being reconstructed, undisturbed ground within the right-of-way and new ground required beyond the right-of-way was shovel-tested at 10 metre intervals. North of Maddaugh Road where the new alignment

is proposed, most of the area was either in hay, pasture, or in bush at the time of the survey. In this lengthy section, including the connection road to the Highway 6 and 401 interchange and the area involved with the new intersection with the 401 west of old Highway 6, test pits were excavated at 10 m intervals over the entire right-of-way. Several areas, however, could not be accessed as permission to enter was denied by the owners. Other areas along this section are covered in mature maple forest and will have to be test pitted in the fall or spring when the leaf cover if off. Under mid-summer conditions these bush lots are too dark to allow adequate examination of soils from the test units. Areas that were examined and areas that were not examined due to permission to enters or bush cover, are indicated in Figure 2.

RESULTS

Only one site of historical significance was identified during the survey. The Segota Site, an early to mid 19th century domestic site, is registered under the Borden System as AiHa-24. It is located immediately north-west of the Maddaugh Road and existing Highway 6 intersection, on Lot 39 Concession Gore, Puslinch Township, Wentworth County. As indicated on the attached archaeological site record form (appendix A), this site lies immediately east of the new Highway 6 right-of-way north of Maddaugh Road and as such should remain intact.

RECOMMENDATIONS

The archaeological survey of the new Highway 6 alignment must be completed prior to highway construction. The bush lots that remain unsurveyed as of this report (Figure 2) should be examined in the late fall or early spring when the foliage and resulting light conditions are not a hindrance. Likewise, survey should be conducted over the areas where access was denied during the 1987 season once permission to enter is granted. Appropriate mitigation strategies for any sites discovered as a result of outstanding survey completion can only be determined if and when any sites of historical significance are identified.

The Segota Site will remain beyond the limits of the proposed right-of-way and should not be impacted by construction. However, given the site's close proximity to the right-of-way and the fact that it will remain a small island of undisturbed ground between new Highway 6, old Highway 6, and the Maddaugh Road, the site should be actively protected from destruction during the construction phase. Protection for the site could be quickly and cheaply afforded by a notation in the contract as to the site's location and significance and perhaps, should this small severance of the Segota property be purchased during negotiations, the site area should be actively protected during construction by the erection of a snow fence around its perimeter.

ACKNOWLEDGEMENTS

We would like to acknowledge, with thanks, the volunteer assistance of several persons during the Archaeological Survey of the New Highway 6 Alignment: Lorna Kelly, Karen Palmer, Cathy Davis, and Luanne Epstein. All told, they contributed about 30 man-days of assistance to the project.

Table 1: HWY 6 Survey Status

Twp.	Con.	Lot	Owner	Survey Tech./ Field Cond.	Survey C/I	Map Section	Comments
West Flamborough	1	11	G. & A. Wright	Test Pit Brush	C	1	Late 19th Century Materials. No Mitigation Recommended.
Puslinch	Gore	39	J. & M. Segota	Test Pit Brush	C	1	Early to Mid 19th Site (AlHa-24) east of Right-of Way. To be Avoided
"	"	38	J. & M. Mathies	Test Pit Brush/Pasture	C	2	
"	"	38	M. Mark-ovinovic	Test Pit Brush	C	2	
"	"	38	J. Schweden	Test Pit Pasture	C	2	
"	"	37	G. & I. Fielding	Cedar Swamp	C	3	Standing water. Area of no heritage potential.
"	"	37	W. Bercowski	Garden Surface coll.	I	3	Woodlot not tested
"	"	36&35	B. Lillycrop		I	4 & 5	Access denied
"	"	35	D. Stewart		I	5	" "
"	"	34	E. Hollenbach	Disturbed	C	6	Old gravel pit.
"	VII	35&34	G. Button	Corn Field	I	7	Poor survey conditions.
"	"	33	W. Winer	Test Pit Pasture	I	8	Woodlot not tested.
"	"	32	F. Metcalf		I	9	Access denied.
"	"	31	J. Hawthorn		I	10	Woodlot not tested.
"	"	31	N. Stewart	Test Pit Pasture	I	10	Woodlot not tested.
"	"	30	M. Corey	Test Pit Brush	I	11	Woodlot not tested.
"	"	29&28	M.T.C.	Test Pit Brush	I	12a, 12b, 13	Woodlot not tested.
"	"	27	Collavino	Test Pit Pasture	C	14	
"	"	26	L. Ferraro	Test Pit Brush	I	15	Woodlot not tested.

ROUTE ALTERNATIVES VISUAL ASSESSMENT

Ontario

Ministry of
Transportation and
Communications

Maintenance Branch
Room 230, Central Building
1201 Wilson Avenue
Downsview, Ontario
M3M 1J8

Telephone No. (416)248-3145

October 29th, 1985

Our File No: 4-84-19

Fenco Engineers,
33 Yonge Street,
Toronto, Ontario.
M5V 1E7

Attn: Mr. Ian Upjohn

Dear Mr. Upjohn:

Re: W.P. 65-76-05
Hwy. 6N, Freelton to Guelph

Please find enclosed a copy of the Aesthetic Assessment for W.P. 65-76-05. This report represents a summary of an analysis of the study area using air photos, discussion with M.T.C. staff and yourself, and a field visit. It is a quick assessment that describes the relative preference based on aesthetics. It is the opinion of this office that alternatives A-1 or C-7 or combinations thereof are preferred visually over D-6, C-5, A-5 or A-3, both from the view points of "view from the road" and "view of the road". Assumptions were made about vertical alignment and the ability to relate the alignment to the topography.

Yours sincerely,

for: L.C. Harmeson,
Landscape Planner,
Landscape Planning Unit.

LCH/nn

c.c. H. Vanderkooij
H. McNeely (Attn: R. Beshiri)
R.M. Dell
Encl.

October 29th, 1985

W.P. 65-76-05
HWY. 6 - FREELTON TO GUELPH

AESTHETICS

Assessment of highway aesthetics must involve all visual factors and the relationships that influence the linkage of a traveller's seeing and reactions. Equally important in assessing the aesthetics of the highway is the perception of the highway in the landscape by viewers not travelling the highway. Therefore for this study, the visual assessment of the identified alternative alignments is developed to assess inputs as they relate to:

(1) the view from the road, &
(2) the view of the road

VIEW FROM THE ROAD

The character of landscape units is a major component of the highway environment and implies input to varying degree of viewer experience and behavior. Viewer experience relates to viewer need and perception relating to the progressin of landscape views, road alignment and cross-section, degree and frequency of enclosure caused by vegetation or topography, landmarks or significant natural or man-made features and the degree of 'fit' of the highway to the landscape. The view from the road should be assessed in a positive nature.

VIEW OF THE ROAD

The opposite viewpoint is not that of the user, but that of an observer of the facility and the degree to which the location and alignment is sensitive to the landscape. The perception of 'fit' is often biased by other impacts such as noise, dust, fumes, headlight glare and intrusion of a life style. Generally the 'view of the road' is considered negatively in that it has caused a change to the status quo. Alignment, road cross-section and landscaping that are sensitive to the character of the landscape can help to reduce the negative impact.

METHODOLOGY - View from the Road

Although aesthetics is basically subjective, a quantitative method has been employed to assist in determining relative visual preference for the alternatives.

The criteria used for assessing visual impact from the road are:

(1) Variety and frequency of spatial enclosure - Spatial enclosure is created by topographical changes, vegetation cover or man-made features. Landscapes that are hilly, rolling or hummocky afford a better opportunity for closure than open. Areas of marginal, dairy, beef, horse or hobby farms generally afford more opportunity for closure through vegetative cover than intense agricultural areas, natural areas or swamps.

(2) Relationship of highway alignment and landscape character - The extent that highway alignment respects such landscape components as topography, field patterns, woodlot configuration, etc. Also considered is the ability of certain landscapes to accept highway alignment, such as no alignment, allowing speeds of 80 kph, adequately fits hummocky landscapes as there is no pattern for fit.

(3) Diversity of landscape types exposed to highway traveller - The extent to which different landscape types are traversed by the highway thus affording the potential for a greater variety of experiences.

(4) Positive visually specific elements - This includes such features as dramatic views,-heritage/culturally significant man-made features, water features, individual trees, etc.

(5) Negative visually specific elements - This includes such features as dumps, junkyards, high voltage transmission towers, extraction areas etc.

To assist in determining a relative preference, scales were developed for each criteria. Each alternative was assessed using the criteria and scale and the relative preference determined by summing the criteria to form a composite number.

SCALE

Variety and frequency of spatial enclosure

No Variation	= 0
Little variation & frequency	= 1
Moderate variation & frequency	= 2
Good variation & frequency	= 3

Relationship of highway alignment & landscape character

Poor relationship	= 1
Moderate relationship	= 2
Good relationship	= 3

Diversity of Landscape Types

No change in landscape type	= 0
Few landscape types crossed	= 1
Moderate landscape types crossed	= 2
Many landscape types crossed	= 3

Positive visually specific elements add one for each occurance of identified specific elements

Negative visually specific elements

- substract one for each occurrence of such elements as junk yards, dumps, extraction site, industrial complex etc..

- Substract one for each high voltage hydro transmission line crossing

- Substract two for each instance of paralleling high voltage hydro transmission line

- Substract two for each occurrence of removing significant roadside trees for widening

METHODOLOGY - View of the Road

A quantative method has also been developed to determine the relative visual preference as it relates to the physical change or inclusion of the highway in the landscape. The criteria for assessing the impact of the highway as it is viewed from the surrounding environment are:

1. The degree to which the alignment, horizontal & vertical & cross-section respect the landscape through which it crosses. Does the highway appear to be a natural extension of the landscape, or does it appear as a major intrusion?

2. The number of viewers, that could observe the degree of fit of the highway to the landscape. A limit of 1 kilometre was used in determining numbers.

SCALE

Degree of 'fit' to landscape

Little relationship or 'fit'	1
Moderate relationship or'fit'	2
Good relationship or'fit'	3

Number of viewers

Many	1
Moderate	2
Few	3

EVALUATION - View from the Road

Alternative	Spatial Enclosure	Relationship to Type	Diversity of types	Positive Elements	Negative Elements	Total
A-22/A-11	1	2	1		-1	3
A-13	2	2	1		-1	4
A-31	0	0	0	+1		1
A-32	0	0	0	+1		1
A-33	0	0	0			0
A-5	1	1	2	+1	-1	4
A-23/A-2/A-3	1	1	2	+1, +1	-1	5
C-1/C-11	2	2	1		-2	3
A-21/A-22/C-71	2	2	1		-1	4
C-71/C-7	3	2	2	+1	-1	7
A-23/A-2/A-3	1	1	2	+1, +1	-1	5
C-71/C-7	3	2	3	+1	-1	8
D-6	2	1	3	+1	-1, -2	4
C-71/C-7	3	2	3	+1	-1	8
C-1/C-5	2	2	2	+1	-2, -2 -1, -1	1
A-13/A-1	3	3	2	+1,+1,+1	-1, -1	9

EVALUATION - View of the Road

Alternative	'Fit' to Landscape	Visibility	Total
A-22/A-11	2	1	3
A-13	2	3	5
A-31	0	2	2
A-32	0	2	2
A-33	0	1	1
A-5	1	2	3
A-23/A-2/A-3	1	1	2
C-1/C-11	2	3	5
A-21/A-22/C-71	2	2	4
C-71/C-7	2	3	5
A-23/A-2/A-3	1	1	2
C-71/C-7	2	3	5
D-6	1	1	2
C-71/C-7	2	3	5
C-1/C-5	2	2	4
A-13/A-1	3	2	5

APPENDIX I

NOISE ANALYSIS

Ministry of Transportation
Ontario

Environmental Technical Paper No.8

Environmental
Noise Impact Assessment

Highway 6
Freelton to Guelph
Update and Supplementary Investigations for Route Location and Preliminary Design
W.P. 65-76-05

DRAFT TECHNICAL PAPER

PLANNING & DESIGN SECTION

Fenco MacLaren Inc.

ENVIRONMENTAL NOISE IMPACT ASSESSMENT
FOR
PROPOSED HIGHWAY 6 REALIGNMENT
BETWEEN FREELTON AND GUELPH

FOR

FENCO MacLAREN INC.

BY

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FEBRUARY 9, 1994

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1.0 INTRODUCTION

In 1992, J. E. COULTER ASSOCIATES ENGINEERING was commissioned by Fenco MacLaren Inc. to carry out an Environmental Noise Assessment of the proposed alternate routes to the existing Highway 6 between Freelton and Guelph as part of the Supplementary Investigation phase of the Route location and Preliminary Design Study. A preliminary assessment of the potential for noise impact and investigation of possible mitigation measures have been carried out. For the area between Crieff Road and Highway 401, there are 3 alternative alignments.

Also reviewed was the potential noise impact of the proposed Highway 6 extended ramps (to Highway 401), which link Highway 6 south to the Hanlon Expressway. Along the Hanlon Expressway, the potential noise impacts at the County Road 34 interchange have been reviewed.

1.1 METHODOLOGY AND DATA SOURCES

The analysis includes the following elements:

a. Sound level calculations were carried out on Vanderbilt University's *STAM2VU1* (Version 1.30) noise prediction program. This is a modified version of the FHWA Version 3 (March 1983) *STAMINA* programme. Further details on *STAMINA* are provided in Appendix D. The Ministry of the Environment and Energy's *ORNAMENT* methodology (*STAMSON 4.1* computer programme) was utilized for the extended Highway 401 ramp calculations due to the simple configuration.

b. Net increase in environmental sound levels for each property exposed to an impact of at least 3 dB was determined for the alternatives. The analysis was carried out to the lesser distance of 600m as per the Ministry of Transportation /Ministry of the Environment and Energy (MTO/MOEE) Protocol.

c. Noise barriers were investigated according to the MTO/MOEE's Protocol.

The net increase in the environmental sound level is the difference between the predicted sound levels due to the traffic on the future alignment and the anticipated ambient sound levels at the same locations for the "no project" condition. The future ambient sound level was deemed to be either 45 dBA L_{eq} (typical of rural daytime background sound levels) or the level generated by local road traffic, whichever would be higher.

The traffic volumes used in the calculations were provided by Fenco MacLaren Inc. as part of the overall study. The projected future sound levels (with and without the project proceeding) are for the year 2011, corresponding to approximately 10 years after project completion as per the MTO/MOEE Protocol.

The number of noise-sensitive land uses along each route was determined using 1:2000 scale mapping prepared by Fenco MacLaren. All data used for calculating the projected sound levels were provided by Fenco MacLaren Inc. There were no projections made by the Acoustic Consultant regarding traffic volume data, speed limits, truck mixture or receptor setbacks.

For classifying noise impact, four categories of descriptors are used in this report, following:

TABLE 1 - NOISE IMPACT DESCRIPTORS	
No Noise Impact	Change less than 3 dBA
Low Noise Impact	Change 3 to 4 dBA
Moderate Noise Impact	Change 5 to 9 dBA
Significant Noise Impact	Change of 10 dBA or more

The sound levels were rounded to the nearest integer for determining noise impact.

1.2 MINISTRY OF TRANSPORTATION NOISE POLICY

For highway construction projects, the following are the main points of the MTO noise mitigation policy that apply:

1. Where a new or expanding highway adjacent to a noise-sensitive land use will result in a sound level increase of greater than 5 dBA (all roadways combined), 10 years after completion, MTO shall investigate noise control measures within the MTO right-of-way.

2. Noise control measures, where applied, will be designed to achieve levels as close to, or lower than, the objective level of pre-construction ambient as is technically, economically and administratively feasible.

3. Noise control measures, where applied, should be cost effective and achieve a minimum reduction of 5 dBA averaged over the first row of receivers.

1.3 GENERAL DESCRIPTION OF EXISTING CONDITIONS

Prior to the completion of this report, J.E. COULTER ASSOCIATES ENGINEERING completed a field survey of the study corridor. The goal of the field work was to indicate the range of background noise found throughout the corridor and to look for any noise-sensitive land uses as yet unidentified from the information available.

In the study corridor, there are no major environmental sound sources other than roadways (existing Highway 6, 401 and the local roadways). The CP Railway (Galt Subdivision) at the southern portion of the study area is a principal mainline carrying freight traffic. The Protocol for determining noise impact does not include short events such as rail and aircraft passbys. There are no industries which contribute significantly to the ambient sound levels. Other than the residential uses through most of the study area (including the Morriston Nursing Home), no other noise-sensitive uses were found.

2.0 IMPACT ASSESSMENT

Between Freelton and Maddaugh Road, where Highway 6 is to be widened only without an alignment shift, there is no noise impact anticipated as the traffic volumes are projected to remain unchanged with or without the project in place.

Between Maddaugh Road and Crieff Road, the proposed new alignment is similar for the three alternatives. The net sound level changes are similar for all receptors impacted by road noise with this area.

The alternative routes are nearly identical in the area south from Crieff Road to Maddaugh Road. As a result, for all alternatives south of Crieff Road, two properties (R12 and R27) are moderately impacted by road noise (6 and 8 dB increase, respectively). Mitigation would not be considered for these properties, given the low cost benefit of constructing a 4m high barrier approximately 600m long for each of the two receivers.

2.1 Crieff Road to Highway 401

All receivers that are located adjacent to the existing Highway 6 alignment (Crieff Road to Highway 401) will experience a decrease (typically 5 dB) in the traffic sound levels due to traffic being diverted to the new alternative to the west of the existing alignment. This is applicable to all three alternatives.

A key plan is provided in Appendix A, Figure 1 identifying the receiver locations.

Alternative 1

The three properties (R28, R29 and R30), located east of the new alignment on the south side of Crieff Road, are expected to experience a moderate increase in noise (ranging from 5 to 9 dB). Noise mitigation has not been considered due to the limited number of properties and very long barrier required to achieve 5 dB improvement.

For those properties situated between Crieff Road and Calfass Road on the west side of the new alignment, a significant noise impact is identified for R31, R38 and R39. The increment in the levels for these properties is 10 to 11 dB for this alternative. The other properties (R35 to R37) are anticipated to have a moderate noise impact ranging from 5 to 7 dB. Noise control mitigation is not expected to be viable, given the length of the segment requiring shielding and the limited number of properties affected.

At the Telfer Glen Subdivision, Alternative #1 runs further to the west compared to Alternatives 2 and 3. The noise impact for the properties (R40 and R41) directly adjacent to the eastern R-O-W is approximately 6 dB, a moderate impact. There is a minor noise impact from R42 to R44. There is no noise impact at R45, located further to the east, as the influences of Highway 401 and the existing Highway 6 reduce the potential noise impacts below 5 dB.

The following tables summarize the noise impact for Alternative 1:

TABLE 2 - SUMMARY OF IMPACTED PROPERTIES - ALTERNATIVE 1

Highway 6	Number of Houses v. Increase Over Ambient (dB)			
Alternative	3-4 dB	5-9 dB	> = 10 dB	Total
1	14	19	3	36

TABLE 3 - SUMMARY OF PROJECTED SOUND LEVELS - ALTERNATIVE 1

Highway 6	Number of Houses v. Projected Sound Level (dB)				
Alternative	45-49.9	50-54.9	55-59.9	60-64.9	Total
1	7	24	4	1	36

Alternative 2

The three properties (R28, R29 and R30), located east of the new alignment and on the south side of Crieff Road, are expected to experience a moderate increase in noise (ranging from 5 to 9 dB). Noise control mitigation has not been considered due to the limited number of properties impacted.

For the R31 property situated between Crieff Road and Calfass Road on the west side of the new alignment, a significant noise impact is identified. The sound level increase for this property is 10 dB. The residence along Calfass Road, west of Alternative 2, will be impacted but to a slightly lesser extent (by 1 to 2 dB) than it would have been by Alternative 1.

Receivers R35 and R36 will increase by less than 5 dB and will experience a minor impact. R37 is expected to have a moderate noise impact (5 dB) for this alternative.

R38 and R39 are expected to have a moderate noise impact. The sound level increases at R38 and R39 are approximately 8 and 5 dB, respectively. R39 is situated west of a dense wood lot where additional noise attenuation is provided by the trees. Noise control mitigation has not been considered for R31 and R35 to 39 due to the limited number of properties impacted by Alternative 2.

This alternative runs adjacent to the Telfer Glen Subdivision where significant noise impact (greater than 5 dB) affects 19 properties (R40 to R42). Given the number of receivers impacted by the overall roadway noise, noise mitigation (acoustic barriers consisting of fencing and earth berming) has been considered for this area as shown in Appendix A, Figure 2). Mitigation measures for the Telfer Glen Subdivision are discussed in the section, "Potential Noise Mitigation Measures".

The following tables summarize the noise impact for Alternative 2:

TABLE 4 - SUMMARY OF IMPACTED PROPERTIES - ALTERNATIVE 2				
Highway 6	Number of Houses v. Increase Over Ambient (dB)			
Alternative	3-4 dB	5-9 dB	> = 10 dB	Total
2	8	18	10	36

TABLE 5 - SUMMARY OF PROJECTED SOUND LEVELS - ALTERNATIVE 2					
Highway 6	Number of Houses v. Projected Sound Level (dB)				
Alternative	45-49.9 dB	50-54.9 dB	55-59.9 dB	60-64.9 dB	Total
2	2	18	15	1	36

Alternative 3

This alternative is quite similar to Alternative 2, except in the area north of Crieff Road, and thus the noise impact is the same for all receivers as noted above with the exception of R31. At that point, the alignment shifts so that the amount of shielding of the road noise by the existing topography and setback is increased from 150 to 300m. The noise impact for R31 is considered moderate for this alternative at 5 dB (compared to 11 and 10 dB for Alternatives 1 and 2, respectively).

The same potential for noise mitigation measures for the Telfer Glen Subdivision, as outlined for Alternative 2, will apply to this alternative as well.

The following tables summarize the noise impact for Alternative 3:

TABLE 6 - SUMMARY OF IMPACTED PROPERTIES - ALTERNATIVE 3				
Highway 6	Number of Houses v. Increase Over Ambient (dB)			
Alternative	3-4 dB	5-9 dB	> 10 dB	Total
3	8	19	9	36

TABLE 7 - SUMMARY OF PROJECTED SOUND LEVELS - ALTERNATIVE 3					
Highway 6	Number of Houses v. Projected Sound Level (dB)				
Alternative	45-49.9 dB	50-54.9 dB	55-59.9 dB	60-64.9 dB	Total
3	2	19	14	1	36

The following table summarizes the noise impact for the three alternatives:

TABLE 8 - SUMMARY OF NOISE IMPACTS (ALT's 1, 2, and 3)			
RECEIVER ID - PROPERTY OWNER	NOISE IMPACT (dB) ALT 1	ALT 2	ALT 3
R12 - Segota	+5.9	+5.9	+5.9
R18 - MacDonald	-5.0	-5.0	-5.0
R19 - Marks	-5.3	-5.3	-5.3
R20 - Nichol	-5.1	-5.1	-5.1
R22 - Brown	-3.6	-3.6	-3.6
R27 - Godfree	+7.9	+7.9	+7.9
R28 - Patterson	+5.4	+5.4	+5.4
R29 - Stewart	+8.8	+9.0	+9.0
R30 - Hilborn	+9.1	+9.3	+9.3
R31 - H. A. Stewart	+10.6	+10.1	+5.0
R35 - Townsend-McKinnon	+5.5	+3.8	+3.8
R36 - Bill	+5.0	+4.1	+4.1
R37 - Morriston Park Nursing Home	+6.7	+5.3	+5.3
R38 - Krusch	+10.9	+8.3	+8.3
R39 - Descary	+9.5	+5.0	+5.0
R40 - 9 Properties, west side of Settlers Court	+5.9	+10.0	+10.0
R41 - 2 Properties, NW corner of Subdivision (ALT 1) 3 Properties, NW corner of Subdivision (ALT 2,3)	+5.9	+7.0	+7.0
R42 - 7 Properties, east side of Settlers Court	+3.6	+6.0	+6.0
R43 - 2 Properties, SE corner of Settlers Crt/Telfer Glen Street	+3.3	+4.4	+4.4

TABLE 8 - SUMMARY OF NOISE IMPACTS (Continued)			
RECEIVER ID - PROPERTY OWNER	NOISE IMPACT (dB) ALT 1	ALT 2	ALT 3
R44 - 5 Properties, North side of Telfer Glen Rd (ALT 1) 4 Properties, North side of Telfer Glen Rd (ALT 2,3)	+2.8	+2.6	+2.6
R45 - 3 Property, North side of Telfer Glen Rd (at bend)	+0.2	+0.1	+0.1

2.2 Highway 401

To accommodate the realignment of Highway 6 along Highway 401, extended ramps are proposed between Hanlon Expressway and Highway 6 south. The Ministry of Transportation is also planning, as a separate project, to upgrade the core and collector lanes of Highway 401 between Highway 6 and the Hanlon Expressway. As the projected volume through this section of Highway 401 is to remain the same with or without the realignment of Highway 6, the net increase in the sound levels to the environment is acoustically insignificant (about +0.2 dB). Two properties (R46 and R51) are located along the south side of Highway 401 and were the reference points for determining the sound environment. Since the total pavement width this section is increasing symmetrically within the R-O-W, the total acoustic energy remains virtually the same and therefore, no noise impact is expected at any property.

The following tables summarize the noise impact for Highway 401:

TABLE 9 - SUMMARY OF NOISE IMPACT FOR HIGHWAY 401 EXTENDED RAMPS		
	Number of Houses v. Increase Over Ambient (dB)	
Roadway	< 3 dB	> = 3 dB
Highway 401	2	0

TABLE 10 - SUMMARY OF PROJECTED SOUND LEVELS FOR HIGHWAY 401 EXTENDED RAMPS			
	Number of Houses v. Projected Sound Level (dB)		
Roadway	55-59.9 dB	60-64.9 dB	65-69.9 dB
Highway 401	0	0	2

2.3 Hanlon Expressway/County Road 34

A screening study was prepared previously that reviewed the feasibility of various scenarios in the Hanlon Expressway/County Road 34. As a result of this analysis, two alternatives are being considered in this report. These two alternative interchanges evaluated in detail were Alternatives 5 Modified and Alternative 7. There are four properties (R47 to 50) in the area that may be affected by the alternatives.

Alternative 5 Modified is configured with a connection road, which terminates 415m west of the Hanlon Expressway. The County Road 34/connection road will pass adjacent to R50 where the sound level increase compared to the "Do Nothing" option is acoustically minor (less than 2 dB) due to the new road being in a cut section. There is no impact and mitigation is not required.

The sound level increases for Alternative 7 are acoustically insignificant (less than 0.2 dB), and no noise impact is generated. The contribution to the overall sound levels from the ramp alternatives is minor compared to the Hanlon Expressway.

The sound levels will be below MOEE's 55 dB L_{eq} for the four properties reviewed for these two alternatives.

The following tables indicate the number of residences and summarize the type of noise impact anticipated for Alternatives 5 Modified and 7.

TABLE 11 - SUMMARY OF NOISE IMPACT FOR HANLON EXPRESSWAY/COUNTY ROAD 34 ALTERNATIVES		
	Number of Houses v. Increase Over Ambient (dB)	
Alternative	< 3 dB	> = 3 dB
5 Modified	4	0
7	4	0

TABLE 12 - SUMMARY OF PROJECTED SOUND LEVELS FOR HANLON EXPRESSWAY/COUNTY RD 34 ALTERNATIVES			
	Number of Houses v. Projected Sound Level (dB)		
Alternative	45-49.9 dB	50-54.9 dB	55-59.9 dB
5 Modified	2	2	0
7	2	2	0

TABLE 13 - SUMMARY OF NOISE IMPACTS FOR (ALT 5 MODIFIED AND 7)		
	NOISE IMPACT (dB)	
RECEIVER ID - PROPERTY OWNER	ALT 5 MOD	ALT 7
R47 - E. Wozniak	+0.1	+0.1
R48 - J. Petrusa	+1.6	+0.2
R49 - M. Petrusa	+0.2	0.0
R50 - D. Rafuse	+1.7	+0.1

2.4 POTENTIAL NOISE MITIGATION MEASURES

The MTO/MOEE Protocol considered noise mitigation where the incremental sound level increase may be 5 dB or greater. MTO will consider installing noise mitigation where it is administratively, economically and technically feasible. Barriers (any combination of berm and acoustic fence is acceptable) are normally considered for areas where there will be a number of properties benefitting from the installation by an average of at least 5 dB.

In the case where only two or three properties are involved (such as R28 to R31 or R36 to 39), and because of the size (both height and length) of any serious mitigation attempt (i.e. achieving at least 5 dB insertion loss), the mitigative measure is not considered economically justified. To achieve 5 dB of reduction, the barriers must typically be 3-4 metres in height and usually at least twice the length of the distance between the road and the receiver. Usually, the mitigation only becomes viable when there is a higher density of residential use, such as a subdivision exposed to the sound.

In this case, the one area where this condition might apply is the Telfer Glen Subdivision (R40 and R41). The noise barrier would extend approximately 650 metres in length along MTO's R-O-W, wrapping along Calfass Road and the "connection" road. The general location of the proposed noise barrier is shown in Appendix A, Figure 2. As there would already be some barrier effect due to the existing topography and the low grades in the area where the barrier might be erected, attaining an additional 5 dB insertion loss will require barriers 10m above

existing grades. As Highway 6 is in a cut at the connection road (for Alternatives 2 and 3), additional barriers will provide diminishing acoustic benefits. The sound levels from all roadways are just above 55 dB L_{eq} for the properties (R40 and R41) adjacent to Highway 6's eastern R-O-W.

Due to the varying topography between the Highway 6 alignment and the Telfer Glen Subdivision, significant earth filling at any point the barrier might be placed would be necessary to achieve the required barrier insertion losses with a reasonable height of acoustic fence. It may become possible to install such a barrier if enough excess material is generated during construction to raise the grades. While such an outcome is not probable, it is recommended that this section of roadway be reviewed more fully once detail design has been carried far enough along to permit accurate assessment of the vertical alignment and cut and fill conditions at this point. There is a small possibility that an effective noise barrier might be made to be practical. At this time, the costs appear prohibitive, but if there were a large surplus of fill material available at low cost and agreement on regrading the lands, a barrier might be practical.

2.5 OTHER REQUIREMENTS

Besides the ongoing potential noise impact from the new project, the MOEE/MTO Protocol also reflects the concern that undue noise impacts from the construction of the project not be created. A preliminary review of the type of construction required indicates that one would not anticipate unusual needs or concerns along the preferred corridor. The standard MTO requirements are that contractors' equipment be in good repair with activities and noise control elements such as engine mufflers consistent with "good practice." Off-Road Equipment may be specified as meeting *NPC-115* of the Model Municipal Noise Control Bylaw (85 dB maximum at 15 metres). The operation of equipment should be limited to 0700 to 1900 hours, except in the case of emergency, for the duration of the construction period, unless the construction is greater than 400 metres from residential areas.

3.0 CONCLUSIONS

The noise impact generated by the proposed alternatives is considered to be modest. There are a number of properties along the existing Highway 6 alignment that will experience a significant reduction in the sound levels compared to the "Do Nothing" scenario. Along the three alternatives to the existing route, there are a number of individual houses, as well as one cluster of homes in a small subdivision, that are anticipated to show 5 dB or more impact due to the project (all 3 alternatives). For most and perhaps all locations, however, noise barriers would not be cost effective in terms of MTO's mitigation policy.

Alternative 1 would cause a moderate to significant noise impact of 5 to 11 dB for receptors R27 to R41 (21 properties in total). Mitigation measures are not likely to be feasible here since a noise barrier (approximately 4m high) would be needed along both sides of the MTO R-O-W for an estimated total length of 2 to 2.5 km. Alternative 2 would cause a moderate to significant noise impact for properties R27 to R31 and R37 to R42 (27 properties in total). Alternative 3 provides virtually the same impact for all properties as Alternative 2, with the exception of R31, where the impact is reduced from a significant to a moderate noise impact. At the Telfer Glen Subdivision, however, there is the possibility that a barrier could be justified for Alternatives 2 and 3 if there were a large amount of fill available for the earth berming. This area should be re-examined at the time of detail design in the case that Alternative 2 or 3 is selected as the preferred option.

The modifications along Highway 401 between Highway 6 South and the Hanlon Expressway will not create a noise impact.

Two alternative interchanges at the Hanlon Expressway and County Road 34 were evaluated in detail: Alternatives 5 Modified and 7. The increment in the sound levels is considered to be minor (less than 2 dB) for Alternative 5 Modified. The incremental increase in the sound levels due to Alternative 7 is acoustically insignificant (0.2 dB). Noise mitigation is not recommended.

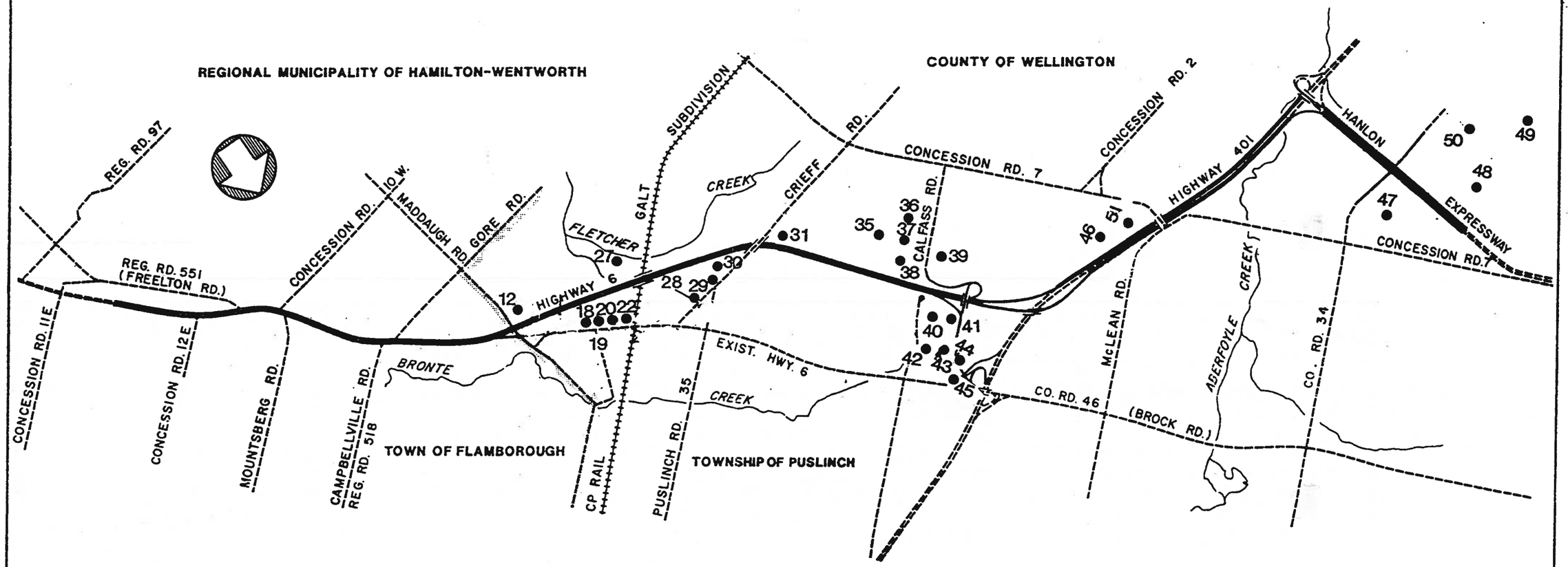
A preliminary review of the type of construction required indicates that one would not anticipate unusual needs or concerns along the preferred corridor. The standard MTO requirements are that contractors' equipment be in good repair with activities and noise control elements such as engine mufflers consistent with "good practice."

4.0 RECOMMENDATIONS

Based on the analysis, the following recommendations are proposed:

1. At the Telfer Glen Subdivision (R40 to R42), Alternatives 2 and 3 would be preferred acoustically, provided it became feasible to construct a noise barrier. In the case that erecting a noise barrier is not practical due to extensive fill and barrier length requirements, then Alternative 1 is preferred for the Telfer Glen Subdivision area as the incremental change in the sound levels will be reduced by 2 to 4 dB for the 19 properties represented by R40 to R42.

2. For the interchange at Regional Road 34, Alternative 7 provides the smallest increment in the sound levels for the affected residences and thus would be preferred acoustically. It should be noted, however, that the sound level change generated by Alternative 5 Modified is considered to be acoustically minor (2 dB). Since changes in the overall traffic noise of less than 3 dB are not reliably detected by the general population, both Alternatives 5 Modified and 7 could be considered acoustically acceptable.



HIGHWAY 6
FREELTON TO GUELPH
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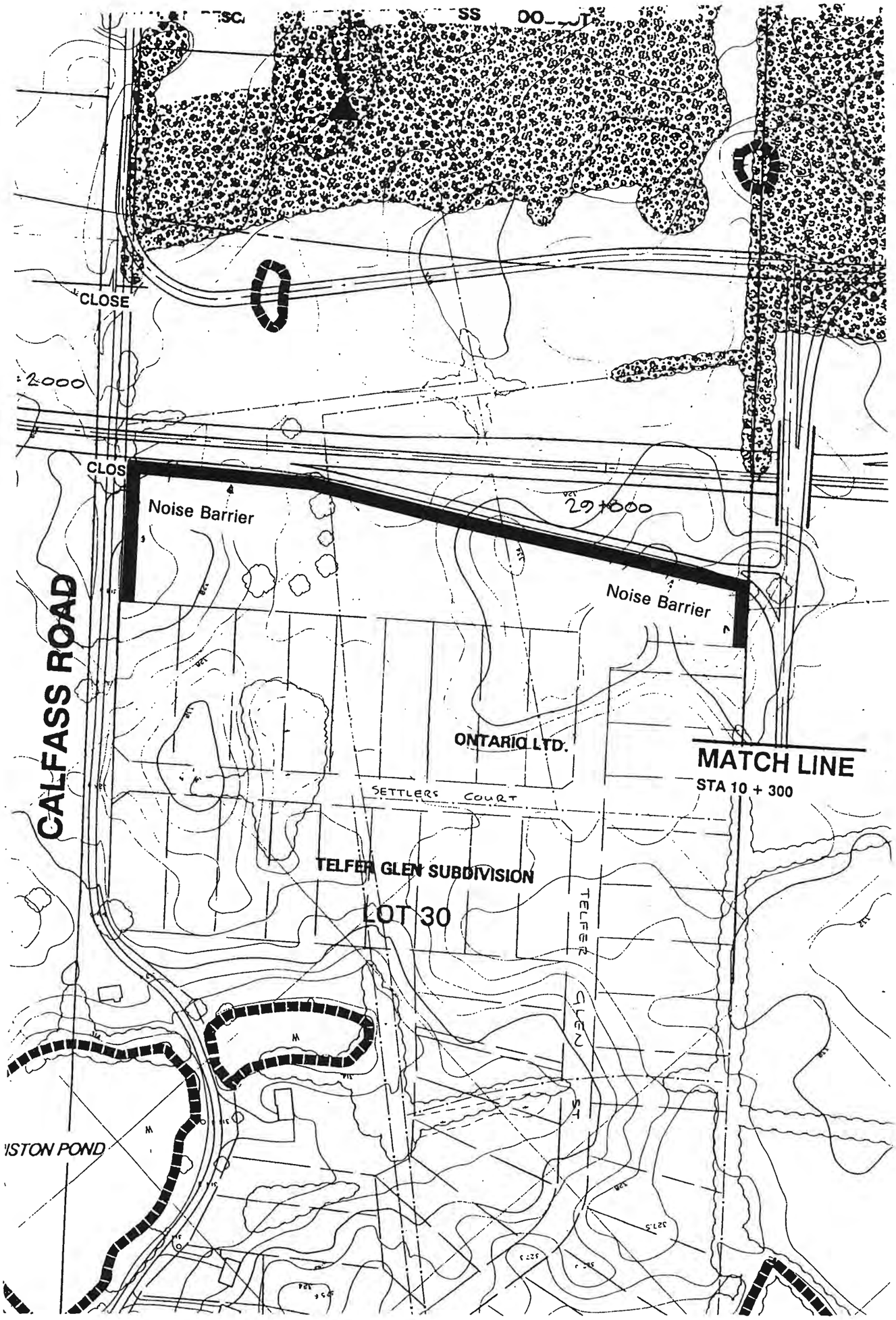
& Preliminary Design Report

LEGEND:
● 1 RECEIVER LOCATION

FIGURE 1

NOISE RECEIVER LOCATIONS



PRELIMINARY NOISE MITIGATION MEASURES

Alternatives 2 and 3

FIGURE 2

APPENDIX B - TRAFFIC DATA

TRAFFIC DATA			
ROADWAY	**CONDITION**	**YEAR**	**AADT**
Hanlon Expressway	Do Nothing	2011	28,900
Hanlon Expressway	With Preferred Alternative	2011	28,900
Highway 6 South	Do Nothing (Existing Alignment)	2011	26,440
Highway 6 South	With Preferred Alternative	2011	18,900
Highway 401	Do Nothing	2011	93,600
Highway 401	With Preferred Alternative	2011	93,600

Notes:

1. AADT is an acronym for Average Annual Daily Traffic. For the sound calculations on this project, the AADT is higher than the SADT (Summer Average Daily Traffic).
2. The posted speed limit assumed was 100 km/hr.
3. There will be 18% commercial vehicles on Highway 6 with a 60/40 split between heavy and medium trucks (as reported in the Preliminary Design Report).

Notes:

a. If initial calc indicates ambient <45 dB, 45 dB is assumed
b. West designation refers to those receptors on west side of MTO R-O-W.
c. East designation refers to those receptors on east side of MTO R-O-W.

	R12W	R27W	R31W	R35W	R36W	R37W	R38W	R39W
ALT 1 - West	62.4	52.1	55.2	49.1	48.3	50.6	55.5	54.0
Existing Hwy 6	51.4	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Total	62.7	52.9	55.6	50.5	50.0	51.7	55.9	54.5
ALT 2 - West	62.4	52.1	54.7	46.6	47.0	48.9	52.6	48.4
Existing Hwy 6	51.4	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Total	62.7	52.9	55.1	48.9	49.1	50.4	53.3	50.0
Change (1 ->2)	0.0	0.0	0.5	1.6	0.8	1.3	2.6	4.5

	R18E	R19E	R20E	R22E	R28E	R29E	R30E	R40E	R41E	R42E	R43E	R44E	R45E
ALT 1 - East	56.4	56.0	56.0	56.6	52.4	54.5	54.6	50.8	54.4	47.3	50.1	53.4	54.9
Existing Hwy 6	66.0	71.9	68.1	59.1	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Total	66.5	72.0	68.4	61.0	53.1	55.0	55.1	51.8	54.9	49.3	51.3	54.0	55.3
ALT 2 - East	56.3	56.0	55.9	56.5	52.4	54.8	54.9	55.6	55.7	50.7	51.5	53.2	54.8
Existing Hwy 6	66.0	71.9	68.1	59.1	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Total	66.4	72.0	68.4	61.0	53.1	55.2	55.3	56.0	56.1	51.7	52.4	53.8	55.2
Change (1 ->2)	0.0	0.0	0.0	0.0	0.0	-0.3	0.3	-4.1	-1.2	-2.4	-1.1	0.2	0.1

	R12W	R18E	R19E	R20E	R22E	R27W	R28E	R29E	R30E	R31W	R35W	R36W	R37W	R38W	R39W	R40E	R41E	R42E	R43E	R44E	R45E
ALT 1	62.7	66.5	72.0	68.4	61.0	52.9	53.1	55.0	55.1	55.6	50.5	50.0	51.7	55.9	54.5	51.8	54.9	49.3	51.3	54.0	55.3
DO NOTHING 2011	56.8	71.4	77.3	73.5	64.6	45.0	47.7	46.2	46.0	45.0	45.0	45.0	45.0	45.0	45.0	45.9	49.0	45.7	48.0	51.2	55.1
Change	5.9	-4.9	-5.3	-5.1	-3.6	7.9	5.4	8.8	9.1	10.6	5.5	5.0	6.7	10.9	9.5	5.9	5.9	3.6	3.3	2.8	0.2
Impact	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No

	R12W	R18E	R19E	R20E	R22E	R27W	R28E	R29E	R30E	R31W	R35W	R36W	R37W	R38W	R39W	R40E	R41E	R42E	R43E	R44E	R45E
ALT 2	62.7	66.4	72.0	68.4	61.0	52.9	53.1	55.2	55.3	55.1	48.9	49.1	50.4	53.3	50.0	56.0	56.1	51.7	52.4	53.8	55.2
DO NOTHING 2011	56.8	71.4	77.3	73.5	64.6	45.0	47.7	46.2	46.0	45.0	45.0	45.0	45.0	45.0	45.0	45.9	49.0	45.7	48.0	51.2	55.1
Change	5.9	-5.0	-5.3	-5.1	-3.6	7.9	5.4	9.0	9.3	10.1	3.9	4.1	5.4	8.3	5.0	10.1	7.1	6.0	4.4	2.6	0.1
Impact	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No

	R12W	R18E	R19E	R20E	R22E	R27W	R28E	R29E	R30E	R31W	R35W	R36W	R37W	R38W	R39W	R40E	R41E	R42E	R43E	R44E	R45E
ALT 3	62.7	66.4	72.0	68.3	61.0	52.9	53.1	54.9	54.3	50.0	48.8	49.1	50.3	53.2	50.0	55.9	56.0	51.7	52.3	53.8	55.2
DO NOTHING 2011	56.8	71.4	77.3	73.5	64.6	45.0	47.7	46.2	46.0	45.0	45.0	45.0	45.0	45.0	45.0	45.9	49.0	45.7	48.0	51.2	55.1
Change	5.9	-5.0	-5.3	-5.2	-3.6	7.9	5.4	8.7	8.3	5.0	3.8	4.1	5.3	8.2	5.0	10.0	7.0	6.0	4.3	2.6	0.1
Impact (>=5 dB)	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No

HIGHWAY 401 EXTENDED RAMPS

	R46	R51
EXTEND RAMPS	65.7	66.9
EXISTING CONFIGURATION	65.6	66.7
	----	----
Change	0.1	0.2
Impact (>=5 dB)	No	No

APPENDIX D - EXPLANATION OF TERMS

The following are a means of assessing the changes in community sound levels where such changes are indicated by a change in the L_{eq} or average sound energy index.

L_{eq}

The L_{eq} is defined as the mean energy of the sound level averaged over the measurement period. It can be considered as the continuous steady sound level which would have the same acoustic energy as the real fluctuating noise measured over the same period of time.

1 dB CHANGE

For sounds presented to a listener, one immediately following the other, a 1 dB change is the smallest increment which can be reliably detected by the general population. If the time delay between presentation of the sounds is more than a few seconds, the change is not reliably detected (i.e. the community is not sensitive to a 1 dB change occurring over 1 year's time). In environmental noise, a 1 dB change occurs with an increase in traffic of 25% (all other traffic parameters unchanged).

3 dB CHANGE

An increase in the L_{eq} of 3 dB is reliably detected by most listeners and is the smallest change considered significant by most planning authorities. It is also the smallest change in the overall L_{eq} (all sounds combined) which can be reliably detected by standard noise monitoring techniques. A doubling of traffic in a community will cause a 3 dB change if traffic is the only major noise source.

5 dB CHANGE

An increase in the overall L_{eq} of 5 dB represents a relatively significant impact in terms of overall L_{eq}, particularly if an area is already at, or above daytime L_{eq} of 55 dB.

10 dB CHANGE

A 10 dB increase in overall L_{eq} represents a doubling in the loudness of the sound and represents a major impact on an urban community especially if the levels are already above 50 L_{eq}.

STAMINA

The *STAMINA* programme performs the highway traffic noise predictions based on the FHWA Highway Noise Prediction Method. Sound level calculations were carried out on Vanderbilt University's *STAM2VU1* (Version 1.30) noise prediction programme. This is a modified version of the FHWA Version 3 (March 1983) *STAMINA* programme. The roadways, barriers and receivers are mapped out in a 3 dimensional model (X,Y,Z co-ordinates). Ground effect is entered for each receiver/roadway pair. It was assumed that the ground effect term, alpha, is 0.66 for flat ground to be consistent with MOEE's noise modelling practice. Where the receiver or roadway was elevated, an alpha value of 0.30 was used. The alpha factor is set to 0 when a barrier intersects line-of-sight between the receiver and the roadway traffic. The model uses the basic traffic parameters such as the numbers of light, medium and heavy vehicles, gradients, speed limits and topographical features such as setbacks and shielding by berms and fences to calculate the sound levels (L_{eq}) for each receiver location.

APPENDIX E - REFERENCES

1. Vanderbilt University, *STAM2VU1* (Version 1.30) noise prediction computer program. This is a modified version of the FHWA Version 3 (March 1983) *STAMINA* programme."

2. Ministry of Transportation, "Environmental Office Manual - Technical Areas - Noise EO-V-1000-00".

3. Fenco MacLaren Inc., "Traffic Projections - Highway 6, Freelton to Guelph, Update and Supplementary Investigation for Route Location and Preliminary Design, W.P. 65-76-05, March 1993".

HIGHWAY 6

FREELTON TO GUELPH

W.P. 65-76-05

Preliminary Design Noise Evaluation

1988
Ministry of Transportation
Central Region, Planning and Design

Dan McKnight
Environmental Planner (Noise)

Preliminary Design Noise Evaluation

Introduction

This evaluation has been undertaken as part of the environmental assessment associated with W.P. 65-76-05.

Background information on the preliminary design of Highway 6 was forwarded to MTO by Fenco consultants. This information consisted of the following:

1) Plans of the preferred alignment showing elevation contours and homes within 600 metres of the right-of-way (Scale 1:2000).

2) Traffic Data for the ambient and post construction conditions (base year was 2004).

3) Information on posted speeds in the area.

Based upon this information, noise predictions were generated through the use of the Ministry approved Stamina 2.0 model. A set of noise predictions were calculated for the ambient condition (year 2004 without Highway 6) and the post construction condition (year 2004 with Highway 6). Plans illustrating the locations of homes and printouts of predicted noise levels are available from the Planning and Design office of Central Region, MTO. A schematic map is attached in order to identify noise prediction receiver locations (residential 'backyards').

Methodology

The existing "Noise Protocol" between MOE and MTO provides a basis for assessing noise impacts and identifying mitigation. The MTO Ministry Directive "A-1" further outlines the procedures for impact assessment and the warrants for appropriate noise mitigation.

These documents indicate that a noise increase of more than 5 decibels (dB) over the "ambient" of a residential receiver is grounds for considering possible mitigation. An impact of over 5 decibels is considered to be a "significant" noise increase. The provincial objective for outdoor noise levels adjacent to new highways is 55 dBA per day. If noise mitigation is applied it should achieve at least a 5 decibel noise reduction. The objective of noise mitigation is to reduce levels as close as possible to the lower of the provincial objective (55 dBA) or the "ambient" condition.

Noise Table

The results of the Stamina 2 noise prediction of potential noise impacts is summarized in the noise table attached to the end of this report. This table was compiled for residences which were within 600 metres of the alignment centreline. By agreement with MOE, the lowest ambient allowed for rural areas was 45 decibels and for hamlets, 50 decibels. Noise predictions below this level were disregarded and the agreed upon ambients were substituted.

This noise table has been summarized into the table illustrated in Figure 1. As it can be seen from this noise table, about 14 homes will experience a slight decrease in noise level. This will occur as some traffic is redirected from the old Highway 6 to the new alignment.

Thirteen homes along the newly aligned Highway 6 will experience a significant noise level increase (in excess of 5 decibels). These homes are located at Maddaugh Road and new Highway 6 (2 homes), Crieff Road and new Highway 6 (5 homes), Calfass Road and new Highway 6 (3 homes), and County Road 34 and the Hanlon Expressway (3 homes).

Mitigation

Noise mitigation within the right-of-way which could be applied to the 18 homes with significant (greater than 5 dBA) noise impacts consists of noise barriers (earth berms and walls), quiet pavement types, and shifts in the horizontal and vertical alignment of the pavement.

For most of the alignment noise barriers would not be technically feasible. This is a result of the great cost involved in the construction of noise barriers for single isiated farm houses set back significantly from the highway. Constructing noise barriers for residences in these locations would not be cost beneficial. The only location on the new alignment where a case for a noise barrier could conceivably be made is for the homes of Billingsly, Stewart and Patterson at Crieff Road and the new Highway 6. Any potential barrier in this location would be at least 750 metres in length and cost approximately $225,000. The study team should make a decision as to whether this cost of approximately $75,000 per residence is in excess of the ptential benefit. Another noise analysis can be performed to determine if any potential noise barrier would provide the required 5 decibel noise reduction (this is unlikely with a setback distance of approximately 125-175 metres from the new Highway 6). My best recommendation for this site is not to provide a noise barrier due to the poor cost benefit ratio, low potential effectiveness of a barrier, and the precedent setting nature of a barrier in this location.

Shifts in the horizontal alignment of the pavement as a form of noise mitigation have been ruled out as the horizontal alignment is fixed due to other environmental and engineering concerns. Shifts in the vertical alignment of the pavement will occur at Crieff Road and the new Highway 6. This will marginally reduce noise levels in the area (approximately a 3 to 4 decibel reduction). A vertical alignment shift, as a form of noise mitigation, is not an option in other areas due to cut and fill considerations.

The use of quiet pavements such as OFC is restricted to urban or built-up areas. It is anticipated therefore, that it will not be an option for this project. If used, quiet pavements can reduce noise levels by 2 to 3 decibels in comparison to normal asphalt pavements.

Construction Noise

The environmental assessment document should contain statements regarding the MTO-MOE construction noise protocol. If complaints about construction nose do arise during the construction of this highway, MTO will investigate according to the provisions of this agreed upon protocol. General noise control measures will be included into the contract package for the Highway 6 project.

Outstanding Noise Concerns

This analysis is complete except for the following information which has not been supplied:

1) The location of any noise sensitive areas from any local municipal noise bylaw (perhaps the nursing home at Calfass Road and new Highway 6).

2) The location of any draft approved subdivision prior to the route designation.

Resultant Noise Level dBA	Decrease under Ambient dBA	Increase over Ambient (dBA) 0 - 5	6 - 10	11 - 15	+16	Totals
71+						0
66-70		5				5
61-65		6				6
56-60	3*	7	2	3		13
51-55	7	2	8			17
45-50	6	3				9
Totals	16	23	10	3		59

*More homes in Morriston will have reduced noise levels but not included in this table because they are outside the 600m study area.

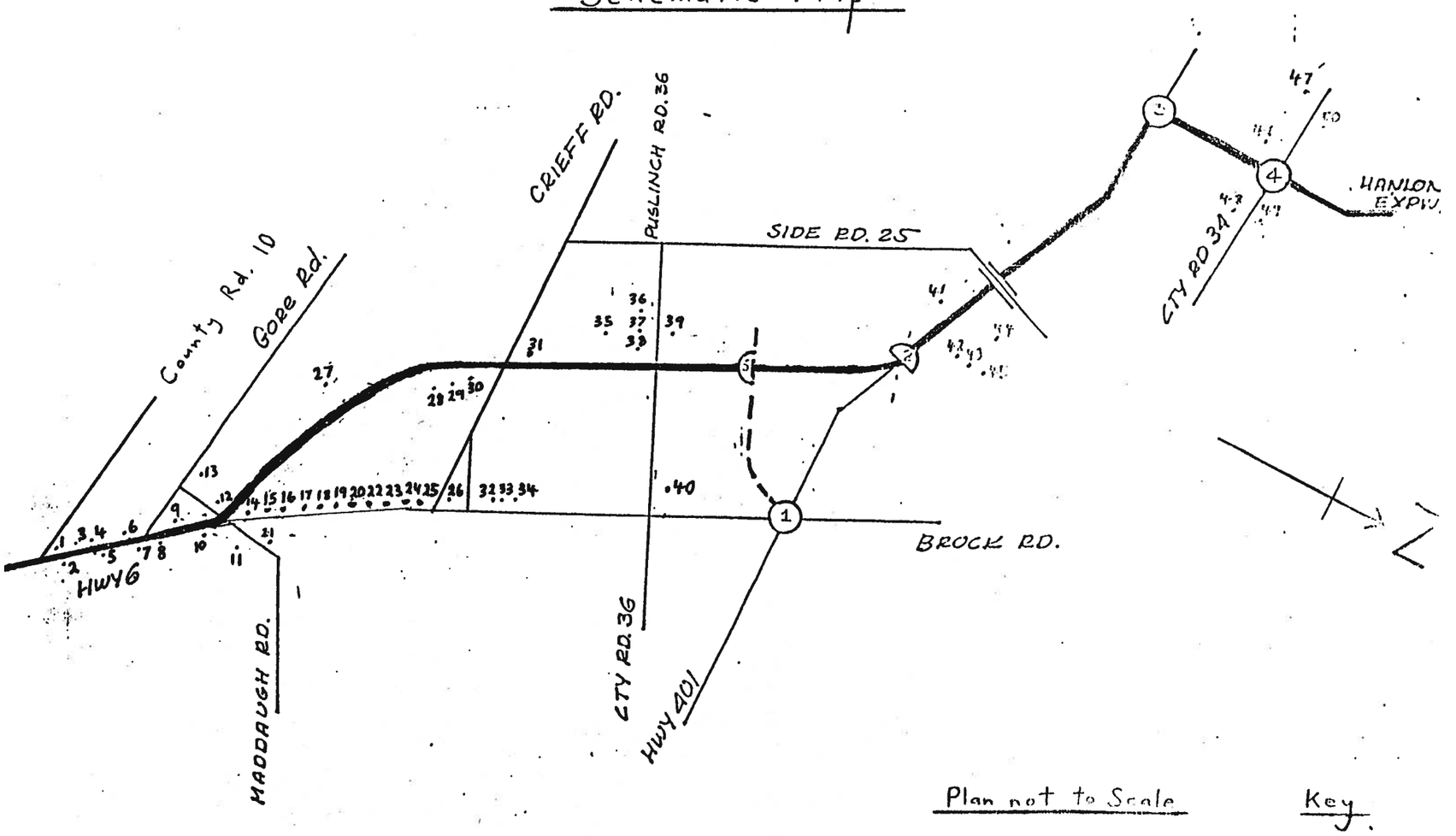
Figure 1: Summary of Noise Impacts for the Preliminary Design of Highway 6

RECEIVER SITE NO.	GENERAL LOCATION	2004 - NO. 6 AVE LEG (24) dBA AMBIENT	2004 - INC NO.6 NO MITIGATION AVG. LEQ (24) FUTURE	2004 - CHANGE IN NOISE LEVEL DUE TO 6, CHANGE (dB)	PROPOSED MITIGATION MEASURES	2004 - INCL. 6 WITH MITIGATION AVE LEQ (24)	IMPROVEMENT DUE TO MITIGATION AVG. LEQ (24)
1		60.5	62.8	2.3	None	62.8	0
2	"	64.3	66.5	2.2	"	66.5	0
3	"	59.6	61.9	2.3	"	61.9	0
4	"	60.4	62.7	2.3	"	62.7	0
5	"	60.1	62.3	2.2	"	62.3	0
6	Hwy. 6 and Gore Rd.	62.9	65.1	2.2	"	65.1	0
7	"	63.6	65.9	2.3	"	65.9	0
8	"	63.8	66.1	2.3	"	66.1	0
9	Hwy. 6 and Maddaugh Rd.	66.2	68.1	1.9	"	66.1	0
10	"	64.9	65.1	0.2	"	65.1	0
11	"	58.1	57.9	- 0.2	"	57.9	0
12	"	53.2	60.4	7.2	"	60.4	0
13	"	48.1	54.6	6.5	"	54.6	0
14	"	58.6	60.4	1.8	"	60.4	0
15	"	58.8	58.6	- 0.2	"	58.6	0
16	"	62.9	54.4	- 8.5	"	54.4	0
17	"	60.1	51.9	- 8.2	"	51.9	0
18	"	62.7	51.1	-11.6	"	51.1	0
19	"	63.6	50.8	-12.8	"	50.8	0
20	"	63.6	50.6	-13.0	"	50.6	0
21	"	62.3	57.3	- 5.0	"	57.3	0
22	"	58.7	51.4	- 7.3	"	57.3	0

RECEIVER SITE NO.	GENERAL LOCATION	2004 - NO.6 AVE LEG (24) dBA AMBIENT	2004 - INC NO. 6 NO MITIGATION AVG. LED (24) FUTURE	2004 - CHANGE IN NOISE LEVEL DUE TO 6, CHANGE (dB)	PROPOSED MITIGATION MEASURES	2004 - INCL. 6 WITH MITIGATION AVE LEQ (24)	IMPROVEMENT DUE TO MITIGATION AVG. LEQ (24)
23	Hwy. 6 and Maddaugh Rd.	58.2	51.4	- 6.8	None	51.4	0
24	Old Hwy. 6 and Crieft	59.5	50.3	- 9.2	"	50.3	0
25	"	59.8	49.2	-10.6	"	49.2	0
26	"	55.3	50.0	- 5.3	"	50.0	0
27	"	45.0	52.3	7.3	"	52.3	0
28	New 6 and Crieft Rd.	45.7	55.5	9.8	Roadway Cut	52.6	2.9
29	"	45.0	57.4	12.4	"	53.6	3.8
30	"	45.0	58.0	13.0	"	54.2	3.8
31	"	45.0	57.0	12.0	"	53.2	3.8
32	Old 6 and Crieff Rd	59.7	47.0	-12.7	None	47.0	0
33	"	59.2	46.8	-12.4	"	46.8	0
34	"	60.6	46.3	-14.3	"	46.3	0
35	New 6 and Pasline Rd.	45	52.9	7.9	"	52.9	0
36	"	45	49.6	4.6	"	49.6	0
37	"	45	48.8	3.8	"	48.8	0
38	"	45	52.9	7.9	"	52.9	0
39	"	45	54.1	9.1	"	54.1	0
40	"	45	46.1	1.1	"	46.1	0
41	Hwy. 401 and Concession 7	64.0	66.0	2.0	"	66.0	0
42	"	56.0	57.0	1.0	"	57.0	0
43	"	55.0	56.0	1.0	"	56.0	0
44	"	55.0	56.0	1.0	"	56.0	0

RECEIVER SITE NO.	GENERAL LOCATION	2004 - NO. 6 AVE LEG (24) dBA AMBIENT	2004 - INC NO. 6 NO MITIGATION AVG. LED (24) FUTURE	2004 - CHANGE IN NOISE LEVEL DUE TO 6, CHANGE (dB)	PROPOSED MITIGATION MEASURES	2004 - INCL. 6 WITH MITIGATION AVE LEQ (24)	IMPROVEMENT DUE TO MITIGATION AVG. LEQ (24)
45	Hwy. 401 and Concession 7	54.0	55.0	1.0	None	55.0	0
46	Hanlan Expr. and County Rd. 34	54.5	61.0	6.5	"	61.0	0
47	"	51.1	56.5	5.4	"	56.5	0
48	"	50.4	53.1	2.7	"	53.1	0
49	"	48.9	55.0	6.1	"	55.0	0
50	"	47.6	53.6	6.0	"	53.6	0

Schematic Map



Plan not to Scale

Key

! Reserve Location

APPENDIX J

AGRICULTURAL IMPACT ANALYSIS (SUPPLEMENTARY)

Ministry of Transportation
Ontario

Environmental Technical Paper No.7

Supplementary Agricultural Investigations

Highway 6 Freelton to Guelph

Update and Supplementary Investigations for Route Location and Preliminary Design W.P. 65-76-05

DRAFT TECHNICAL PAPER

PLANNING & DESIGN SECTION

Fenco MacLaren Inc.

AGRICULTURE

1.0 DATA SOURCES, RELIABILITY AND INFORMATION GAPS

Agricultural Data for the Highway 6 - Freelton to Guelph Route Refinement was updated. Information on the nature and status of agricultural operations throughout the study area was reviewed during a reconnaissance survey conducted the first week of December, 1992. During the survey, detailed descriptions, including a photographic record, were prepared. In addition, a review of the Puslinch Official Plan was carried out.

2.0 DESCRIPTION

Agricultural operations

The following table provides descriptions, locations and owners of the farm operations surveyed. The location of each farm has been plotted (refer to appendices).

For the most part the farm operations have remained in the same state since last inventoried, however, a few changes have occurred. Most notably, the large dairy farm operated by the Visser's is no longer intact. All buildings and silos, with the exception of two implement sheds have been demolished. We understand that the farm has been sold to developers for future commercial development, although there is currently no application for such development before the Township. Also, the Buttand farms elderberry operation, that straddles the 401 at Concession 7, does not appear to be in operation. The area identified as market garden on OMAF land use systems mapping was being cultivated for soyabean and corn crops.

The Hollenbach beef/horse farm, the Sutton dairy farm and the Winer farm appear to have remained unchanged.

Table 1 - Agricultural Operations

Operation No.	Owner	Location	Description
1	B. Lillycrop	Gore Concession, Lot 36	♦ implement dealership ♦ bank barn - good condition ♦ steel clad implement shed ♦ steel grain bin ♦ 30' capped concrete silo ♦ no evidence of livestock
2	E. Hollenbach	Gore Concession, Lot 34, 35	♦ Long Lane Farms ♦ extensive beef and horse operation ♦ includes large stable
3	H. Stewart	Concession VII, Lot 34	♦ hobby horse farm ♦ steel clad pole barn ♦ implement shed
4	G. Sutton	Concession VII, Lot 35	♦ dairy operation (active) ♦ bank barn and extension in very good condition ♦ milkhouse ♦ implement shed ♦ capped concrete silo
5	W.D. Winer	Concession VII, Lot 33	♦ bank barn with 2 extensions ♦ 2 abandoned silos ♦ building in good condition ♦ no evidence of livestock
6	McKinnon-Townsend	Concession VII, Part Lot 32	♦ bank barn in good condition ♦ capped concrete silo ♦ no evidence of livestock
7	H. Stewart	Concession VII, Lot 31	♦ bank barn with an extension in fair condition ♦ small beef operation
8	W.D. Winer	Concession VII, Lot 30	♦ steel clad bank barn with an extension in good condition ♦ 2 concrete silos (one is capped) ♦ beef operation ♦ livestock observed
9	D. McMillan	Concession VII, Lot 29	♦ bank barn in fair condition ♦ no livestock ♦ no photo

Table 1 - Agricultural Operations

Operation No.	Owner	Location	Description
10	D.D. McKinnon	Concession VII, Lot 28	♦ bank barn with extension in fair to good condition ♦ steel clad implement silo ♦ 70' capped concrete silo ♦ 2 Butler grain storage bins ♦ no evidence of livestock
11	University of Guelph	Concession II, Lot 24	♦ bank barn in fair condition ♦ uncapped concrete silo ♦ wooden implement shed ♦ steel clad pole barn with attached feeder bin ♦ steel clad pole barn with 45' capped concrete silo ♦ approximately 40 ponies in pasture
12	Visser	Concession II, Lot 24	♦ 2 steel clad implement sheds
13	Wozniak	Concession III, Lot 23, 24	♦ bank barn with extension in fair condition ♦ small wooden implement shed ♦ no evidence of livestock
14	G & A Crow	Concession II, Lot 21	♦ hobby farm (sheep) ♦ bank barn with extension in fair condition ♦ attached milkhouse ♦ 60' uncapped concrete silo ♦ wooden implement shed ♦ appears to have once been a dairy operation
15	Petrusa	Concession III, Lot 21	♦ bank barn in good condition ♦ no livestock
16	A. Maggiolo	Concession III, Lot 21	♦ bank barn in fair condition ♦ no livestock
17	M. MacDonald	Concession III, Lot 22	♦ bank barn in good condition ♦ no evidence of livestock ♦ no photo

Review of the Puslinch Official Plan update, re: Rural/Agriculture land use designations

The Official Plan of Puslinch has created two designations to deal with agricultural lands. The first designation, Agriculture, includes those lands containing soils of high capability for agriculture (Class 1, 2 and large blocks of Class 3 land), and those lands supporting large agricultural operations. The second designation, Rural, includes areas of poorer quality soils with lower agricultural capability. These designated areas are illustrated on the enclosed Official Plan Schedule "A".

The goals and objectives of the designations are to ensure that agriculture remains the predominant land use in those areas. This is especially true for those lands designated agricultural. The Rural designations are considered less of priority for agricultural preservation.

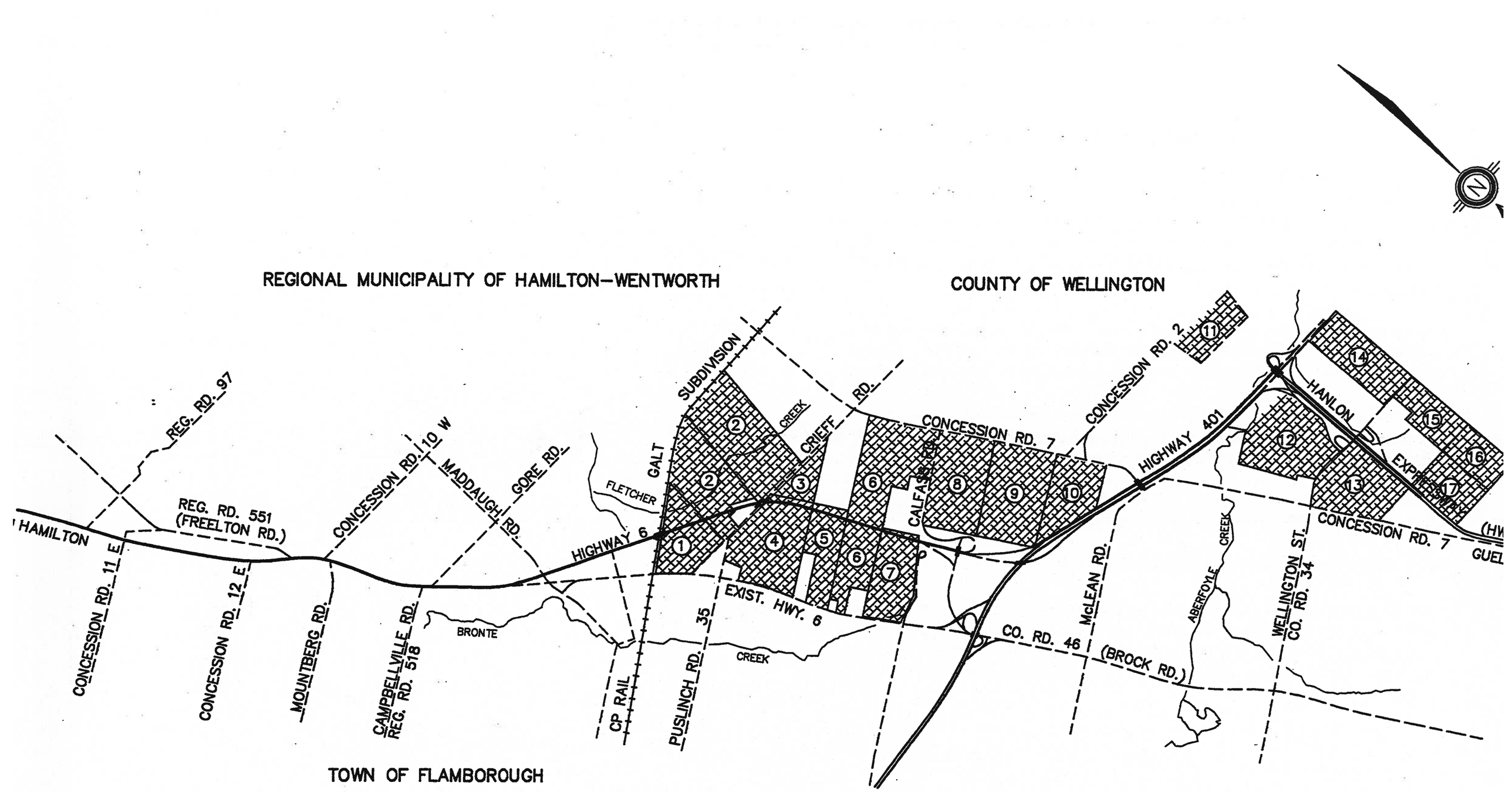
Both of these designations occur in the Study Area. This is especially true in the area south of Calfass Road where only the hamlet designation around Morriston is not designated rural or agricultural. The areas of agricultural designations include the Lillycrop, Hollenbach, Sutton, Stewart, Winer, and McKinnon (in parts) farms south of Calfass Road. Also included in the designation are portions of the Winer, McKinnon and McMillan farms south of the 401 and portions of the former Visser farm and the Wozniak farm north of the 401.

3.0 ENVIRONMENTALLY SENSITIVE AREAS/ISSUES

As noted above, there are a number of active agricultural operations throughout the study area. In many cases these operations represent a single source of livelihood. Thus, during the consideration of alternatives the amount of farmland taken out of production should be minimized. Farm severances which jeopardize the operational viability of a farm should be avoided, where possible.

REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH

COUNTY OF WELLINGTON



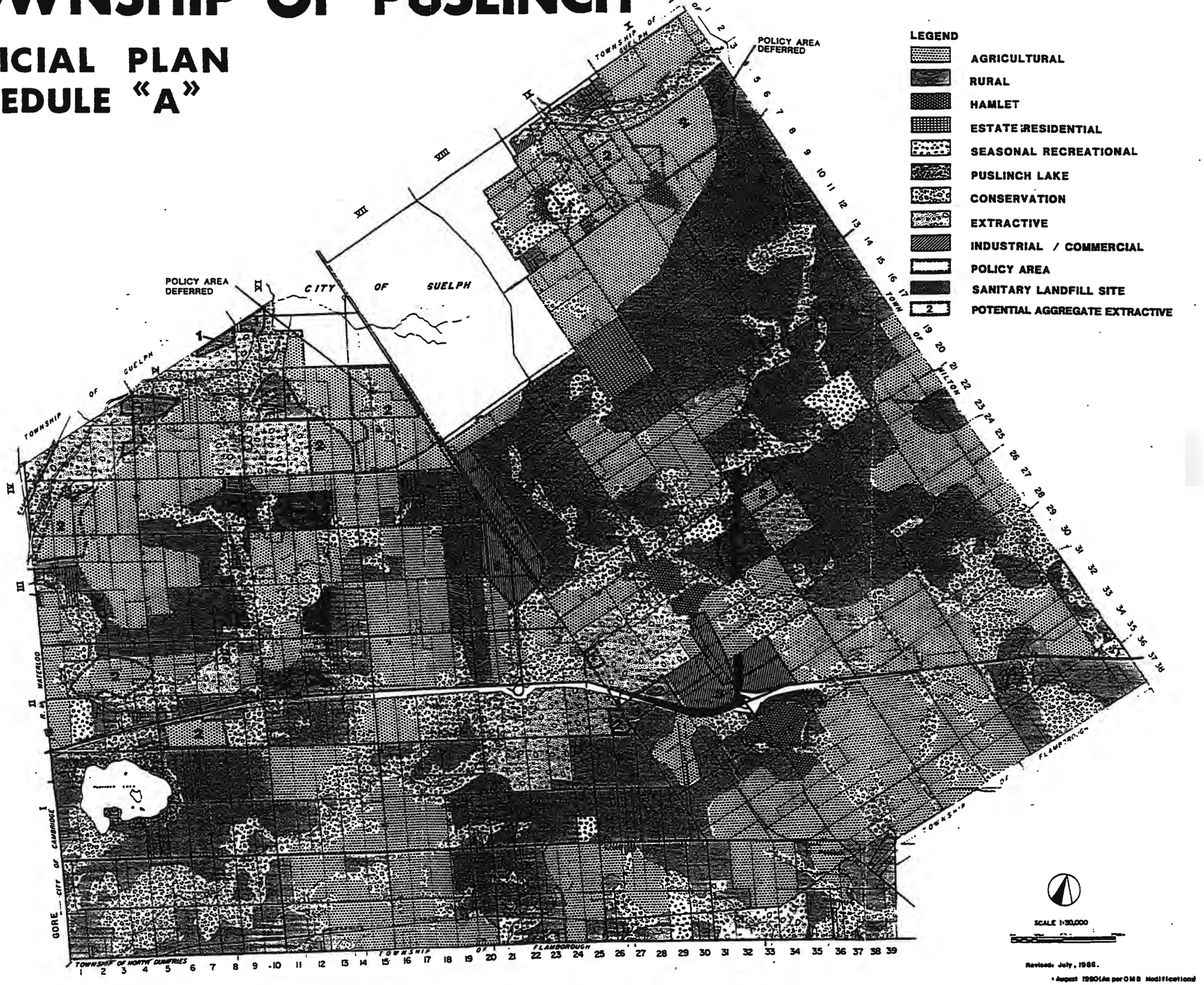
TOWN OF FLAMBOROUGH

TOWNSHIP OF PUSLINCH

FARM OPERATIONS WITHIN THE STUDY ARE

TOWNSHIP OF PUSLINCH

OFFICIAL PLAN SCHEDULE "A"



Revised: July, 1986.

• August 1990 (As per OMB Modifications)

APPENDIX K

SPECIAL CONSIDERATIONS

McCARTHY & McCARTHY

BARRISTERS SOLICITORS

PATENT & TRADE MARK AGENTS

P.O. BOX 48
TORONTO DOMINION BANK TOWER
TORONTO-DOMINION CENTRE
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0604....3029-5001151
FACSIMILE NOS.(416) 868-0673
(416) 362-1812
CABLE CARTAN, TORONTO

OUR REFERENCE:

RECEIVED
AUG 14 1985
M.T.C.
REGIONAL
PLANNING &

August 13, 1985

Mr. Harry Vander Kooij
Ministry of Transportation
and Communication
Planning and Development
Section
Central Region
5000 Yonge Street
Willowdale, Ontario
M2N 6E9

Dear Mr. Vander Kooij:

Re: Highway 6: Freelton
to Highway 401

We are the solicitors for Mr. and Mrs. Franz Hollenbach who are the owners of land located in the Township of Puslinch. Our clients are most vitally interested in the current public discussion with respect to a possible realignment of Highway 6.

On behalf of our client, we have been monitoring the public consideration of improvements to Highway 6 since early in 1980. At that time, our clients were the owners of a farm property located to the west of the Village of Morriston on a highway known as Crieff Road. One of the route alternatives then under active consideration by the Ministry would have had a very substantial impact on their farming operation and for that reason, among others, our clients were active in making representations to the Ministry. In due course, a recommended route was settled upon which our clients found to be quite satisfactory. However, for reasons which are not entirely clear, the recommendations of the Ministry staff were not implemented and the matter has remained in a planning phase for some five years. We now understand that further proposals are being considered by the Ministry and that there will be a public information meeting in November at which time the Ministry will identify a number of routes which it favours without, at that time, making a final selection of a particular route.

Our purpose at this time is to provide to the Ministry an outline of our clients' concerns. We begin by noting first our clients' long-term interest in this matter. Second, we would like to point out that our clients have not only taken comfort in the original staff recommendations, they have also required additional lands, both freehold and leasehold, in the hopeful expectation that the staff recommendations would ultimately be implemented. The holdings of our clients at this time constitute more than 230 acres of freehold land and 520 acres of leasehold land. Further, they hold options to purchase an additional 300 acres of lands. They carry on a most substantial farming operation. In order to assist staff in identifying that operation, we have attached a plan which shows, marked in yellow, the leasehold land and, in pink, the freehold land. Our clients currently have a herd of in excess of 400 heifers and are raising some 40 pure-bred trakenher horses. In addition to our clients, there are five full-time employees on the farming operation as well as the usual seasonal farm employment. Having invested substantially both their time and their money in creating this very significant farming operation, our clients are concerned indeed that a proposed re-routing of Highway 6 might impair or destroy their ability to carry on and improve the existing operation.

We hasten to add that our clients appreciate the necessity to improve Highway 6. They take the view, however, that the improvements should be undertaken in such a way as to minimize the impact on the better agricultural lands and the existing active farming operations. It is their strongly held view that the staff recommendations made some years ago achieved those objections and it is their hopeful expectation that the staff recommendations to be forthcoming in November will reflect the same approach.

We would be grateful if staff could indicate, in due course, when and where the public meeting is to take place.

Yours very truly,

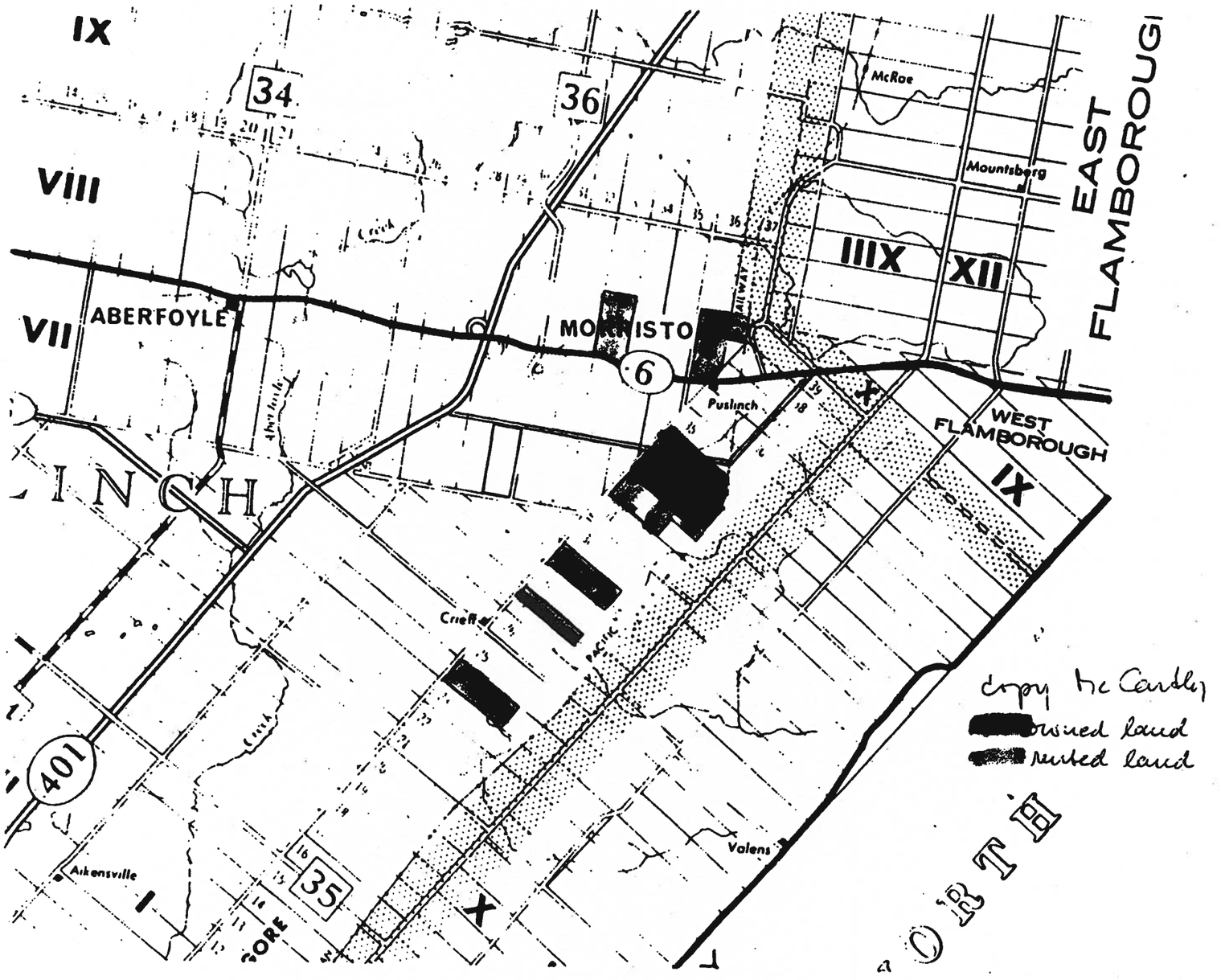
McCARTHY & McCARTHY

Per:

Phillip L. Sanford/ca

PLS:ca

cc. M. Johnston
Mr. and Mrs. Hollenbach


IX
34
36
VIII
McRae
Mountsberg
EAST FLAMBOROUGH
IIIX
XII
VII
ABERFOYLE
MORRISTON
6
Puslinch
WEST FLAMBOROUGH
IX
LINCH
Creek
401
Aikensville
35
X
Valens
NORTH
copy to Cardy
owned land
rented land

McCARTHY & McCARTHY

BARRISTERS SOLICITORS

PATENT & TRADE MARK AGENTS

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FACSIMILE NOS.(416) 868-0673
(416) 362-1812
CABLE CARTAN, TORONTO

OUR REFERENCE:

October 15, 1985

DELIVERED

L. D. House, P. Eng.
Project Manager
Fenco Engineers Inc.
33 Yonge Street
Toronto, Ontario
M5E 1E7

Dear Mr. House:

Re: Highway 6 - Freelton to Guelph Route
Location and Preliminary Design Study

We acknowledge with thanks your letter dated September 25, 1985.

Our client is certainly pleased to hear that the Project Team is aware of the existence and significance of large scale farming operations such as that conducted by Mr. and Mrs. Hollenbach in the Study Area. As you can appreciate, a number of the alternatives under consideration by the Ministry and its consultants are of very great concern to Mr. and Mrs. Hollenbach. We do not wish to repeat the statements made in earlier letters but we have been requested to provide certain additional information. In that regard, we enclose a copy of the letter signed by Mr. Hollenbach and addressed to the Township of Puslinch. Appended to that letter is a much more detailed description of the Hollenbach's farming operation than the description previously provided to the Ministry. Attached as well are three coloured plans prepared by Mr. Hollenbach which show the properties he and his wife own and their relationship to the various proposals under study by the Ministry.

. . . /2

We hope that the enclosed information is of assistance in the ongoing study process.

Yours very truly,

McCARTHY & McCARTHY

Per: Phillip Sanford

Phillip L. Sanford

PLS:ca

Enclosures

cc. Mr. and Mrs. Hollenbach
H. Vander Kooij, Esq.

LONG LANE FARMS
PUREBRED TRAKEHNER HORSES
PUREBRED HORNED HEREFORDS

FRANZ & ELKE HOLLENBACH
RURAL ROUTE 2
PUSLINCH, ONTARIO, CANADA
N0B 2J0

TELEPHONE (519) 824-1502

October 2, 1985

Township of Puslinch
Mr. Archie McRobbie
Reeve
RR # 3
GUELPH, Ontario
NIH 6H9

re: Hwy 6, Route Alternatives recommended for detailed Analysis and Evaluation

Dear Mr. McRobbie:

Thank you for giving us the opportunity to express our concerns regarding the Hwy 6 matter, by meeting you on Oct. 3, 1985. This letter, as well as the enclosures are meant to give you and the council detailed informations about our situation.

Our farm is locked in by the CN Railroad track in the South and Concession 1 in the North. A 115 KV Hydro Line is running diagonally through the property. We understand that at present there are 6 route alternatives selected for further studies, 3 of them are crucial for our operation, namely C5, D6 and C7, which was not shown in the Public Information Centre No. 1 on June 20, 1985. We have learned that there are even combinations of those 3 routes under investigations.

Within the last 5 years, we have tried to build up a Hereford cow/calf operation, as well as a horse breeding operation, which

depends heavily on the cattle operation. At times, when unemployment rose drastically, we put our money into a farm operation, not only by creating 5 fulltime employments, but also investing in property, livestock, equipment and buildings, hoping to build a future for us and our children. Doing this, we have not only saved a unique, but run down set of barns and buildings of the last century, but also put valuable agricultural land back in business by renting and working over 600 acres of land.

Route alternative C5 will cut Lot 33 in half und runs through our cattle barn, C7 will cut Lot 34 in half and take away the wintering place for our cow herd. (Lot 34 holds the head water for Spencer Creek and is, as we were told, highly sensitive from an environmental point of view). D6 brings a 4 lane highway into our frontyard. It is impossible to keep the operation of the farm going with either 1/2 of the farm being cut off, or the wintering of the cattle made impossible or being forced to use a 4 lane, heavy traffic highway for the day to day operation from the home farm to the rented farms. At the same time we realize that our existence is put on risk, we get the chance to acquire and lease neighboring land that was severed recently, we are unable to give a response.

We are sure, that our letter shows clearly what impact alternatives C5, C7 and D6 have in regard to our operation, and invite the councillors to come and get a personal impression of what we are talking about.

Yours sincerely

Franz Hollenbach

encl. Description of Farm Operation
Latest route alternatives & location of home farm & leased land
Home farm & leased land
Route alternatives affecting farm operation

C McCarthy

LONG LANE FARMS

PUREBRED TRAKEHNER HORSES
PUREBRED HORNED HEREFORDS

FRANZ & ELKE HOLLENBACH
RURAL ROUTE 2
PUSLINCH, ONTARIO, CANADA
N0B 2J0

TELEPHONE (519) 824-1502

October 2nd, 1985

Description of Farm Operation

In 1980 we immigrated to Canada and bought Lot 33 Conc. Gore, a then not operating farm, to start a purebred Hereford cow/calf operation (21 cows with calves, 1 bull). We built a pole barn (80' x 65'), a concrete yard and a work shop. In 1982 we got assurance from MTC, that widening Hwy 6 would not affect our property.

We then bought Lot 34, fenced both lots, doubled the barn and the yard, built a pit silo, increased the herd and rented more land. At present we work 220 acres of our own, as well as 8 other farms (600 acres), 4 of them on Crieff Road, 1 on Leslie Road, 1 on Conc. 7, 1 on Hwy 6. (see encl.) Our herd consists today of 140 bred cows, 40 first bred heifers, 125 calves and 5 bulls. We grow our own feed (corn, grain, hay), selling only surplus crops.

In 1982-83 we added a purebred horse breeding operation to the cow/calf operation, after extensive restoration of a set of 3 old barns. We built 30 stalls, a quarantine station and an indoor arena (130' x 65'). At present we have 11 broodmares, 3 stallions and house 25 horses alltogether.

Beside ourselves (2 persons) we employ 1 manager, who lives on the farm with his family and 4 full time staff. In summer we hire extra help.

The cattle on the home farm stay out at all times. We winter the bred cows (140) on Lot 34, where we have water year round. Only early cows calve in the barn (January till April), where we winter our calves (125). Lot 33 & 34 are pastured on rotation from spring to fall. The first bred heifers (40) winter on a rented farm, but are brought back to the home farm for calving and re-breeding. Over 80% of our breeding is done artificial. In summer we pasture on the same farm the heifers that have to be bred for the first time (40-50), as well as the last year's calves, that have to be finished. About 70 cows with calves pasture in summer on rented land. Depending on the growing conditions for pasture, we have to feed cattle on 4 different farms.

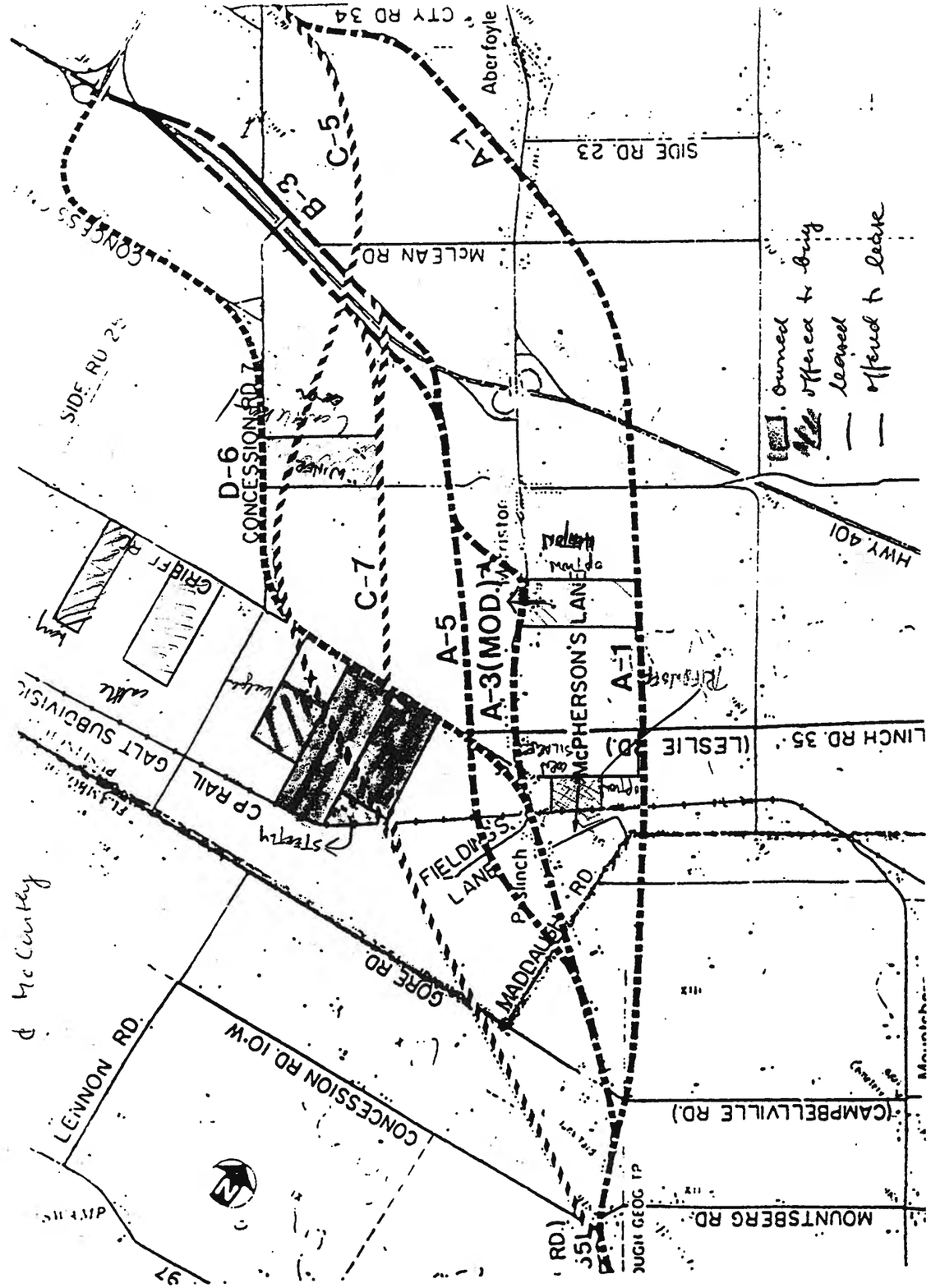
All crops are grown on rented land, app. 120 acres corn, 50 acres grain and 200 acres hay. Straw we usually buy from other farmers, but bale it ourselves.

Our operation depends on rented land, which means extensive work outside and travel to and from the home farm. We raise good breeding stock for the commercial, as well as the purebred breeder, however we are not competing with the "show cattle business". To maintain a healthy operation, we have to have a herd of about 200 cows in calf every year.

Oct 2, 85

C McCarthy

Latest route alternatives & location of home farm & leased land



OCT 24 1985
Office of the Clerk Treasurer

October 17, 1985

Township of Puslinch
Mr. Archie McRobbie
Reeve
RR # 3
GUELPH, Ontario
N1H 6H9

Dear Mr. McRobbie

As a matter of introduction since I have never met you; I am Franz and Elka Hollenbach's farm manager.

My reason for writing you is to express my concerns regarding the proposed highway 6 alternative routes between Freelton and 401.

After studying maps of the area I can see several routes that would close this farming operation down. C-5 would split the property in half and also go through our cattle barn. This would make the property of little use for a cow calf pasture unit, which is all this land can really be used for. C-7 would go directly through the wintering area for the cow herd; destroying it. Without a wintering place for the herd the operation would be forced out of business. Route D-6 would lock us in on the north side, making it impossible to move back and forth to the rented land which is also very vital to this operation.

Studying the map further; it would appear to me that possibly route A-1 would be the best; except for the part north of 401, which seems totally unnecessary. It would be the most direct route and could follow the lot line which would involve only the back ends of most properties and also involve few buildings.

I enjoy working for Mr. and Mrs. Hollenbach very much. If this operation has to be shut down because of the highway it would terminate my job as well as the jobs of four others people employed here; not to mention the farmland that would be rendered useless.

Hoping my concerns will be considered, I remain

Yours sincerely

PHILIP J. RITTER

Philip J. Ritter

PS - looking forward to meeting you sometime

LONG LANE FARMS

PUREBRED TRAKEHNER HORSES
PUREBRED HORNED HEREFORDS

FRANZ & ELKE HOLLENBACH
RURAL ROUTE 2
PUSLINCH, ONTARIO. CANADA
N0B 2J0

TELEPHONE (519) 824-1502

November 19, 1985

Township of Puslinch

Mr. Archie MacRobbie
Reeve

GUELPH, Ontario

Re: Latest Modifications in regard to widening Highway 6

Dear Mr. MacRobbie:

The November Pamphlet distributed by the Ministry of Transportation and Communications has not at all taken any pressure off the future of our farm operation, but added another threat (modified C7). Mr. Ian Upjohn from Fenco had requested informations about traffic flow from and to our farm (heavy equipment only) and I enclose my letter to them for your attention.

As things are circling in on us, we would like to present our problem to the new Council and ask you to grant us a meeting in the near future.

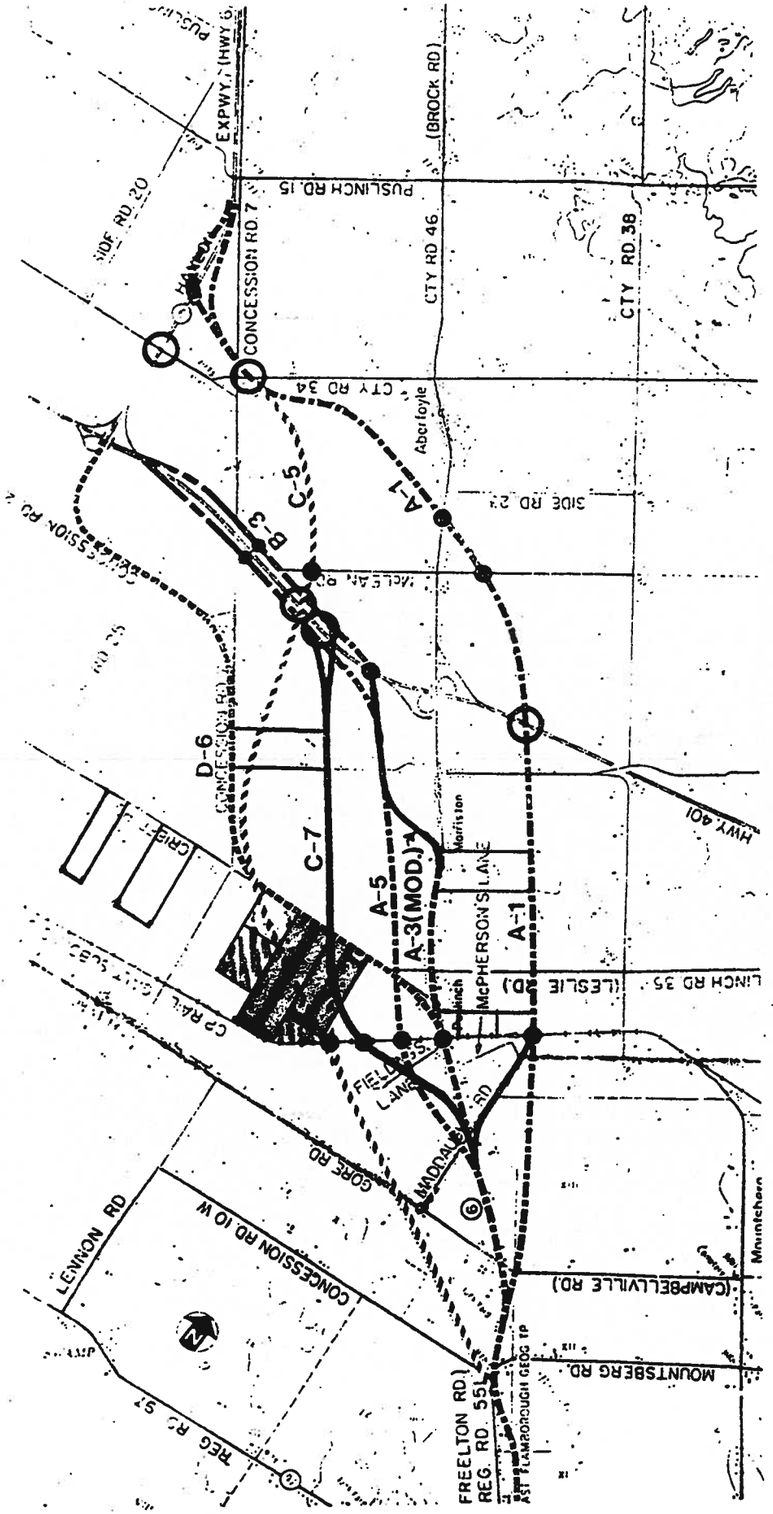
We are pleased to see that in regard to alternative A1, we were at least able to produce some input into the thinking by putting the attention of the planners to a real "backyard"-connection to Highway 401, that has far less impact on existing farming operations than any route alternatives west of A3 and provides a by-pass of both Puslinch and Morriston.

Yours sincerely

Franz Hollenbach

Franz Hollenbach

& Fenco



ROUTE ALTERNATIVES RECOMMENDED FOR
DETAILED ANALYSIS AND EVALUATION

PROPOSED MODIFICATIONS AND
ADDITIONS TO ROUTE ALTERNATIVES

LEGEND:

ADDITIONAL ROUTES - DEVELOPED SINCE FIRST PUBLIC INFORMATION CENTRE (JUNE, 1985)

PREVIOUSLY DEVELOPED ALTERNATIVE ROUTES

PROPOSED INTERCHANGES

PROPOSED GRADE SEPARATIONS.

HIGHWAY 6 - FREELTON TO GUELPH
ROUTE LOCATION AND PRELIMINARY DESIGN STUDY
W.P. 65-76-05

FENCO/NOV 85/42471/1400.

LONG LANE FARMS

PUREBRED TRAKEHNER HORSES
PUREBRED HORNED HEREFORDS

FRANZ & ELKE HOLLENBACH
RURAL ROUTE 2
PUSLINCH, ONTARIO, CANADA
N0B 2J0

TELEPHONE (519) 824-1502

L.D. House, P. Eng.
Project Manager
Fenco Engineers Inc.
33 Yonge Street
TORONTO, Ontario
M5E 1E7

November 20, 1985

Re: Highway 6
Traffic with Farm Equipment from and to our Home Farm
(Lot 33 Conc. Gore)

Dear Mr. House,

Ian Upjohn requested by phone informations on traffic from and to our home farm, especially in regard to the use of farm equipment. Following our off-hand informations, we have undertaken a detailed study and give you the results.

Referring to the enclosure, we want to add some explanations. East of our farm, we have to run equipment to the locations 1 through 3, west of our farm there are the locations 4 through 8. The locations are at present in use as follows:

1) Winter feeding area for at present 150 cows in calf (planned: 200 cows in calf). Feeding takes place from October to April, or 220 trips from and back to the home farm (feeding silage and round bales, blowing snow and moving cattle).

2) Land in corn and hay, 170 trips from and to the home farm to get crops in and out.

3) Farm used for hay, grain and corn, as well as wintering first bred heifers (35 at present, 50 - 80 planned) and finish bulls from May to September (65 in 1986, 80 - 100 planned) - 80 trips from and to home farm.

4) Farm used for hay and corn, as well as spring and summer pasturing of 35 - 40 cows plus calves, 70 trips from and to the home farm.

5) Summer pasturing of 25 - 30 cows plus calves or 110 trips from and to home farm.

6- Farms used to grow and crop hay, trips from and to the home farm 250.
8)

The figures only include traffic with heavy equipment and do not take into account the use of light equipment, like trucks, serving the different locations, while heavy equipment is in use, as well as the normal traffic to all locations, where cattle is located to check animals and transport feed by truck.

Basically, at present, traffic to the west is as heavy as to the east and split fairly even in summer, with a heavier load to the east in winter.

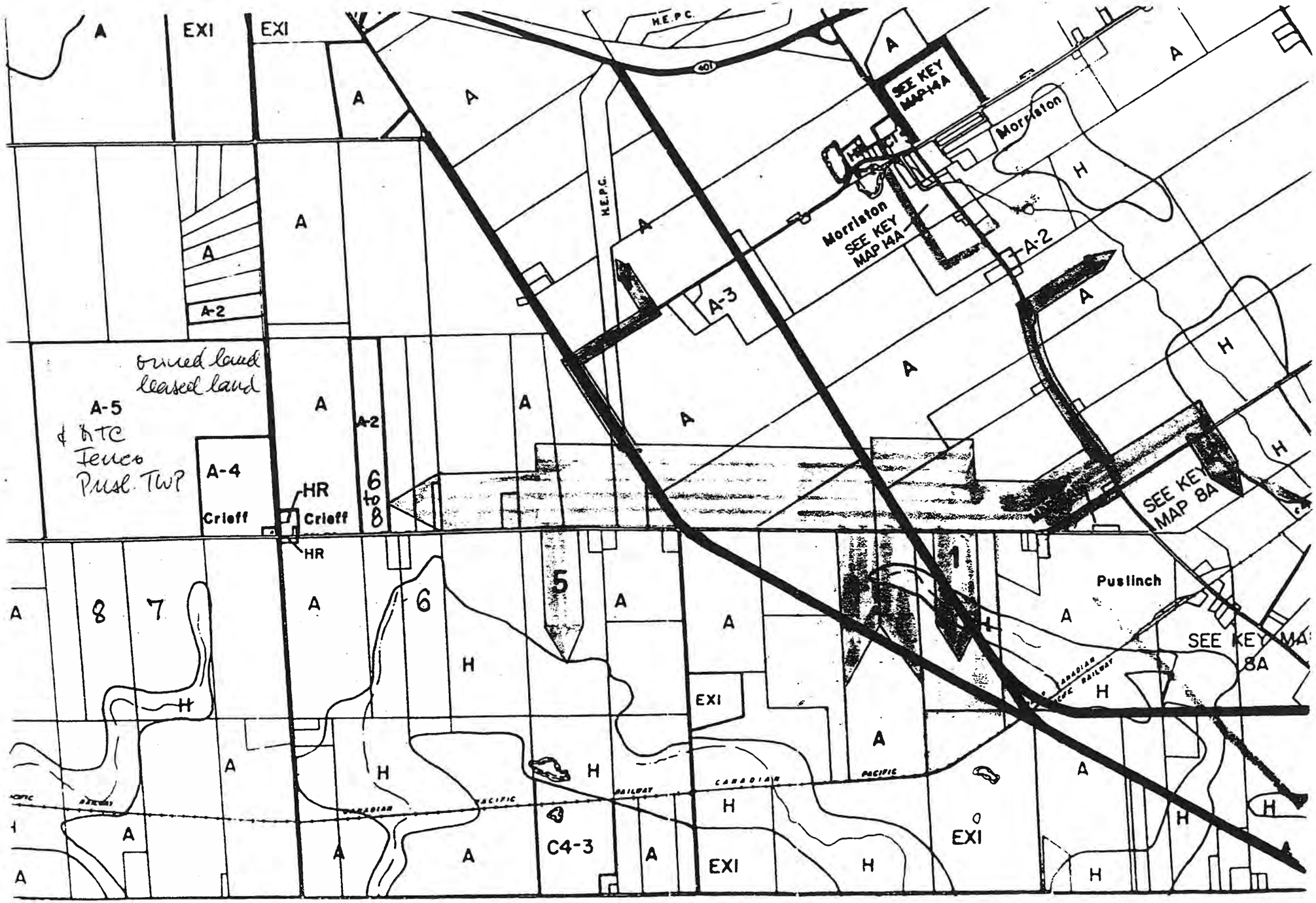
Yours truly

LONG LANE FARMS

Franz Hollenbach

Franz Hollenbach

Copy: McCarthy
MTC
Township of Puslinch



A
EXI
EXI
H.E.P.C.
401
SEE KEY MAP 14A
Morriston
Morriston
SEE KEY MAP 14A
A-2
A-3
H
A-2
A-5
owned land
leased land
& HTC
Fence
Pusl. TWP
A-4
Crieff
HR
Crieff
HR
6 to 8
SEE KEY MAP 8A
Puslinch
SEE KEY MAP 8A
8
7
6
5
1
EXI
C4-3
EXI
EXI
CANADIAN PACIFIC RAILWAY

LONG LANE FARMS

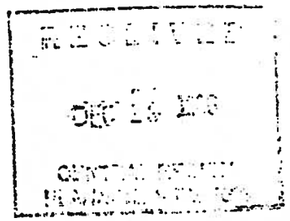
PUREBRED TRAKEHNER HORSES
PUREBRED HORNED HEREFORDS

FRANZ & ELKE HOLLENBACH
RURAL ROUTE 2
PUSLINCH, ONTARIO, CANADA
N0B 2J0

TELEPHONE (519) 824-1502

Mr. H. Vander Kooij
Ministry of Transportation
5000 Yonge Street
Willowdale, Ontario
M2N 6E9

December 12, 1986



Dear Mr. Vander Kooij:

Following up on our meeting on December 10, 1986, we are forwarding our comments and objections to the latest proposal of the Ministry about the widening of Highway # 6.

In comparison to Alternative C-72, the new routing of Highway # 6 certainly has reduced the loss of weather protection for our cattle. However, we cannot accept the proposed intersection of Highway # 6 and Crieff Road.

While shelter is one of our main concerns to protect the cattle against harsh weather conditions, the availability of land where the cattle can be fed, the possibility of handling the loading of our yearly grain and corn harvest, as well as the accessability of the property from and to Crieff Road are most important and vital to our operation.

We enclose a map showing our feeding area (marked blue) and the area used for handling grain and corn (marked red). The proposed intersection will reduce our feeding area by more than 30 %, not taking into account that about 15 % of the area cannot be used when covered by water or ice, and will eliminate our current loading area totally.

The feeding area has to provide room to feed 200 - 220 cows from October to May mainly, which means that 4 - 5 big feeder wagons have to be refilled with silage every three days. Even by using a four wheel drive 90 hp tractor, loaded wagons can only be moved on flat land; depending on the snow situation tracks have to be blown first to get wagons in and out. The existing feeding area is just big enough to serve 200 - 220 cows; any reduction would force us to decrease the size of our herd.

At present we work close to 1.000 acres. This year we had a crop of grain corn of 300 tons, not including silage corn. To handle the harvest, which takes weeks, we park up to three 48 ft trailers with 3 boxes on the rack off the road just beside the fence. Filling of the boxes has to be done at the same level from our property. We have fenced off the neccessary area (marked red on the map) to set up augers, a generator and lights, and to bring in dump wagons and grain boxes as they are filled on the different farms where corn was grown. Cash cropping will increase over the years, depending on how much more land can be rented. (125 more acres in 1986). There is no possibility to load grain crops on our home farm and any new loading facilities near the entrance to our wintering area will be at the expense of the feeding area, which would leave us with less than 50 % of the present area and no chance to feed the amount of cattle we need.

The present entrance to the wintering area from Crieff Road is visible from both directions because the road is straight. Even heavy equipment moving in and out can be clearly seen at safe distances. At harvesting time the trailers are parked well on the shoulder and loading only affects passing traffic in a minimal way. The proposed intersection with Highway # 6 changes things totally. The entrance to the farm will be close to the intersection and can only be seen from both sides at a short distance. Equipment moved in and out could only be detected very late,

crop handling would divert drivers attention when they should concentrate on the traffic at the intersection. Crossing of the road when entering or leaving the wintering area could only be detected by drivers at the very last moment, especially when there would be a backup towards the farm entrance. Due to the topographical situation of the farm, movements into the property would now be downhills, which would make it even more difficult to go in and out.

As we have explained to the Ministry earlier, our operation has to have 200 - 220 cows, and we have to grow our own feed as well as a cash crop. The problems arising with the rerouting of Highway # 6 can only be solved by relocating the interchange with Crieff Road to the North, which in our opinion also creates a safer intersection, perhaps even at 90° rather the presently proposed 80°. We assume the intersection would be on the same level as existing Crieff Road and would have traffic lights to enable crossings with farm equipment.

We will be away in January and will contact you in February.

With best wishes for the season and 1987,

sincerely yours,

LONG LANE FARMS

Franz Hollenbach

Franz Hollenbach

c.: Ont. Fed. of Agriculture
McCarthy
Fenco

LONG LANE FARMS

PUREBRED TRAKEHNER HORSES
PUREBRED HORNED HEREFORDS

FRANZ & ELKE HOLLENBACH
RURAL ROUTE 2
PUSLINCH, ONTARIO, CANADA
N0B 2J0

TELEPHONE (519) 824-1502

Wellington Federation of Agriculture
Mr. George Strachan, President
R.R. # 1
Harristion, Ontario
N0G 1Z0

December 12, 1986

RECEIVED
DEC 16 1986
CENTRAL REGION
PLANNING & DESIGN

Dear George:

The Ministry of Transport and Communications has chosen the final route for the new Highway # 6. I send you our response letter and some plans to document the situation.

Alternative C-72 has been modified and the new route just cuts the corner of our farm, however, the location of the new intersection of Crieff Road, which previously was planned outside of our property, puts our operation at the same risk as C-72 did before. To keep it off our farm will cost the neighboring farmer another 2.5 acres. He certainly loses a lot of land, but there is a good chance he could rent other land to grow crops. There is no advantage for us, if the shelter for our cattle remains intact, but at the same time our handling area is eliminated.

As this is the final round in our struggle to survive, we ask the Federation again to assist us in our efforts to locate the new intersection to the North. This change will cost the Ministry no more, but will keep our farm alive.

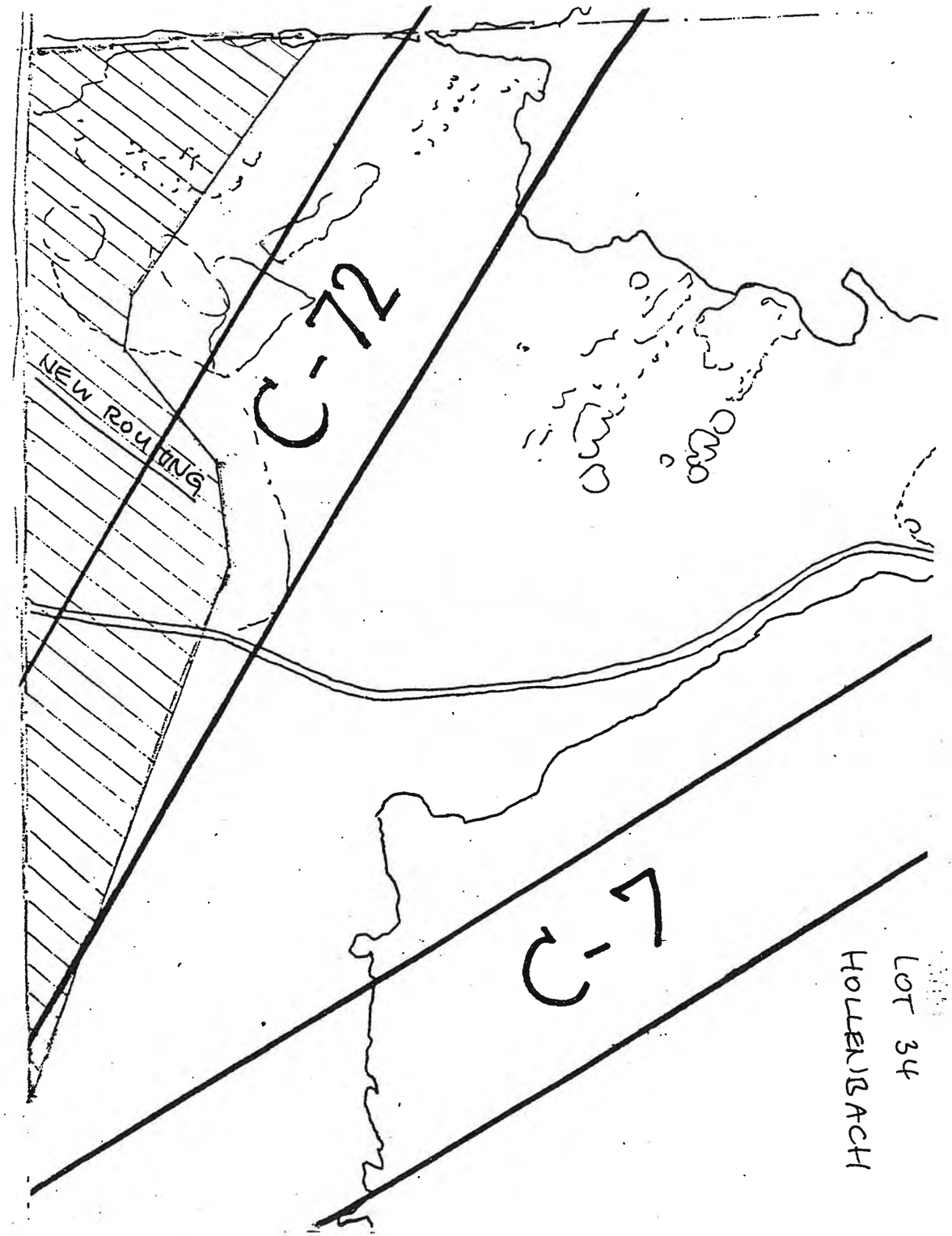
With Christmas Greetings and all good wishes for 1987,
sincerely yours,

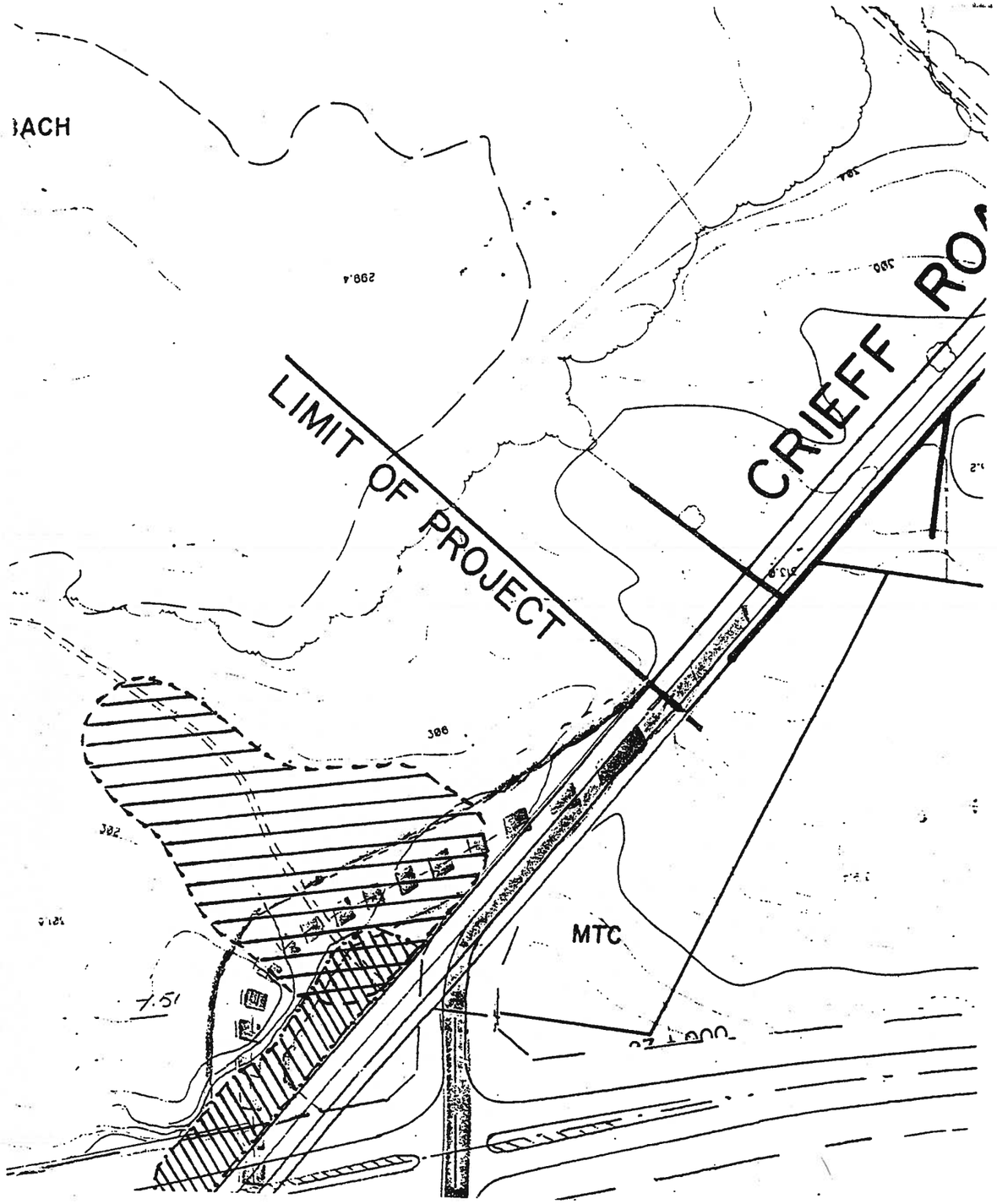
LONG LANE FARMS

Franz Hollenbach

Franz Hollenbach

c MTC Mr. Vander Kooij




LIMIT OF PROJECT
CRIEFF RO
MTC

Fenco

FENCO ENGINEERS INC.
33 YONGE STREET, TORONTO
ONTARIO, CANADA M5E 1E7
TEL.: (416) 365-9955
TELEX. 06-23765
CABLE: LAVALIN TOR

January 6, 1987

Mr. F. Hollenbach
Long Lane Farm
R.R. #2
Puslinch, Ontario
NOB 2JO

Dear Mr. Hollenbach:

HIGHWAY 6 - FREELTON TO GUELPH
ROUTE LOCATION AND PRELIMINARY
DESIGN STUDY - W.P. 65-76-05

Pursuant to your request at our meeting of December 17, 1986 and a subsequent request to H. Vander Kooij on December 30, 1986, we enclose the following material for your information:

1. 1:2000 scale plan showing the proposed alignment for new Highway 6 (including local road realignments) between the divergence point at existing Highway 6 and Highway 401.

2. Proposed profile of new Highway 6 between the CP Rail Galt Subdivision line and the north limit of the G. Sutton farm on Lot 35 Concession 7 Township of Puslinch.

3. Profile of the proposed realignment of Crieff Road in the vicinity of the intersection with new Highway 6.

We trust this information is of sufficient detail to meet your needs. Any points for further clarification should be referred to H. Vander Kooij at (416) 224-7581.

Yours very truly,
FENCO ENGINEERS INC.

I.K. Upjohn, MCIP
Senior Environmental Coordinator

cc: Mr. H. Vander Kooij, M.T.C., Central Region

42471
IKU:fj

Lavalin

Ontario

Ministry of
Transportation and
Communications

Planning and Design Section,
Central Region,
5000 Yonge Street,
Willowdale, Ontario.
M2N 6E9
Telephone: (416) 224-7581

January 22, 1987

Mr. F. Hollenbach,
Long Lane Farms,
R.R. 2,
Puslinch, Ontario.
NOB 2JO

Dear Mr. Hollenbach:

This will acknowledge receipt of your letter dated December 12, 1986, with your comments as a follow up to our meeting on December 10, 1986, in the Puslinch Community Centre.

The Project Team has received valuable input from the meeting with property owners affected by the selected route. We found a majority very supportive of the proposals. However, it is impossible to build a 4 lane highway without some negative impacts. We are now exploring various adjustments to the selected route.

As we discussed at our meeting on December 10, 1986, the approved process and availability of funding will likely preclude any construction from starting within 5 years. The approval process under the Environmental Assessment Act includes the submission of an Environmental Assessment Report to the Ministry of the Environment, tentatively scheduled for late 1987. Following submission, the Minister of the Environment will request public comments on the proposal and if at that time you are not satisfied, you can request a hearing before the Environmental Assessment Board.

I trust that the ultimate solution to the Highway 6 location will retain the viability of your farm and those of your neighbours.

Yours truly,

H. Vander Kooij,
Senior Project Manager.

HVK/rb

c.c. C. Southey
J. Desrochers - London
L. House - Fenco
G. Strachan

LONG LANE FARMS

PUREBRED TRAKEHNER HORSES
PUREBRED HORNED HEREFORDS

FRANZ & ELKE HOLLENBACH
RURAL ROUTE 2
PUSLINCH, ONTARIO, CANADA
N0B 2J0

TELEPHONE (519) 824-1502

March 2, 1987

The Reeve, Deputy Reeve
and Councillors of the Township
of Puslinch
GUELPH, Ontario

RECEIVED
MAR 6 1987
CENTRAL REGION
PLANNING & DESIGN

Dear Sirs,

Since I wrote to the Township first the composition of the Council has changed, and new members of Council may be unaware of the representations I made to earlier Councils concerning the adverse effects on LONG LANE FARMS of certain of the proposals for widening Highway 6. Members of Council may also be unaware of the vast amount of investment in terms of both time and money which has gone into the operation of LONG LANE FARMS since it was commenced in 1980 upon the purchase of lot 33 from Mrs. Lucia MacDonald of what is now our home farm.

In 1980 the home farm was not in fact an active or operating farm and its century-old barns were in ruins. It was recognized that to restore the home farm to operation would require considerable investment. For that reason, prior to completing the purchase, when I became aware that the Ministry of Transportation was considering the design and construction of a Freelton to Highway 401 by-pass, I had certain enquiries made for me. One of the route alternatives then under consideration would have rendered LONG LANE FARMS unusable as a farming operation. At that time I made many representations to the Ministry of Transportation and was pleased to note that Ministry Staff were consistent in recommending a route which would have no impact on farming operations in the area of LONG LANE FARMS.

Based on the comfort derived from the recommendating of Ministry Staff and from enquiries made of Council, I purchased in 1982 the adjoining

inactive farm from Mr. Rumsey. In the 5 years from my original purchase in 1980 I improved the farms, leased other farms, including 100 acres from my neighbour Mr. Bill Winer, until by now I farm over 800 acres. My wife and I work full time as do 5 others (full-time) in the operation of our business which consists of a 180 head purebred Hereford herd, 140 yearlings, including replacement heifers and breeding bulls, and 165 calves to come and a purebred Trakehner horse breeding operation of some 25 horses, conducted from the extensively restored barns and newly constructed cattle barn, machine-shop, quarantine station and in-door riding arena. In addition to full-time workers I also employ a number of seasonal workers. Our herd is enrolled in the Provincial Beef Herd Improvement Program, as well as the Total Herd Evaluation Program of the Canadian Hereford Association. All our bulls are on R.O.P. Test, run on our approved private Test Station.

For reasons that I do not understand the former Minister of Transport, Mr. M. Snow, did not apparently act on the recommendations of staff and the matter has remained in the planning stage some 7 years. I have always appreciated the need to improve Highway 6 but I have believed the improvements could be undertaken with minimal impact on the better agricultural land and existing active farming operations. The Ministry Staff recommendations made some years ago achieved these objectives. Why have these recommendations been put aside?

In the question of better agricultural land I believe that there is a misunderstanding about the value of my land which may be affected by recent proposals. That part of my land cannot be evaluated only on its ability or lack to produce grain crops. Mr. T. Bacigalupo described the land in question as a "very stony feed-lot area where cattle winter". The land is not in any sense a "feed-lot" but for reasons of water and shelter provided by the physical features of the land, it is a natural winter "barn" for 200 expensively bred cattle with a value in excess of $ 350,000 which pasture the land on rotation with other pastures on the farm. If this particular piece of land is lost through

expropriation, it is highly doubtful the cost of compensation would allow the operation to continue as a viable business. I estimate that the cost of constructing a winter barn with water and road services would exceed $ 350,000.

The comparison by Mr. T. Bacigalupo of my land providing invaluable shelter for purebred breeding stock as well as pasture with land of better soil is meaningless if the land is not economically evaluated in the context of its operation and use. I have offered detailed critisism in the past to both the Council and the Ministry about the proposals and I would be grateful for the opportunity to submit my thoughts to the Council.

In the past the Township of Puslinch wrote to me promising to keep me informed of developments with this matter of such great interest and importance to me. I have no information direct from the Council, although I did appreciate meeting Mr. A. MacRobbie on October 3, 1985. I would appreciate your advising me in the future of any development affecting my farm, including any meeting where the highway proposal is to be discussed.

Yours truly,

LONG LANE FARMS

Franz Hollenbach

Franz Hollenbach

copy: Reeve
Deputy Reeve
Councillors 3
MTC
OMAF
WFA
McCarthy
all Mr. A. MacRobbie

LONG LANE FARMS

PUREBRED TRAKEHNER HORSES
PUREBRED HORNED HEREFORDS

FRANZ & ELKE HOLLENBACH
RURAL ROUTE 2
PUSLINCH, ONTARIO, CANADA
N0B 2J0

TELEPHONE (519) 824-1502

The Reeve, Deputy Reeve
and Councillors of the Township
of Puslinch
GUELPH, Ontario

May 23, 1987

Dear Mr. MacRobbie:
Dear Mr. Gauthier:
Dear Mr. Visser:

Thank you for your recent visits to the Long Lane Farms and your interest in our difficulties with the various plans proposed by the Ministry of Transportation for the widening of Highway 6.

We understand that few people affected by the proposals will welcome them, but we are upset, not just because of our considerable investment of money and effort into the making of a large, viable, commercial farm operation out of non-operational farms purchased and leased from our neighbours, but because we and our advisers acted with all prudence in every step of the operation of our farm business. We made inquiries and obtained assurances from the Ministry of Transportation prior to the purchase, that our farms would not be affected by the widening of Highway 6.

In earlier submissions, we have outlined the considerable size of our operation and we will not repeat that, except to say that part of Lot 34 has value far beyond that of ordinary agricultural land, because it serves as a winter barn for 200 of our cattle. This area is invaluable as a winter refuge because:

(a) it is protected against winds from all directions
(b) there is an easy and short access from Crieff Road to the feeding area and the area where we handle grain and corn crops
(c) there is an existing entrance from the home farm to the winter area
(d) the feeding area is maximum 250 feet from Crieff Road
(e) the slope to the feeding area is not steep
and
(f) because of the foregoing reasons there is no difficulty of supplying feed to the herd twice a week from September to May in any wheather conditions. Each feed requires five feeder wagons of between 6 and 7 tons.

The proposal now favoured by the Ministry of Transportation and supported by the Ministry of Agriculture, has the least impact on us of all the proposals, because although shelter for the cattle is reduced against northwesterly and northeasterly winds, because of the lowering of the easterly hill on Lot 34,

(a) there will still be protection by the remaining hillside, where 40 to 60 cows calve from March to May
and
(b) the access will not be touched.

With respect, Mr. Reeve, we think that your own recent proposal to save George Sutton's "best" land does not serve the interest of preserving, to its fullest extent, our "outdoor barn". According to our information, we submit that the highest and best use of land (in expropriation terms) of our "outdoor barn" far exceeds in compensable terms the highest and best use of Sutton's "best" six acres. We understand your proposal to mean a move the widening west by thus eliminating our easterly hill, including the most valuable hillside, and creating the need to supply other wind and wheather protection. This proposal, if moved any further westwards, would also remove the existing entrance and reduce the feeding and loading area. A new entrance

at the hill on the west side of Lot 34 would be approximately 33 feet above the feeding area and would create greater feed carriage difficulties and hazards, because of an increased gradient and the need for three times as much snow plowing as now. As Lot 34 is approximately 15 feet lower than Suttons's land there would be an increased need for drainage and protection against winter salting, as cattle are there and drink water in the spring from water holes.

We enclose a plan of the front part of Lot 34 showing the present use, the proposal of the Ministry of Transportation, and the effect of a further realignment of the highway 100 feet to the southwest. As we explained to you, modifications only can be judged once plans are made available. While we want to be helpful, we certainly have to protect ourselves.

Yours very truly,

LONG LANE FARMS

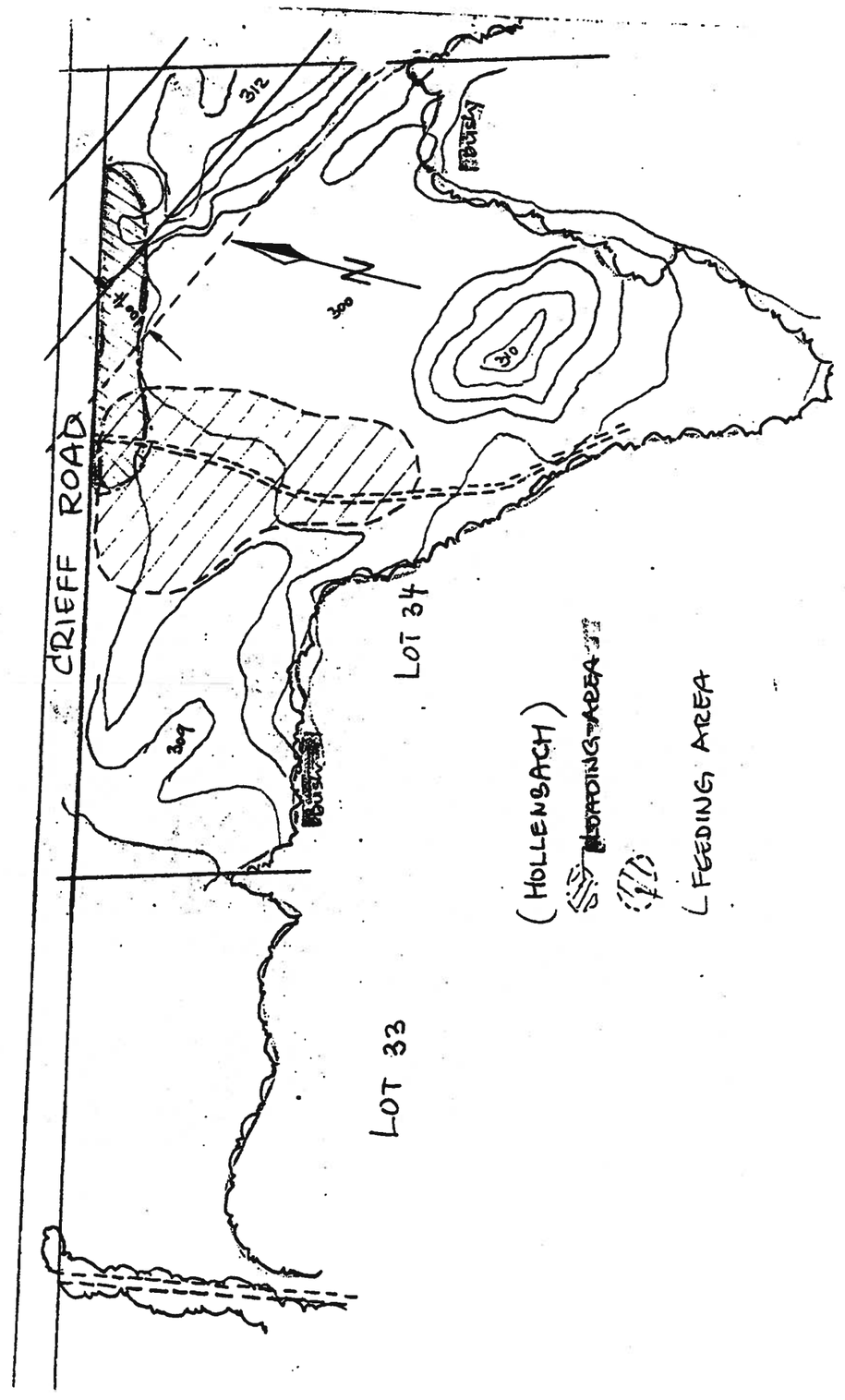
Hollenbach

Franz Hollenbach

copy: MTC
McCarthy
OMAF

P. Billings
A. Wittenberg
C. Southey
A. Mincher - Trenco

received 1987-05-27-13:00



TOWNSHIP OF PUSLINCH
RECEIVED
JUN 17 1987
Office of the Clerk Treasurer

LONG LANE FARMS

PUREBRED TRAKEHNER HORSES
PUREBRED HORNED HEREFORDS

FRANZ & ELKE HOLLENBACH
RURAL ROUTE 2
PUSLINCH, ONTARIO CANADA
N0B 2J0

TELEPHONE (519) 824-1500

June 17, 1987

The Township of Puslinch
Council - Technical Committee
GUELPH, Ontario

Re: Highway # 6 - proposed Routing as per Presentation on June 11, 1987

Dear Sirs:

On May 28, 1986 we submitted to the Township our complaints against Alternative C-72 of the project for widening Highway # 6 (copy enclosed). The proposal presented to owners at the meeting on June 11, 1987 is more detailed, but identical to Alternative C-72, which we had not only rejected in our letter to the Council, but also in various meetings with the Ministry of Transportation.

We submit our objections against the latest proposal (see enclosure), as the highway, if built as presented on June 11, 1987, would force us to discontinue our present operation because

(a) the wintering area for pregnant cows of approximately 19 acres, will be reduced by six acres or 32% (not taking into account a new access to the feeding area, that will have to be provided) and will not leave enough usable area to winter 200 pregnant cows,
(b) the easterly hill, which gives shelter to the cows against northwesterly to northeasterly winds, will no longer be accessible to cows and therefore, sufficient shelter for the cattle will not be left,
(c) the hillside of the easterly hill, where cows calve from March to May well protected against winds from northwest to northeast, will not be accessible any longer, and there is no substitute for the lost calving area,

(d) the now used area for feeding silage from Fall to Spring will be reduced to a size not big enough to feed 200 cows,
(e) the existing entrance and the slightly sloped access to the feeding area, that has a maximum length of 250 ft., will be eliminated, and a new access will be at least three times longer, creating greater difficulties and hazards for the handling of feed because of an increased slope, as well as higher costs for maintenance in the winter, and will further reduce the usable wintering area,
(f) the existent level area to handle and load grain crops will be eliminated with no substitute area being available.

As we told the Council and the Ministry of Transportation, the proposals presented by the Ministry to us in December 1986 are acceptable to us, especially after a bridge over Highway # 6 was proposed, however, we cannot agree with the latest proposal. Our understanding of Mr. MacRobbie's comments during his visit to the farm was, that the Ministry was going to explore possibilities of how the highway could be moved to the west, providing or creating comparable shelter, easy access to the feeding area big enough to feed 200 cows, and a level handling area for grain crops. This might not be possible by preserving all of George Sutton's best land, but to us it seems to be a technical task of the engineers in charge of the project to find new proposals for discussions.

Yours truly,

Franz Hollenbach

Franz Hollenbach

copy: MTC

LONG LANE FARMS

PUREBRED TRAKEHNER HORSES
PUREBRED HORNED HEREFORDS

FRANZ & ELKE HOLLENBACH
RURAL ROUTE 2
PUSLINCH, ONTARIO, CANADA
N0B 2J0

TELEPHONE (519) 824-1502

May 28, 1986

Township of Puslinch
att.: Mr. Archie MacRobbie Reeve
RR # 3
GUELPH, Ontario
N1H 6H9

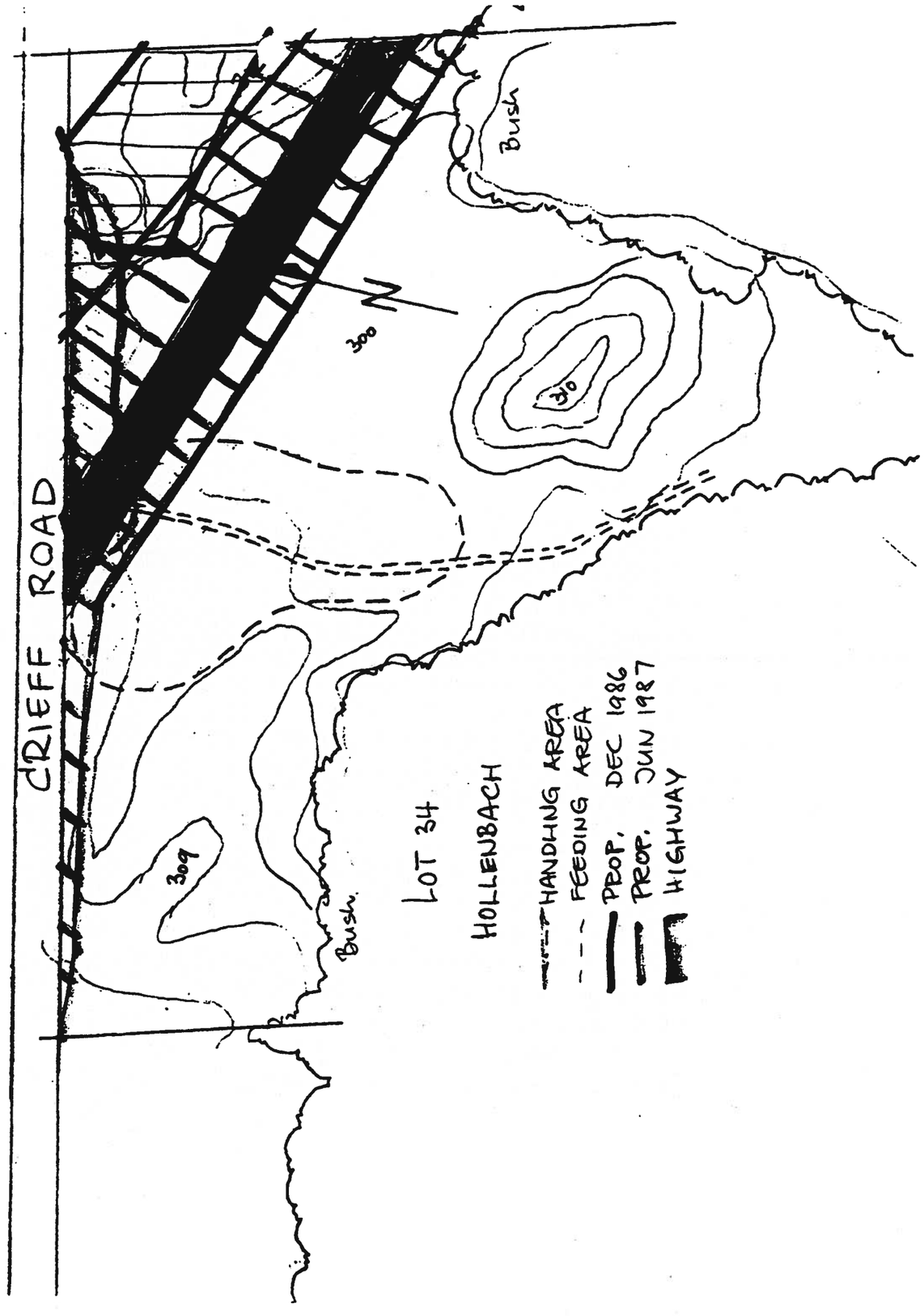
Re: Highway 6 (stage 7)

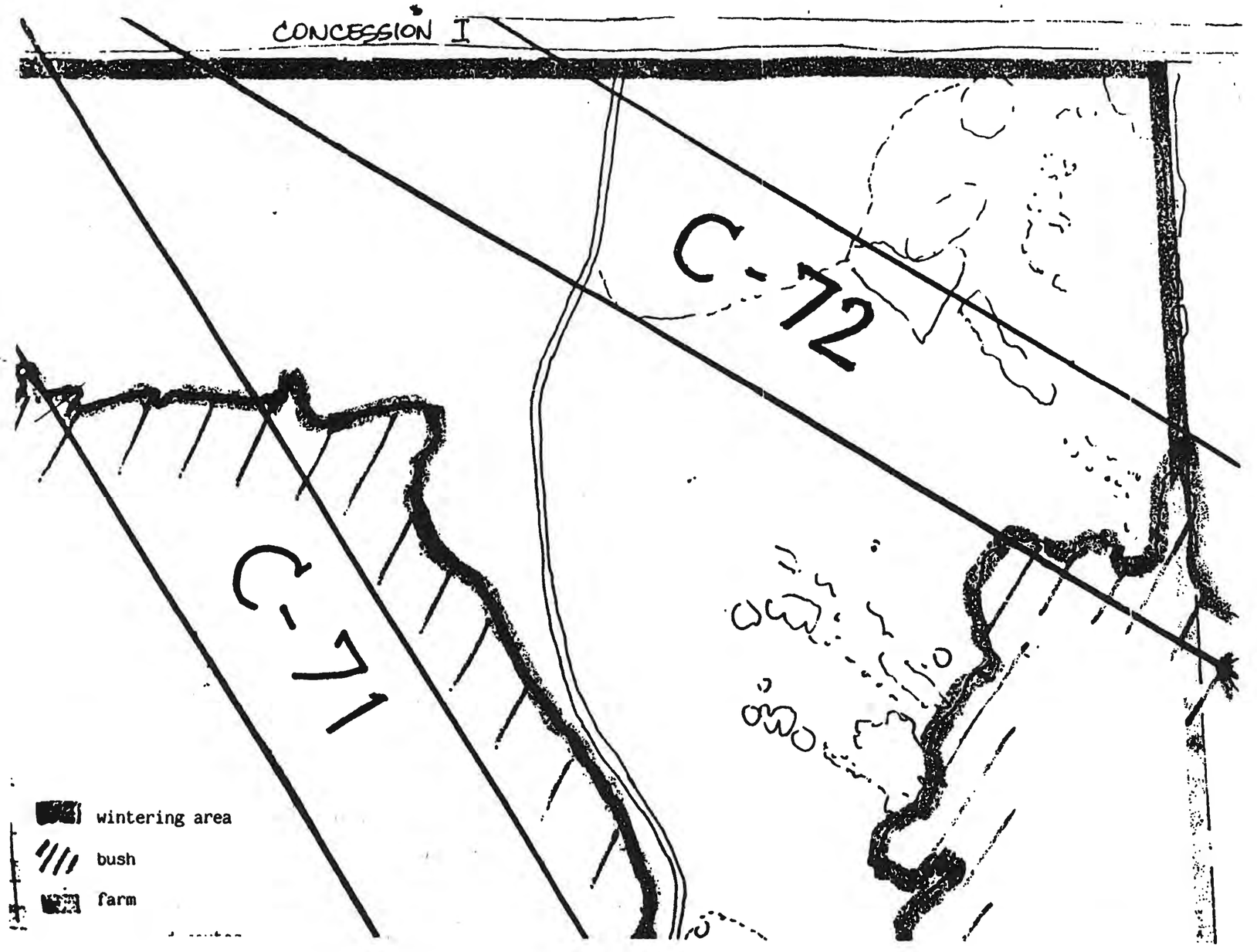
Dear Mr. MacRobbie:

The technically preferred route presented at the latest Public Information Centre is Alternative C-7, which was introduced last summer mainly by you.

We enclose a map (encl. A) to explain the severe impact of C-72 (part of Alternative C-7) to our purebred Hereford cow/calf operation. The area marked orange shows part of Lot 34, which is the wintering area for up to 200 cows in calf. Alternative C-72 will not only reduce the area by 45 %, but also cut off the entrance to the lot and eliminate weather protection against winds form North to East. The remaining area will be reduced furthermore, as a new entrance has to be built and the cattle have to be kept at a safe distance off the highway, to protect them against "salting" of the highway.

To maintain a healthy operation, we not only have to run a herd of 200 cows in calf, but also depend on the use of the natural set up we have of keeping the cattle in open housing year round. C-72 will make it impossible to continue our present operation, as the winter area will be reduced to app. 50 % and we lose the protection against the worst weather




CONCESSION I
C-72
C-71
wintering area
bush
farm

Lavalin

MEMORANDUM

TO	File	DATE	August 5, 1987
FROM	I. K. Upjohn - Fenco Toronto	PROJECT No	42471 - 1104
SUBJECT	HIGHWAY 6 - FREELTON TO GUELPH ROUTE LOCATION AND PRELIMINARY DESIGN STUDY PROPERTY OWNER MEETINGS (HOLLENBACH - LILLYCROP)		

As a result of the latest discussions with F. Hollenbach regarding possible means of mitigating potential impacts to his winter feedlot (June 23, 1987), the Project Team agreed to investigate various measures and meet further with Mr. Hollenbach. Similarly, based on a commitment to Puslinch Council to meet with owners requesting a meeting and/or investigation of reasonable mitigation measures, the Project Team made arrangements to meet with B. Lillycrop and D. Stewart Sr. H. Vander Kooij and I. Upjohn met with Messrs. Hollenbach and Lillycrop at their respective properties on Thursday July 30, 1987. Arrangements to meet with the Stewarts on the same day fell through as a result of a request by them to alter the meeting date which could not be accommodated. The following is a synopsis of those meetings.

F. Hollenbach/ P. Ritter (9:30 a.m.)

. New Material Presented:

- 1:1000 plan showing highway design proposal; reconfigured northeast corner (servance) for use as sheltered area with access to main feedlot via oval CSP cattle pass; elimination of undesirable low area south of feedlot where standing water accumulates; removal of gravel pile to afford additional sheltered area for calving; conceptual access road relocation; associated grading and drainage

- 5 cross-sections through reconfigured northeast corner to show cattle pass and relationship to existing protective ridge.

- 4 cross-sections through main feedlot to show scale of a 5m berm on west side of highway plus windbreak effect of Crieff Road overpass

. Mr. Hollenbach still has two main concerns:

1) Loss of Prime Cattle Area - most sheltered calving area lost. Are new sheltered area, area freed by removal of gravel pile and provision of 5m berm adequate substitutes for loss of area immediately adjacent to existing ridge?

2) Reduction in Overall Area - a question of economics. Will remainder area be sufficient to support intensity of livestock (220 calves) to maintain viability of cow-calf operation?

Lavalin Inc. ADM-14-01-E-84/10

. Other questions/comments related to mitigation proposals; responses.

1) Will cattle pass get plugged with snow; can it be relocated further from the north corner (to the south)? Should not be subject to snow blockage due to Crieff Road windbreak and distance from the lee of same where snow will accumulate. Difficult to relocate to the south due to profile/drainage constraints (highway draining to low point at CP Rail immediately south).

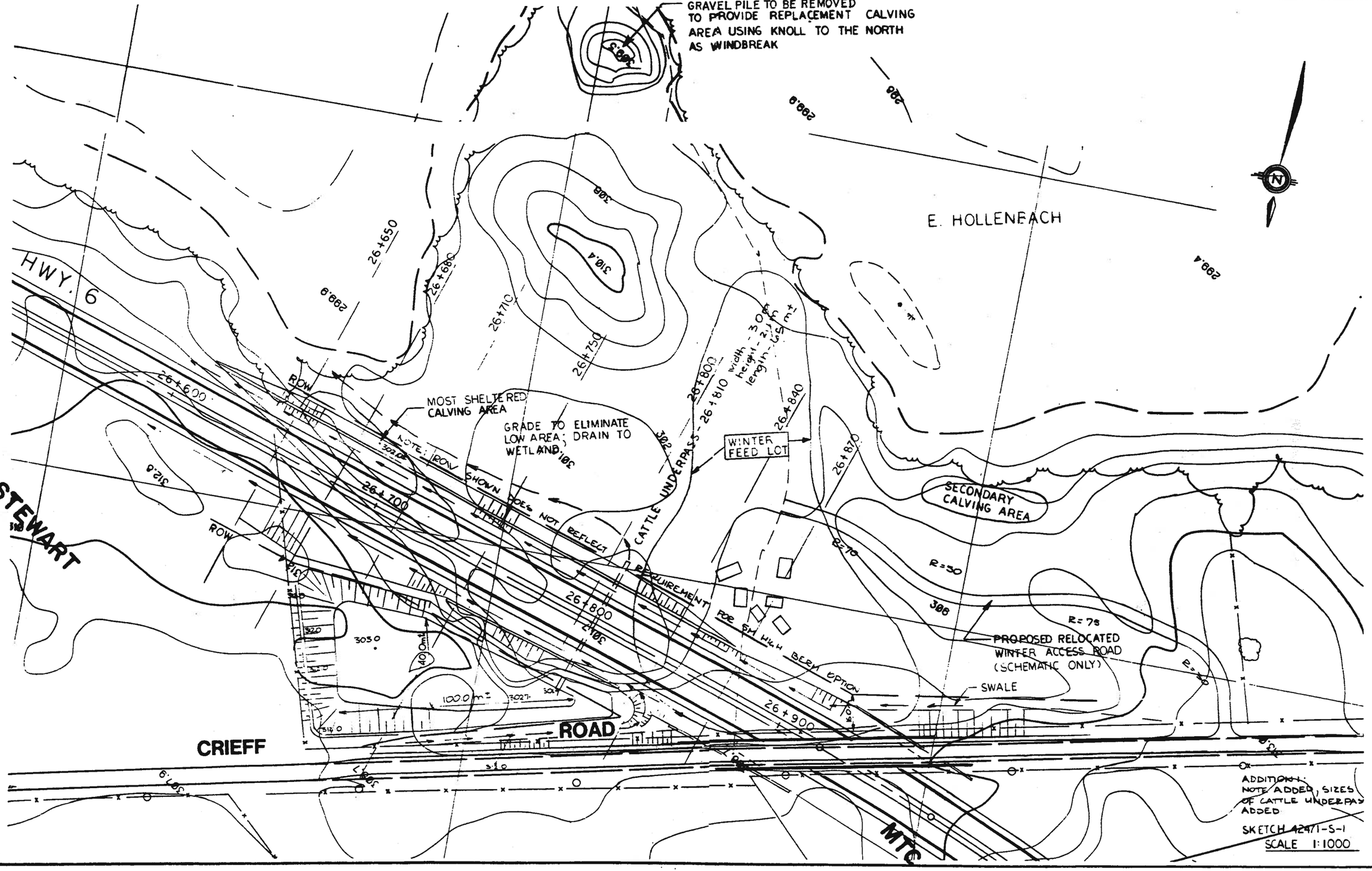
2) Surface underfoot in cattle pass must be such that drainage will be maintained. Type of material has not been determined.

3) Would prefer cattle pass function solely as such and vehicular (4WD tractor plus 9-foot high horse trailer) for retrieval of down cattle in north east corner be via ramp from Crieff Road, regardless of reduction in area for provision of ramp. A viable option, but MTC must now consider cost implications of providing cattle pass access to such a small parcel (0.5ha total, 0.2 ha flat).

4) Concern over length of new access to feedlot.

5) We inquired as to acceptability of possible clearance of a corner of cedar bush to provide additional area. Mr. Hollerbach cited concern with preserving wetland. Subsequent investigation by us of area in question revealed peripheral cedar surrounding internal area selectively cleared to some degree apparently to promote growth of cedar pole trees. We determined that this area could be used contingent upon appropriate infilling and approval by MNR and other interested agencies.

Copy of plan left with Mr. Hollenbach. Fenco to forward cross-sections plus profile.



HIGHWAY 6

FREELTON TO GUELPH

Environmental Assessment & Preliminary Design Report

POSSIBLE ADDITIONAL WORKS ON E. HOLLENBACH PROPERTY

APPENDIX L

TRAFFIC ANALYSIS

EXERPT FROM:

TRAFFIC ENGINEERING STUDY CONDUCTED IN CONJUNCTION WITH DEVELOPMENT, ANALYSIS AND EVALUATION OF ROUTE ALTERNATIVES

1.0 EXISTING CONDITIONS

The directional split on Highway 6 between Freelton and Highway 401 and on the Hanlon south of the City of Guelph limits is approximately 50/50. The Design Hourly volumes has been determined to be 10.4% of the AADT. The commercial vehicle content was established to be 18%.

With the above figures in mind, the existing two lane facility has a LOS "E" (1984 volumes) in the peak hour with indications for unstable flow occurring quite often. The main reasons for the low level of service are the large truck component and the lack of turning bays.

1.1 Accident Rates

Accident data for 1982 for Highway 6 between Freelton and Morriston revealed that this section of the highway exhibited an accident rate (0.74 accidents per million vehicle kilometres) lower than the 1981 Provincial Average for Kings highways (1.1 a/mvkm). However, between Morriston and Highway 401 the accident rate was 2.5 a/mvkm.

Notably, personal injuries occurred in almost 50% of all accidents. During 1982, three fatalities were recorded between Freelton and Morriston. These characteristics may be attributable to a combination of the type of accident (the majority were rear end collisions), apparently related to turning movements to many commercial and residential accesses, high speed and the relatively high proportion of heavy commercial vehicles (average daily 18%; estimated maximum daily 25-30%).

High speed regional traffic, and commercial vehicles in particular, has been cited as being "intimidating" by those making local trips. Residents of the Hamlets of Aberfoyle and Morriston and the University of Guelph with buildings close to the Highway 6 right-of-way have expressed concern with the increasing volumes of high speed traffic, citing problems such as noise, vehicle/pedestrian conflicts, and adverse impacts to air quality, landscaping, development potential and property values in general.

1.2 Origin-Destination Survey (1984)

In order to obtain existing O-D destination information within the study area, and thus be in a position to judge the various alternatives in terms of meeting the study objectives and removing the through traffic from the affected residential areas, MTC (Transportation Demand Forecasting Office) carried out an O-D interview survey at the two interchanges within the study area. The station locations are shown on Figure 1.1.

From the overall P.T.Z/COR ZONES and provincial network, an area of 20 zones was isolated; Figure 1.2.

The isolated trip tables are shown on Table 1.1.

These trip tables were used as base information for the future O-D tables/forecast demand volumes for the various alternatives (see part 2.0).

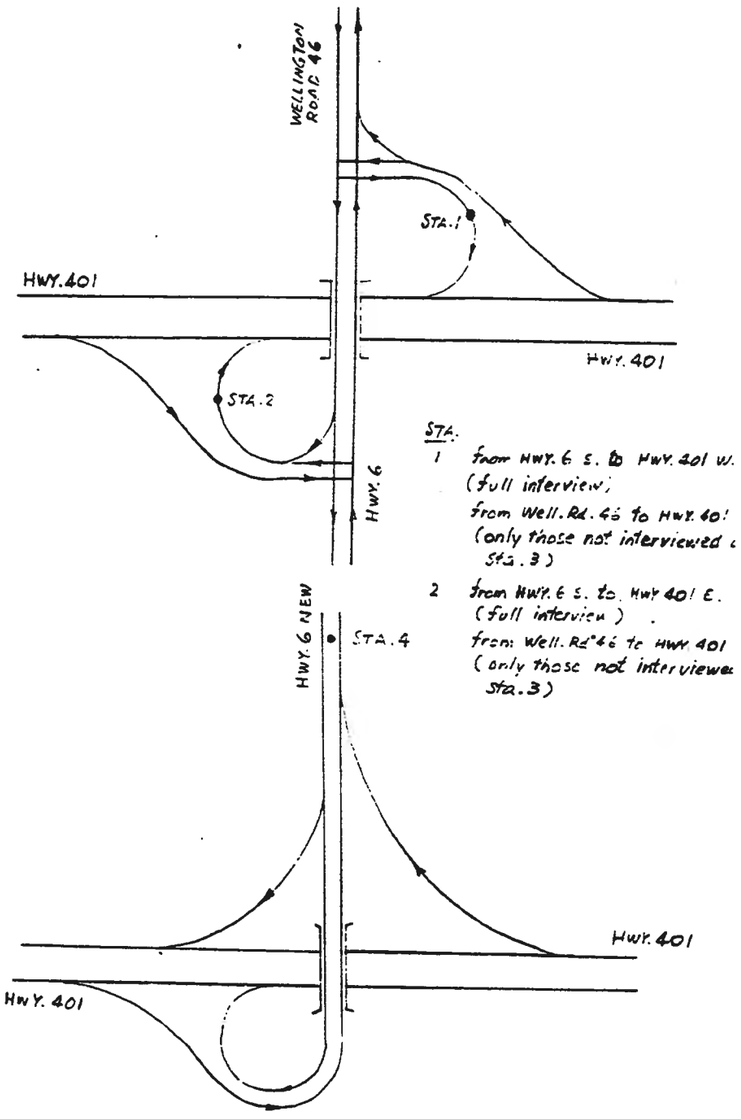
1.3 Main Conclusions from the Existing Traffic Conditions

The main conclusions from the existing traffic conditions, with regard to developing viable alternatives, can be summarized as follows:

a) The existing two lane facility is approaching capacity in the peak hours and is not providing sufficient comfort and safety for the local traffic throughout the day;

b) None of the cross roads through and turning traffic at Highway 6 is of sufficient size to warrant traffic signals. At the same time, the high percentage of through traffic and of long range heavy commercial vehicles, may require additional safety precautions to secure safe manoeuvres for the local traffic, particularly provision of left turn lanes;

c) The main desire lines through the study area indicate that besides the major demand along Highway 401, the second highest desire line is Highway 401E - Guelph and vice versa. The third largest desire flow is Highway 6 south - Guelph and vice versa. This implies clearly that in order to satisfy one of the main objectives of the study, to reduce traffic on Brock road, the new route for Highway 6 should be attractive for the S-N as well as for the E-N moves.



STA.

1 from HWY. 6 S. to HWY. 401 W. (full interview)
from Well. Rd. 46 to HWY. 401 (only those not interviewed at Sta. 3)

2 from HWY. 6 S. to HWY 401 E. (full interview)
from Well. Rd. 46 to HWY 401 (only those not interviewed Sta. 3)

Figure 1.1 1984 HIGHWAY 6 (NORTH OF HIGHWAY 401) O-D SURVEY LOCATIONS OF SURVEY STATIONS

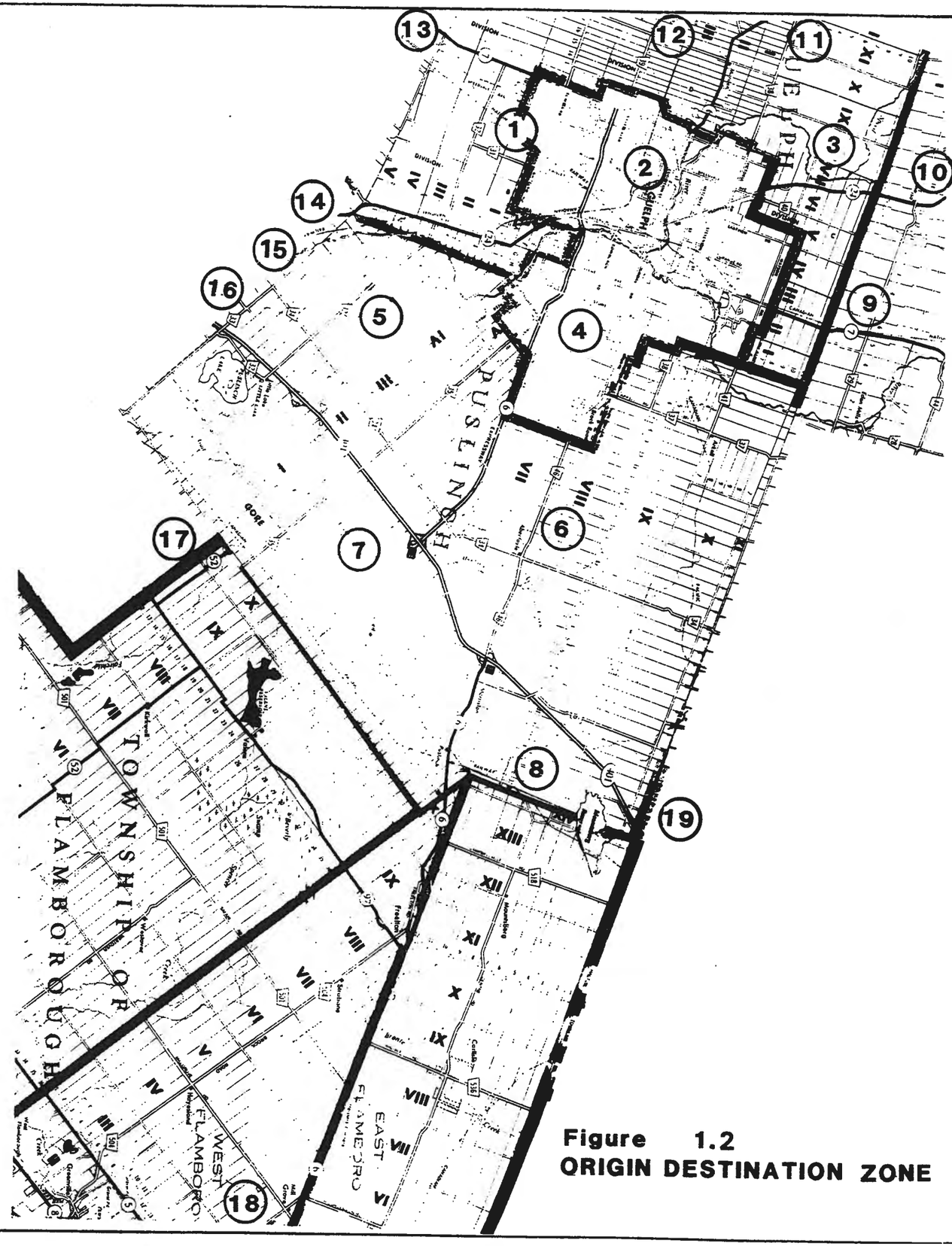


Figure 1.2 ORIGIN DESTINATION ZONE

HIGHWAY 6
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HIGHWAY 6 ISOLATED TRIP TABLES (CARS)

FROM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1						23	4	46			7		10	24			9	108	907					1138
2		10	9		4	57	8	170	15	13	2		35	161			8	319	1433	7				2251
3						7		24	129	4				6			2	50	29					251
4				5		48	4	60					33	133		38	38	164	1549					2072
5								12						8	7			6	35					68
6	28	39	18	19		55		47			9					70	8	36	190					519
7				11	7	20											7		44					89
8	62	136	29	157	7	105			11			7				90	8	43	113	12				780
9			68	3				4						10				7	4					96
10	3	19	10										17	7				4	2					62
11		3		4		7	13	5					35				3	187	198					455
12																		28	158					186
13	25	29	6	12							32													104
14	43	134	33	147	13				17															387
15					14																			14
16				31		40		5										20	432	4				532
17	10	17		20		6	17	7		5	24							63	20					189
18	291	295	46	211		19		6	17		184	17				437	43		6	14				1586
19	839	1021	42	1114	38	81	15	5	9		236	177				1266				12				4855
20	5	5				7	3	5								3	9		16					53
TOTAL	1306	1708	261	1734	83	475	64	396	198	22	494	201	130	349	7	1904	135	1035	5136	49				15687

GRAND TOTAL OF MATRIX 15687

HIGHWAY 6 ISOLATED TRIP TABLES (TRUCKS)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1						14							3						80					97
2						12	3	10					49	43			6	65	445					633
3									11				8											19
4								25						18		8		3	22					76
5		2																						2
6	8	25		8		14							18					103	192					368
7						11										18								11
8	4			8							2					2			14					30
9		14	18	8																				40
10														4										4
11													11					77	53					141
12																		10	68					78
13	22	9									24													55
14		27	15	15																				57
15					2																			2
16				2		25												17	29					73
17		4																						4
18	91	57				24					41	37				160	14							424
19	249	262		19		152					54	28				276								1040
20																								
TOTAL	374	400	33	60	2	252	3	35	11		121	65	71	65		464	20	275	903					3154

GRAND TOTAL OF MATRIX 3154

TABLE 1.1

ISOLATED TRIP TABLES

2.0 TRAFFIC ANALYSIS

2.1 Projected Link Volumes - Methodology

The internal and external traffic zones as determined or the O-D survey (see Part 1.2), were subjected to a past growth review in terms of generated traffic potential.

An overall growth factor was determined for each zone based on population/numbered work places growth potential, as well as commercial/industrial activities. In discussion with the City of Guelph Planning Officials, and MTC-S/W Region Traffic, and in line with the provisions of the Town of Puslinch Official Plan, these Overall growth Factors were translated in average annual generated traffic growth as shown on Table 2.1.

Table 2.2 gives the summary O-D Table for year 2004 using the data from Tables 1.1 and 2.1.

2.2 Projected Link Volumes on the "Do Nothing" Alternative

The assignment of the year 2004 O-D table was carried out for the "Do Nothing" alternative with subsequent calibration using the 1984 AADT volumes to fill in missing moves from the O-D survey. This assignment is shown in Figure 2.1. It is based on average operational speed of 60 km/h for both the Hanlon and Brock Road.

The basic AADT figures on Figure 2.1 are based on the expected traffic growth as shown in Table 2.1, which is somewhat higher than the past historic growth on both the Hanlon Expressway and Brock Road south.

In order to be able to judge the sensitivity of this difference, the projected future AADT based on the historic past growth average are shown in brackets as "lower growth scenario" figures.

TABLE 2.1
PROJECTED TRAFFIC GENERATION GROWTH - WITHIN THE STUDY AREA

Zone	Description	Growth Overall Factor (1984-2004)	Projected Annual Traffic Growth
1	West Guelph	2.19	4%
2	Central & North Guelph	1.48	2%
3	Eastern Guelph	1.48	2%
4	University of Guelph area	2.19	2%
5	Northwest Puslinch	1.37	1.6%
6	Brock Road area	2.19	4%
7	Southwest Puslinch	1.37	1.6%
8	South Puslinch/North Flamborough	1.37	1.6%
9	Highway 7E	1.48	2%
10	Highway 24E	1.48	2%
11	Highway 6N	1.48	2%
12	County road 86	1.48	2%
13	Highway 7W	1.48	2%
14	Highway 24W	1.48	2%
15	County Road 34W	1.48	2%
16	Highway 401W	1.48	2%
17	County Road 35S	1.48	2%
18	Highway 6S	1.48	2%
19	Highway 401E	1.48	2%

Each current demand volume between two zones identified by the 1984 O-D survey was multiplied by the average growth for the particular pair of zones. The projected O-D table is shown on Table 2.2.

2.3 Projected Link volumes on the Representative Alternatives

A "shortest travel time" assignment of the 2004 O-D matrix was manually carried out for the following alternatives: A-1, A-5/B-2 combined alternative C-1/C-4/C-5, alternative D-1 D-6/D-4, alternative E-2, alternatives C-7a and b and alternative C-7 modified. These year 2004 AADT assignments are shown on Figures 2.2 to 2.9.

The following assumptions were made for these assignments:

- 60 km/h operational speed for old Highway 6 south of Highway 401 and for Brock Road.

ZONE TO->	1				2				3				4				5				6				7				8				9				10			
FROM	%	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
1	4	0	0	0	0	2	3	0	0	2	3	0	0	2	3	0	0	1.6	2.8	0	0	4	4	51	112	1.6	2.8	4	1	1.6	2.8	70	122	2	3	0	0	2	3	0	0
2	2	4	3	0	0	0	0	0	0	2	2	0	0	2	2	0	0	1.6	1.8	4	6	4	3	89	160	1.6	1.8	14	20	1.6	1.8	190	272	2	2	0	0	2	2	0	0
3	2	4	3	0	0	2	2	0	0	2	0	0	0	2	2	0	0	1.6	1.8	4	6	4	3	19	32	1.6	1.8	0	0	1.6	1.8	2.9	41	2	2	0	0	2	2	0	0
4	2	4	3	0	0	2	2	0	0	2	0	0	0	2	2	0	0	1.6	1.8	0	0	4	3	18	32	1.6	1.8	0	0	1.6	1.8	29	41	2	2	0	0	2	2	0	0
5	1.6	4	2.8	0	0	2	1.8	4	0	2	1.8	0	0	2	1.8	0	0	1.6	0	0	0	4	2.8	0	0	1.6	1.6	7	10	1.6	1.6	12	16	2	1.8	0	0	2	1.8	0	0
6	4	4	4	51	0	2	3	89	0	2	3	16	0	2	3	0	0	1.6	2.8	0	0	4	0	0	0	1.6	2.8	20	35	1.6	2.8	105	182	2	3	0	0	2	3	0	0
7	1.6	4	2.8	4	0	2	1.8	14	0	2	1.8	0	0	2	1.8	0	0	1.6	1.6	0	0	4	2.8	0	0	1.6	0	0	0	1.6	1.6	0	0	2	1.8	0	0	2	1.8	0	0
8	1.6	4	2.8	70	0	2	1.8	190	0	2	1.8	0	0	2	1.8	0	0	1.6	1.6	0	0	4	2.8	0	0	1.6	1.6	0	0	1.6	0	0	0	2	1.8	11	16	2	1.6	0	0
9	2	4	3	0	0	2	2	0	0	2	2	0	0	2	2	0	0	1.6	1.8	0	0	4	3	0	0	1.6	1.8	0	0	1.6	1.8	0	0	2	0	0	0	2	2	0	0
10	2	4	3	0	0	2	2	0	0	2	2	0	0	2	2	0	0	1.6	1.8	0	0	4	3	0	0	1.6	1.8	0	0	1.6	1.8	0	0	2	2	0	0	2	2	0	0
11	2	4	3	0	0	2	2	0	0	2	2	0	0	2	2	0	0	1.6	0	0	0	4	3	0	0	1.6	1.8	0	0	1.6	1.8	0	0	2	2	0	0	2	0	0	0
12	2	4	3	0	0	2	2	0	0	2	2	0	0	2	2	0	0	1.6	1.8	0	0	4	3	0	0	1.6	1.8	0	0	1.6	1.8	0	0	2	2	0	0	2	2	0	0
13	2	4	3	0	0	2	2	0	0	2	2	0	0	2	2	0	0	1.6	1.8	0	0	4	3	0	0	1.6	1.8	0	0	1.6	1.8	0	0	2	2	0	0	2	2	0	0
14	2	4	3	0	0	2	2	0	0	2	2	0	0	2	2	0	0	1.6	1.8	0	0	4	3	0	0	1.6	1.8	0	0	1.6	1.8	0	0	2	2	0	0	2	2	0	0
15	2	4	3	0	0	2	2	0	0	2	2	0	0	2	2	0	0	1.6	1.8	0	0	4	3	0	0	1.6	1.8	0	0	1.6	1.8	0	0	2	2	0	0	2	2	0	0
16	6	4	5	0	0	2	4	0	0	2	4	0	0	2	4	0	0	1.6	3.8	0	0	4	5	0	0	1.6	3.8	0	0	1.6	3.8	0	0	2	4	0	0	2	4	0	0
17	6	4	3	10	0	2	2	25	0	2	2	0	0	2	2	0	0	1.6	1.8	0	0	4	3	0	0	1.6	1.8	0	0	1.6	1.8	0	0	2	2	0	0	2	4	0	0
18	6	4	3	211	0	2	2	449	0	2	2	0	0	2	2	0	0	1.6	1.8	0	0	4	3	0	0	1.6	1.8	0	0	1.6	1.8	0	0	2	2	0	0	2	4	0	0
19	6	4	5	1339	0	2	4	2323	0	2	4	0	0	2	4	0	0	1.6	3.8	0	0	4	5	0	0	1.6	3.8	0	0	1.6	3.8	0	0	2	4	0	0	2	4	0	0
20	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			58.4	1690	0		41.4	3094	0		39.4	18	0		43.4	0	0		36.2	8	12		58.4	178	336		38	45	66		37.8	408.9	674		41.4	11	16		43.4	0	0	

ZONE TO->	11				12				13				14				15				16				17				18				19				20				1->20
FROM	%	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	ROW TOTAL
1	4	2	3	0	0	2	3	0	0	2	3	0	0	2	3	0	0	2	3	0	0	6	5	0	0	2	3	10	18	2	3	211	381	6	5	1339	3552	0	0	5	0	5934.4
2	2	2	2	0	0	2	2	0	0	2	2	0	0	2	2	0	0	2	2	0	0	6	4	0	0	2	2	25	37	2	2	449	667	6	4	2323	5090	0	0	0	0	9387.4
3	2	2	2	0	0	2	2	0	0	2	2	0	0	2	2	0	0	2	2	0	0	6	4	0	0	2	2	2	3	2	2	50	74	6	4	42	92	0	0	0	0	408.3
4	2	2	2	0	0	2	2	0	0	2	2	0	0	2	2	0	0	2	2	0	0	6	4	54	118	2	2	38	56	2	2	211	314	6	4	1593	3490	0	0	0	0	6035.4
5	1.6	2	1.8	0	0	2	1.8	0	0	2	1.8	0	0	2	1.8	13	19	2	1.8	7	10	6	3.8	0	0	2	1.8	0	0	2	1.8	6	9	6	3.8	38	80	0	0	0	0	269
6	4	2	3	9	16	2	3	0	0	2	3	0	0	2	3	0	0	2	3	0	0	6	5	106	281	2	3	8	14	2	3	242	437	6	5	674	1523	0	0	0	0	3868.4
7	1.6	2	1.8	13	19	2	1.8	0	0	2	1.8	0	0	2	1.8	0	0	2	1.8	0	0	6	3.8	0	0	2	1.8	17	24	2	1.8	44	63	6	3.8	15	32	0	0	0	0	283
8	1.6	2	1.8	5	7	2	1.8	7	10	2	1.8	0	0	2	1.8	0	0	2	1.8	0	0	6	3.8	94	198	2	1.8	8	11	2	1.8	43	61	6	3.8	141	297	0	0	12	0	1219
9	2	2	2	0	0	2	2	0	0	2	2	0	0	2	2	17	25	2	2	0	0	6	4	0	0	2	2	0	0	2	2	17	25	6	4	9	20	0	0	0	0	154.4
10	2	2	2	0	0	2	2	0	0	2	2	0	0	2	2	0	0	2	2	0	0	6	4	0	0	2	2	5	7	2	2	4	6	6	4	2	4	0	0	0	0	69.4
11	2	2	0	0	0	2	2	0	0	2	2	57	85	2	2	0	0	2	2	0	0	6	4	0	0	2	2	24	36	2	2	341	507	6	4	344	754	0	0	0	0	2187.6
12	2	2	2	0	0	2	2	0	0	2	2	0	0	2	2	0	0	2	2	0	0	6	4	0	0	2	2	0	0	2	2	91	135	6	4	294	644	0	0	0	0	1205.4
13	2	2	2	0	0	2	2	0	0	2	0	0	0	2	2	0	0	2	2	0	0	6	4	0	0	2	2	0	0	2	2	0	0	6	4	0	0	0	0	0	0	41.4
14	2	2	2	0	0	2	2	0	0	2	2	0	0	2	2	0	0	2	2	0	0	6	4	0	0	2	2	0	0	2	2	0	0	6	4	0	0	0	0	0	0	41.4
15	2	2	2	0	0	2	2	0	0	2	2	0	0	2	2	0	0	2	0	0	0	6	4	0	0	2	2	0	0	2	2	0	0	6	4	0	0	0	0	0	0	41.4
16	6	2	4	0	0	2	4	0	0	2	4	0	0	2	4	0	0	2	4	0	0	6	0	0	0	2	4	0	0	2	4	751	1659	6	6	490	1571	0	0	4	0	4550.4
17	2	2	2	0	0	2	2	0	0	2	2	0	0	2	2	0	0	2	2	0	0	6	4	0	0	2	0	0	0	2	2	71	106	6	4	20	44	0	0	0	0	319.4
18	2	2	2	0	0	2	2	0	0	2	2	0	0	2	2	0	0	2	2	0	0	6	4	0	0	2	2	60	0	2	0	0	0	6	4	6	13	0	0	1	0	781.4
19	6	2	4	0	0	2	4	0	0	2	4	0	0	2	4	0	0	2	4	0	0	6	6	0	0	2	4	0	0	2	4	0	0	6	0	0	0	0	0	16	0	3753.2
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
			41.4	27	42		41.4	7	10		41.4	57	85		41.4	30	44		41.4	7	10		75.4	254	597		41.4	197	206		41.4	2531	4444		75.4	7330	17206		0	38	0	40555.3

LEGEND

A = PROJECTED ANNUAL TRAFFIC GROWTH (%) $[a_j]$

B = $\frac{a_i + a_j}{2}$

C = EXISTING VOLUME

D = FUTURE VOLUME

TABLE 2.2

SUMMARY O-D TABLE YEAR 2004 AADT VOLUMES

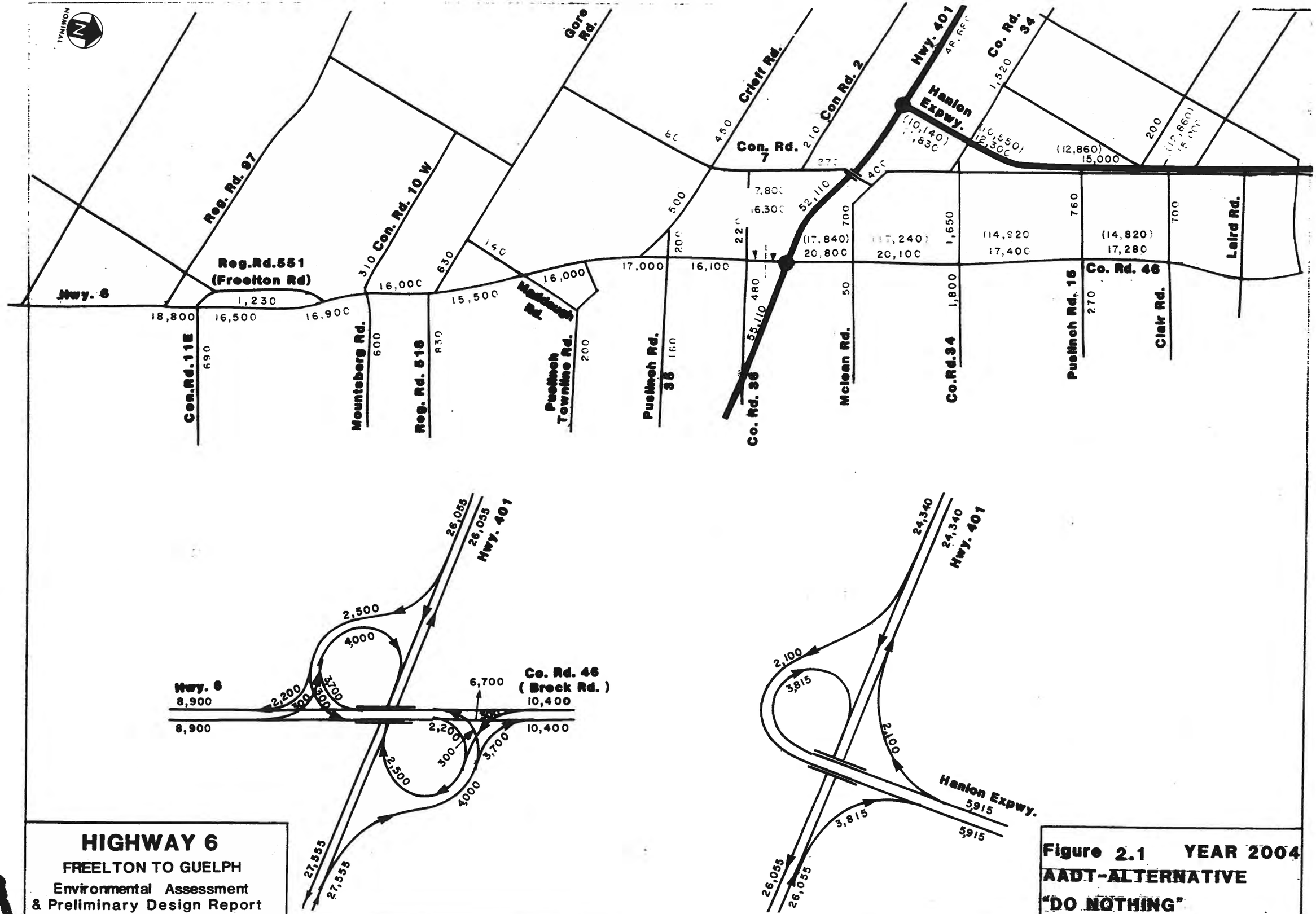

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Figure 2.1 YEAR 2004 AADT-ALTERNATIVE "DO NOTHING"

- Improved operational speed along the Hanlon to 80 km/h (unspecified improvements).

- Control screens were maintained for all year 2004 assignments including "Do Nothing" alternative on the screens shown on Figure 2.10.

For screen 5-5 as shown on Figure 2.10, a lower growth scenario for the corridor traffic, based on the historical growth for the past 9 years, is reflected in the AADT projection figures shown in brackets.

Time loss for a stop condition: 15 seconds.
Time loss for passing through traffic signals: 25 seconds.

2.4 Preliminary Comments on the Traffic Service offered by the Various Alternatives

a) "Do Nothing" Alternative - Figure 2.1

- four lane Highway 6 south of Highway 401 will be required by Year 1994
- Even four lanes on County road 46 (Brock Road) will not meet the demand
- The Hanlon picks up traffic, mainly as an escape route from County road 46 but is still below capacity (low utilization)
- Intersection problems emerging within the Highway 6/County Road 46/401 interchange

b) A-1 Alternative - Figure 2.2

- The new alignment picks up the bulk of the S-N traffic
- It also picks up the prevailing part of the E-N traffic; only 3,000 AADT use Brock Road
- Favourable split at the north screen; 3:1 for the Hanlon

c) A-5/B-2 Alternative - Figure 2.3

- Picks up slightly less traffic at the south end than A-1
- More traffic going E-N (3,900 AADT) uses Brock Road
- Favourable split at the north screen

d) C-1/C-4/C-5 Alternative - Figure 2.4

- Picks up good portion of the S-N traffic at the south end
- Substantial portion of the E-N traffic stays on Brock Road (4,400 AADT)
- Favourable split at the north screen

e) D-1/D-6/D-4 Alternative - Figure 2.5

- Less favourable split at the south end
- Substantial portion of E-N traffic stays on Brock Road (5,980 AADT)
- 2:1 split at the north screen

f) E-2 Alternative - Figure 2.6

- The worst split at the south end; under-utilization of the new alignment
- With regard to E-N traffic; similar to D-1/D-6/D-4
- Most unfavourable split at the north screen

g) C-7 Alternative - Figures 2.7, 2.8 and 2.9

- Compatible with C-1 and A-5 split at the south end
- With regard to E-N traffic; second best to A-1
- 2:1 split at the north screen

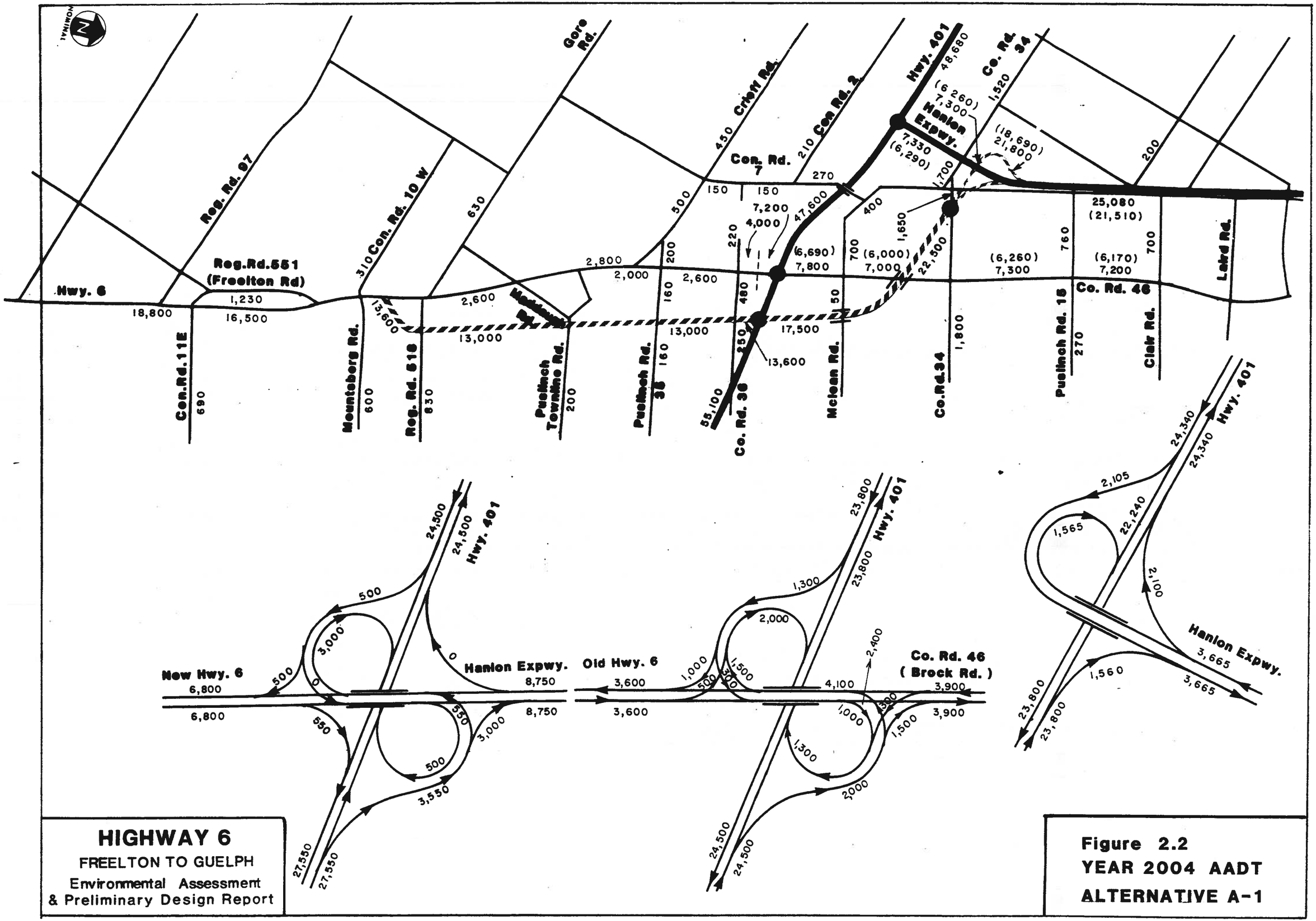

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Figure 2.2
YEAR 2004 AADT
ALTERNATIVE A-1

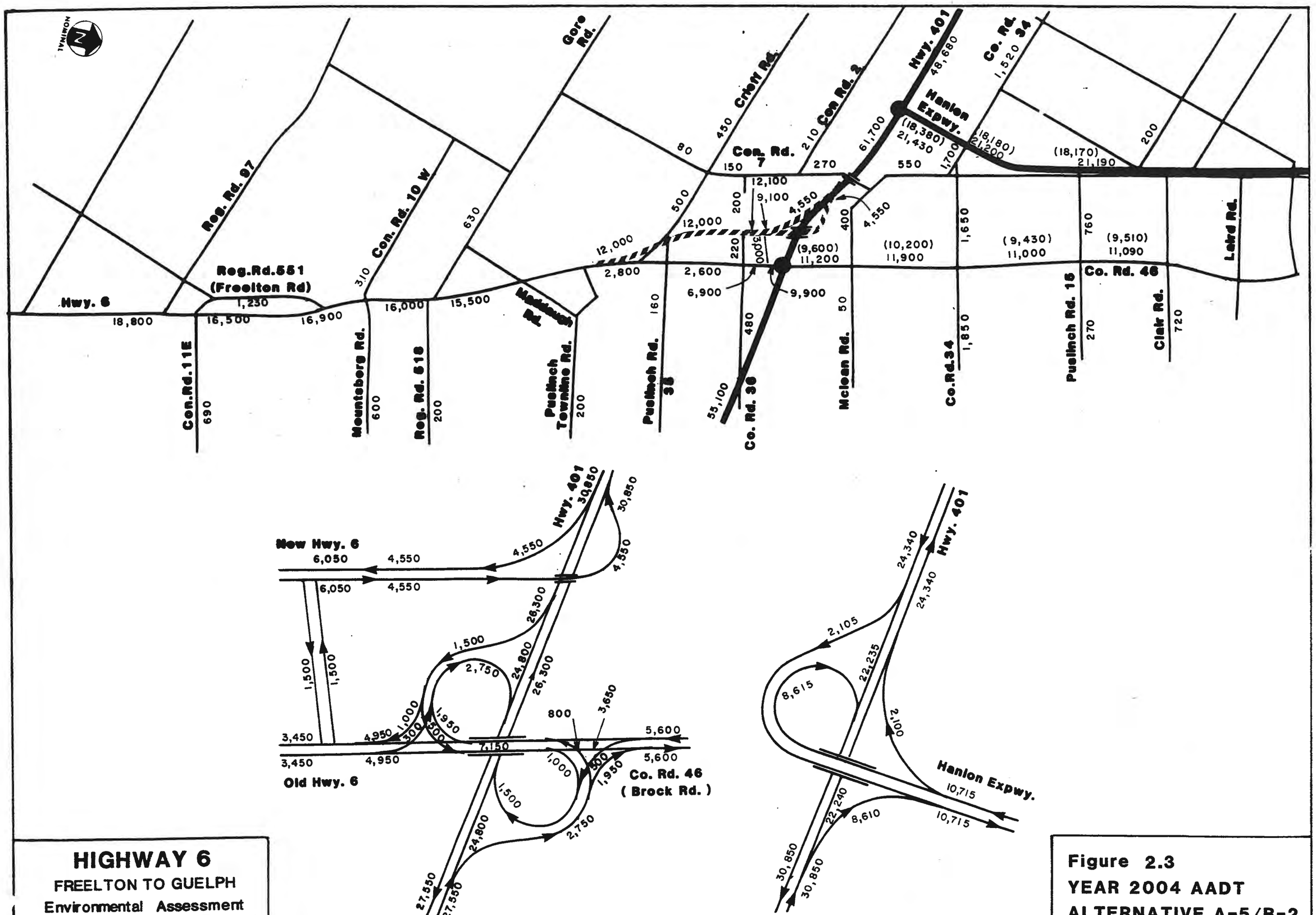

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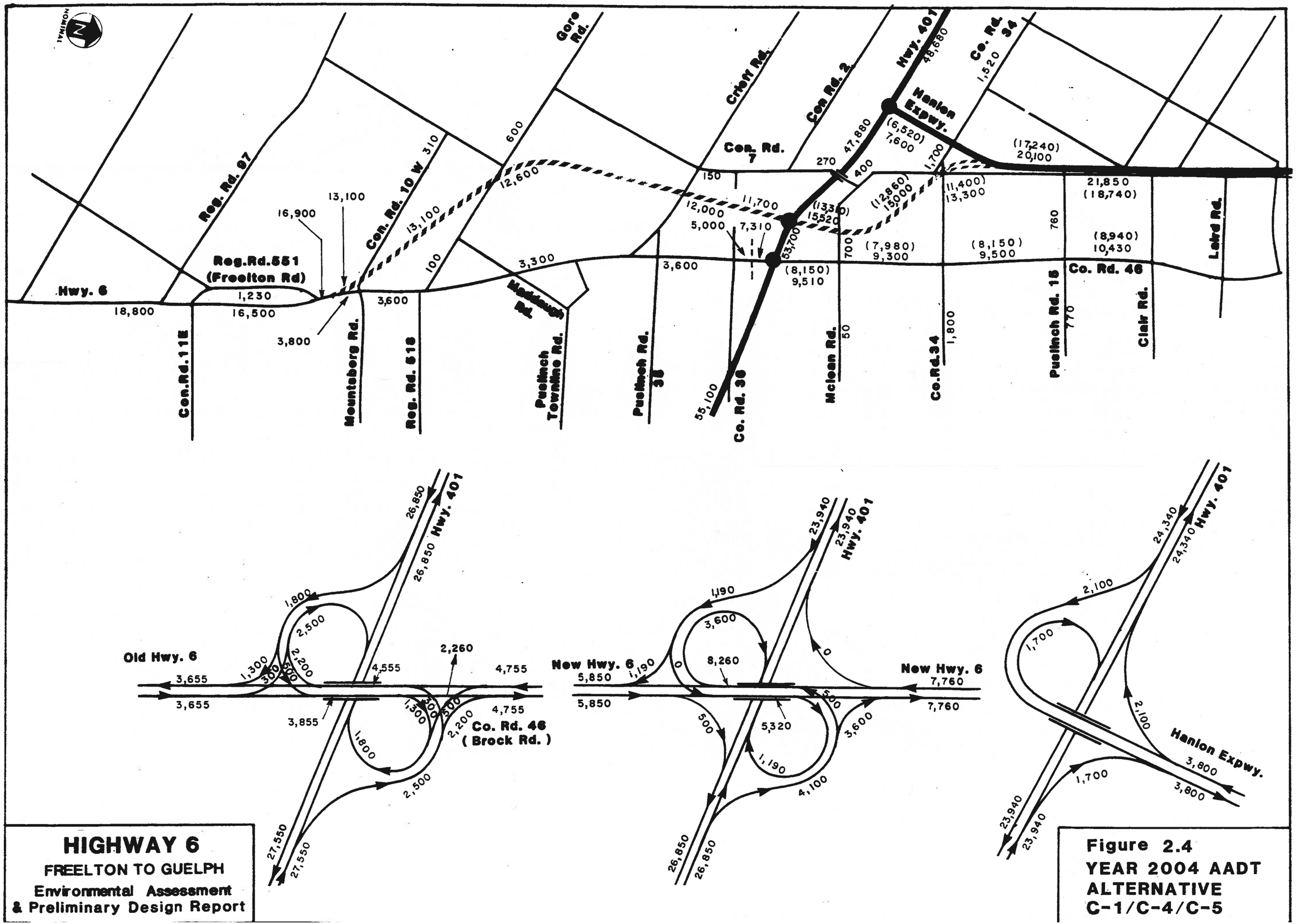
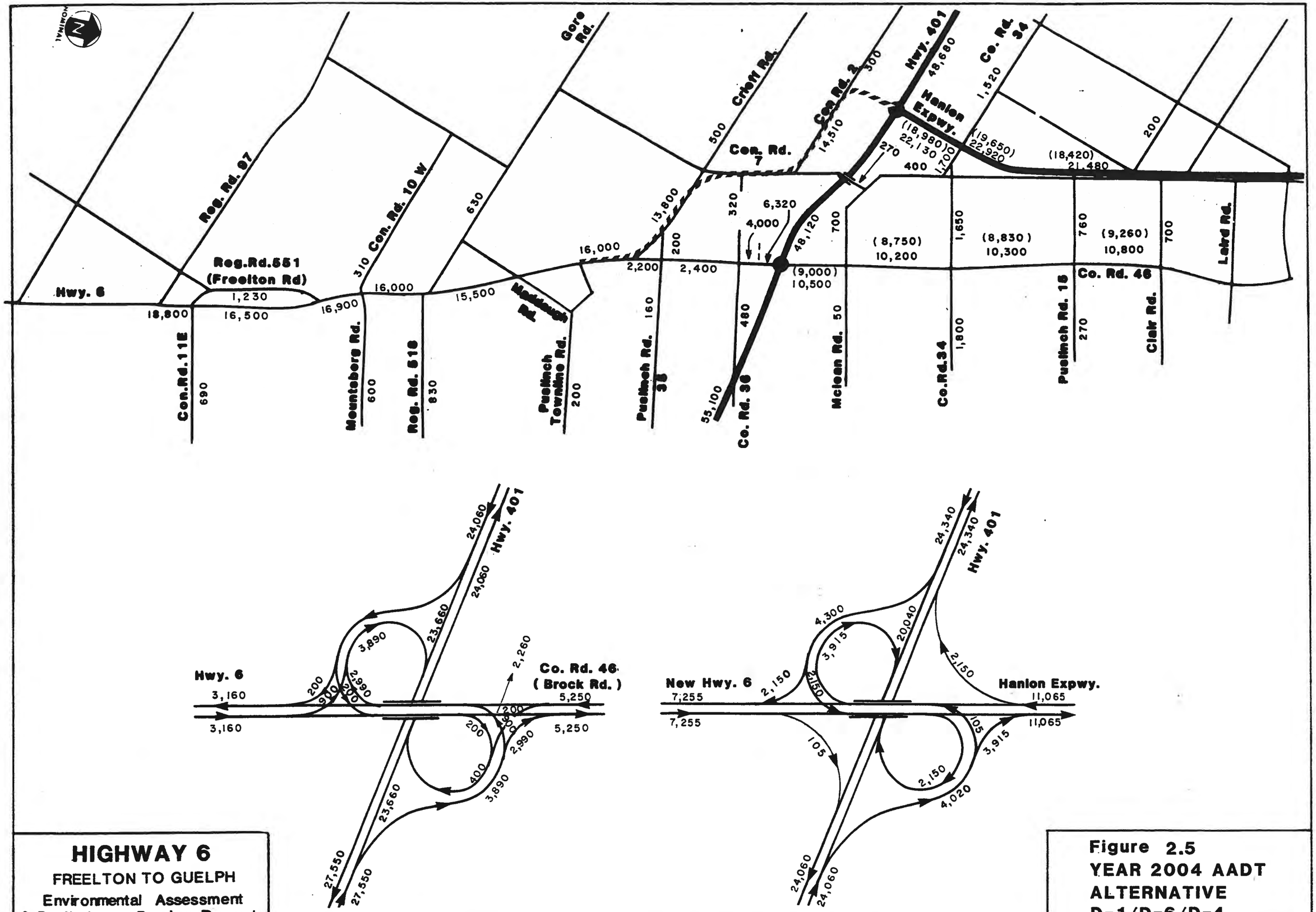
Figure 2.3
YEAR 2004 AADT
ALTERNATIVE A-5/B-2



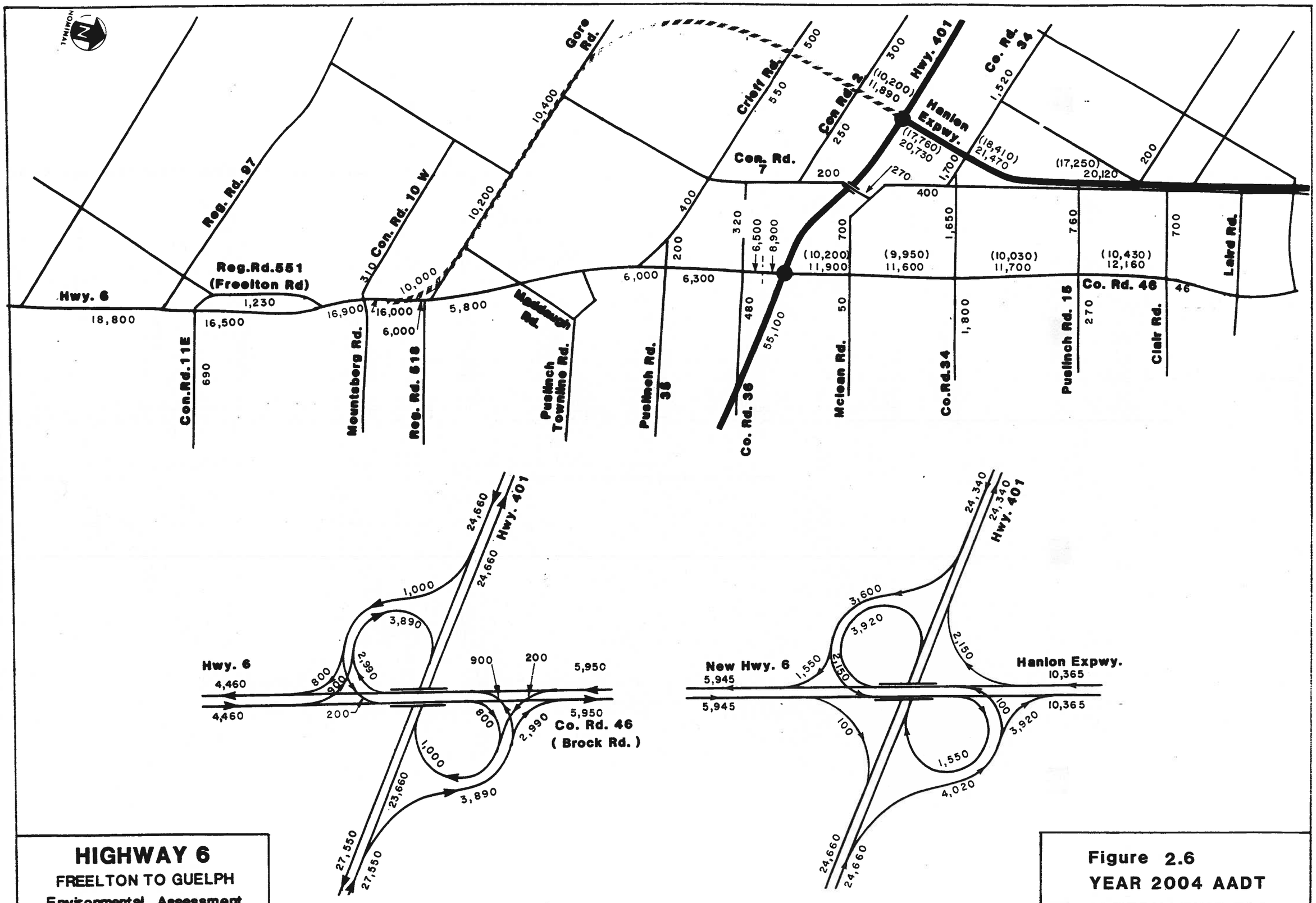
HIGHWAY 6
FREELTON TO GUELPH
Environmental Assessment & Preliminary Design Report

Figure 2.4
YEAR 2004 AADT
ALTERNATIVE
C-1/C-4/C-5



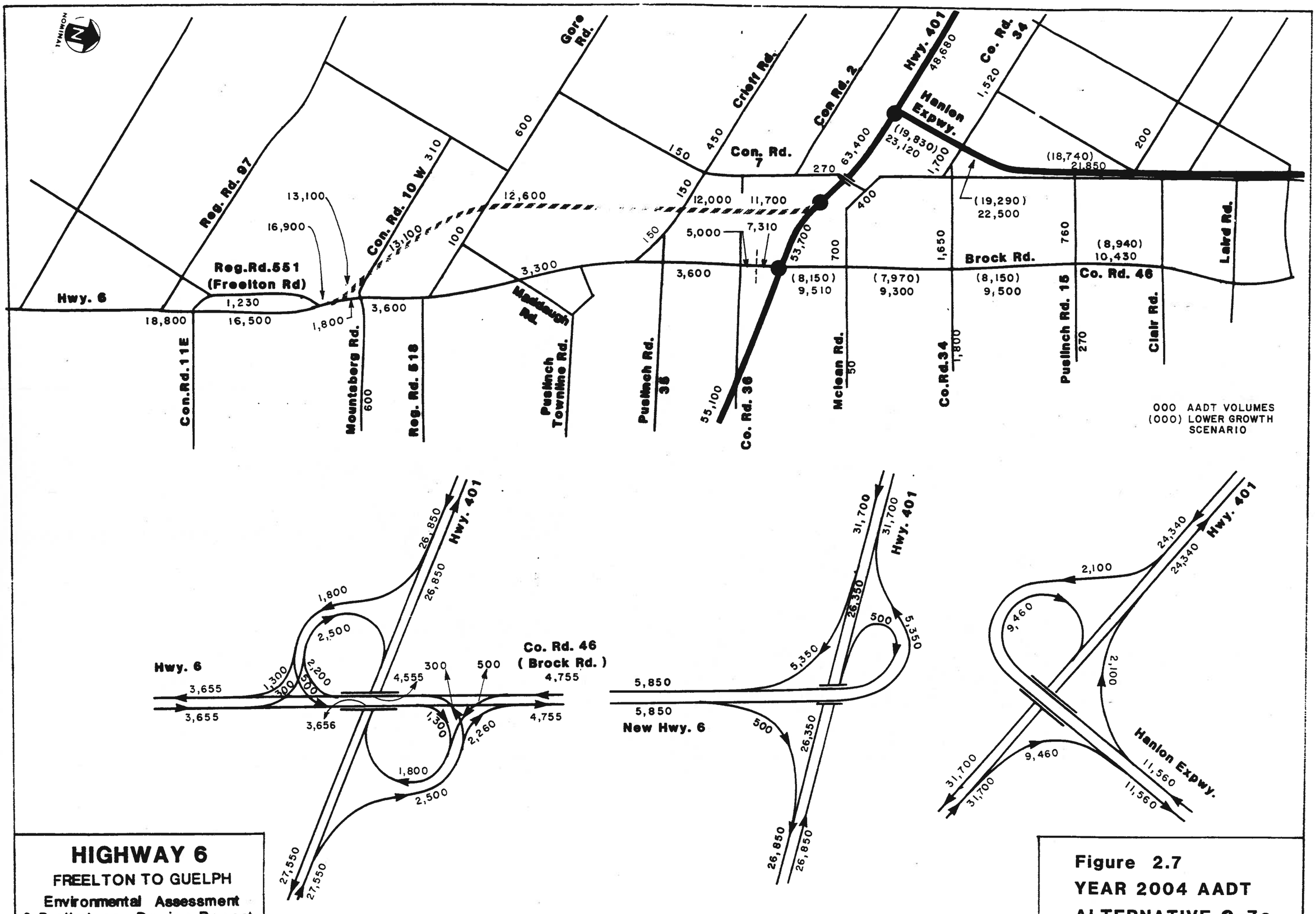
HIGHWAY 6
FREELTON TO GUELPH
Environmental Assessment
& Preliminary Design Report

Figure 2.5
YEAR 2004 AADT
ALTERNATIVE
D-1/D-6/D-4



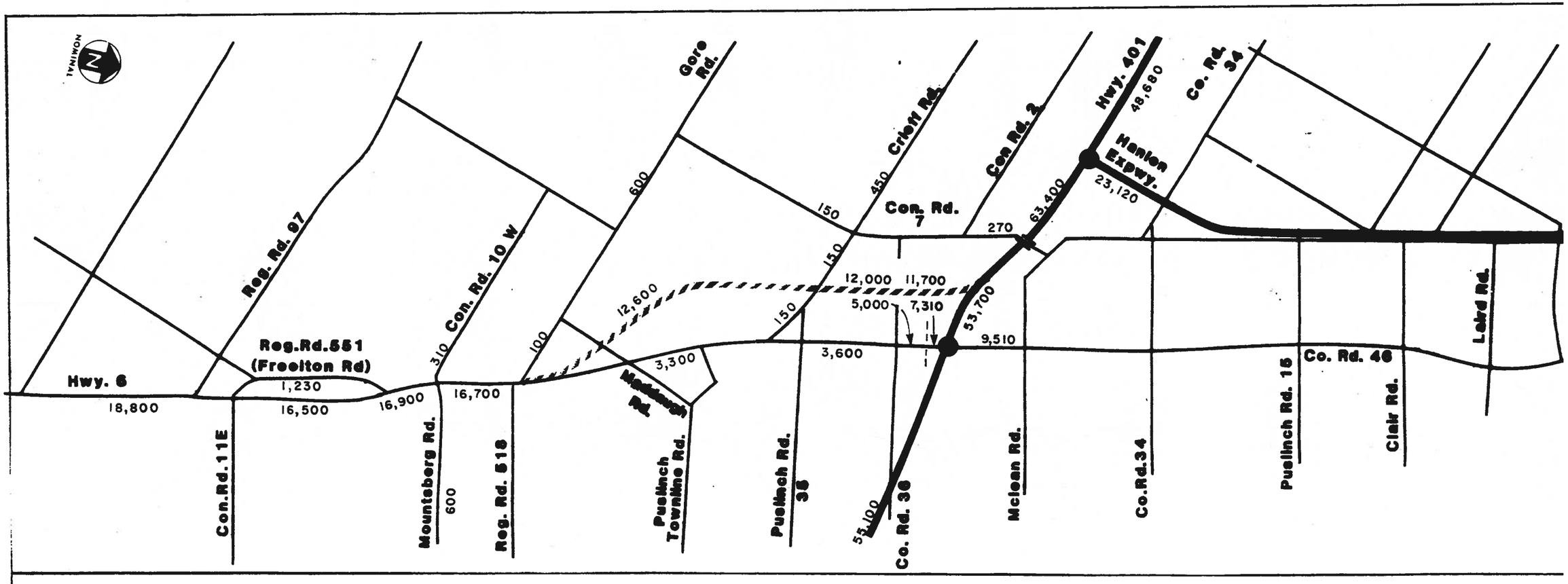
HIGHWAY 6
FREELTON TO GUELPH
Environmental Assessment
& Preliminary Design Report

Figure 2.6
YEAR 2004 AADT
ALTERNATIVE E-2



HIGHWAY 6
FREELTON TO GUELPH
Environmental Assessment
& Preliminary Design Report

Figure 2.7
YEAR 2004 AADT
ALTERNATIVE C-7a

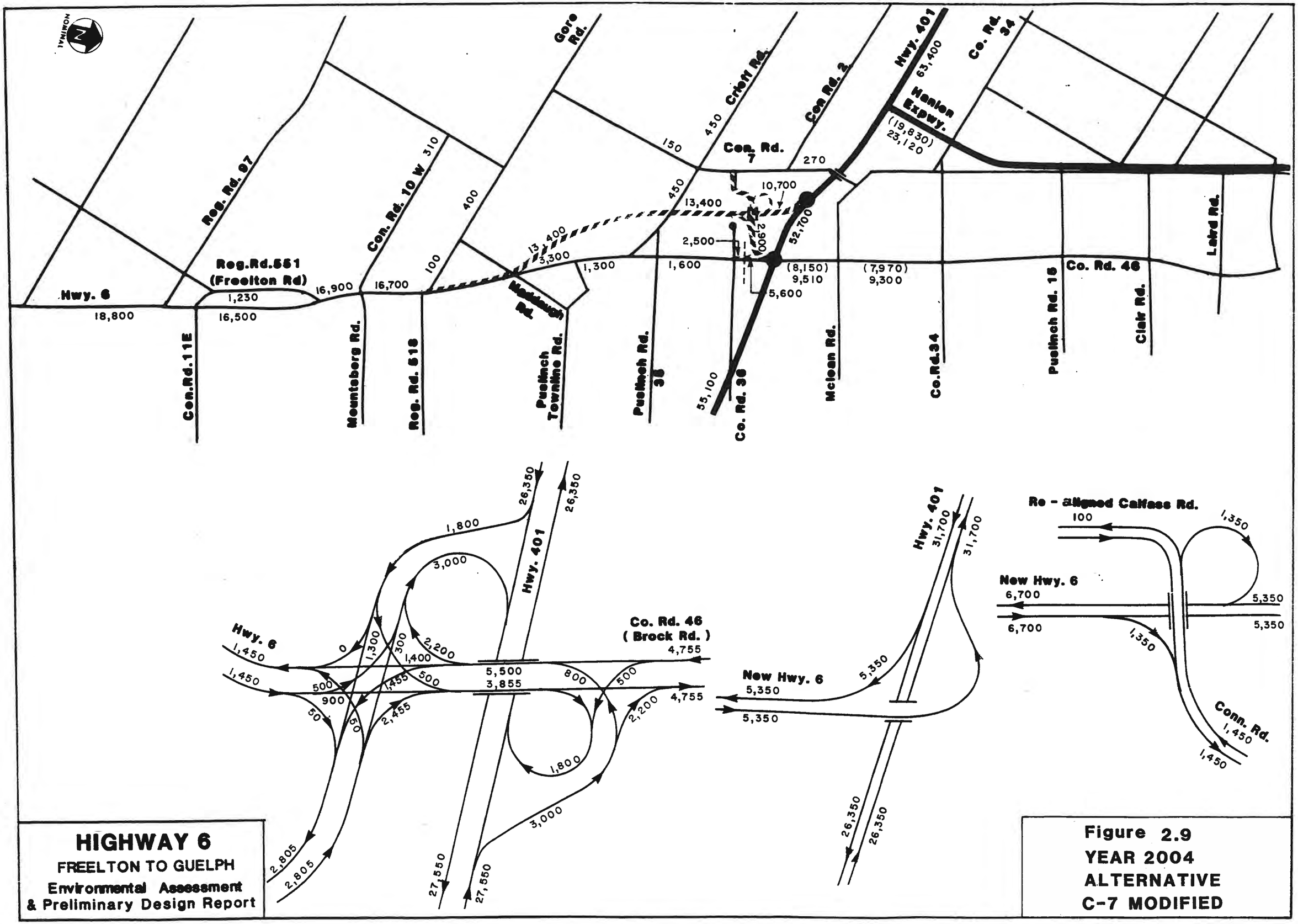


HIGHWAY 6

FREELTON TO GUELPH

Environmental Assessment
& Preliminary Design Report

Figure 2.8
YEAR 2004 AADT
ALTERNATIVE C-7A

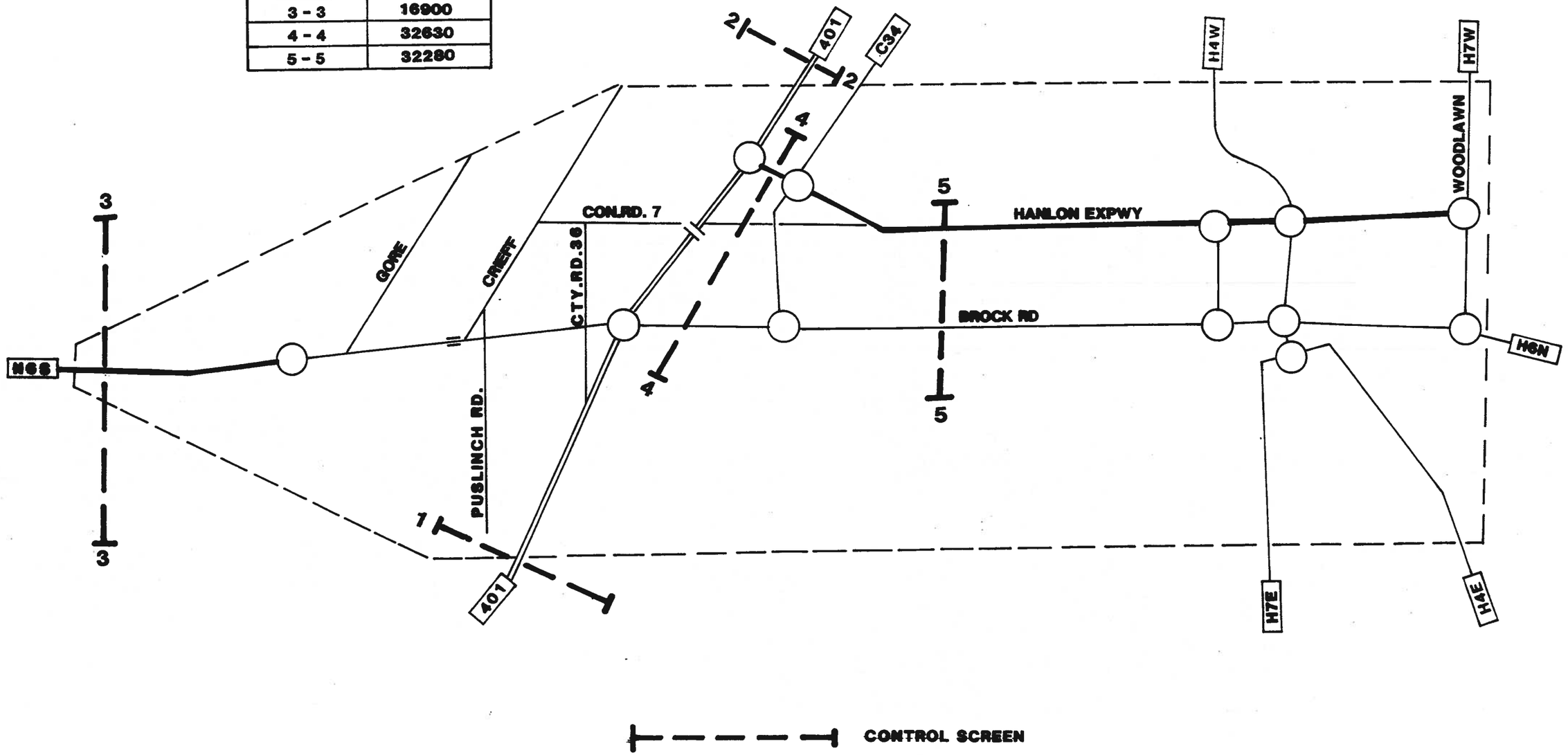


HIGHWAY 6
FREELTON TO GUELPH
Environmental Assessment
& Preliminary Design Report

Figure 2.9
YEAR 2004
ALTERNATIVE
C-7 MODIFIED

YEAR 2004

SCREEN NO.	TOTAL AADT
1 - 1	55110
2 - 2	48690
3 - 3	16900
4 - 4	32630
5 - 5	32280



HIGHWAY 6
FREELTON TO GUELPH
Environmental Assessment
& Preliminary Design Report

Figure 2.10
CONTROL SCREENS

Ministry of Transportation
Ontario

TRAFFIC PROJECTIONS

Highway 6
Freelton to Guelph
Update and Supplementary Investigation for Route Location and Preliminary Design
W.P. 65-76-05

TECHNICAL PAPER

ANNING & DESIGN SECTION

Fenco MacLaren Inc.

TRAFFIC PROJECTIONS

HIGHWAY 6
FREELTON TO GUELPH

UPDATE AND SUPPLEMENTARY INVESTIGATIONS FOR ROUTE LOCATION AND PRELIMINARY DESIGN STUDY

W.P. 65-76-05

MARCH 1993

FENCO MacLAREN

TRAFFIC PROJECTIONS

INTRODUCTION

In 1985, MTO initiated the Route Location and Preliminary Design Study for Highway 6 from Freelton to Guelph. Several alternative routes were developed and evaluated with a technically preferred route selected in 1986. During 1987 the technically preferred route was refined in the Preliminary Design stage. An Environmental Assessment Report was written and submitted to external Ministries/Agencies for Pre-Submission review and comment in September 1989. During the latter part of 1990, the Project Team met to address reviewers' comments and develop a response strategy. A tentative work program was prepared and submitted to MTO in July 1991. No further work has been carried out from that point. The MTO has now re-activated this project.

This Report has been prepared in order to update the traffic volume assignments for the existing and future alignment of Highway 6 between Freelton and Guelph. The Report includes a brief summary of the methodology utilized to arrive at the assignments, a summary of a few minor inconsistencies noted in the existing count data, as well as the assumptions utilized in assignment of the future volumes.

1) 1991 AADT

Existing traffic volumes were obtained either from direct counts, or extrapolation of earlier counts using past historical growth rates. The following data sources were utilized:

- Technical Paper - Projected AADT Traffic Volumes on the Representative Alternatives, Fenco - Final Revision 3, October 25, 1985
- MTO, Memo from J.M. Stevens to W.J. Brown, 1990-10-03
- MTO, Memo from N. Mudrinic to M. Swim, 1993-02-02
- The Township of Puslinch, Memo from J. Howlett to M. Swim, 1993-02-11
- The County of Wellington, Memo from R. Dale to M. Swim, 1993-02-12
- The Regional Municipality of Hamilton-Wentworth, Memo from H. Salatandrie to M. Swim, 1993-02-25
- Various MTO counts 1989, 1990, 1991, 1992
- Traffic volume forecasts from the Guelph and Area Transportation Planning Study, 1993.

Methodology

All counts were extrapolated to bring them to a common base year of 1991. Twenty-year growth factors have been applied to the counts in order to arrive at forecast volumes for the existing road network in 2011. Traffic assignments were then determined based on assumed travel patterns after implementation of the subject project.

Due to the variability of sources and time span involved in the count data that was collected, it was necessary to "massage" some of the counts in order that the continuity and consistency of the data presented be maintained. Two concerns regarding the count data became apparent during this analysis:

a) Highway 401 traffic counts indicate that westbound volumes west of Highway 6 S/Brock Road (1991 -28,950 vpd) are lower than volumes east of Highway 6 S/Brock Road (1991- 31,000 vpd).

However, two separate traffic counts taken in 1989 and 1991 at the Highway 401/ Highway 6 S/Brock Road Interchange ramp terminals indicate that westbound volumes on Highway 401 west of Highway 6 S/Brock Road should be higher than east of Highway 6 S/Brock Road (1991 - 1822 vpd).

These figures represent a discrepancy of 3872 vpd in the Hwy 401 traffic volumes through the interchange, a difference of approximately 13%.

b) Traffic volumes on the Highway 400/Highway 6 S/Brock Road interchange ramps from 1989 to 1991 indicate a growth rate over this 2-year period in excess of 25% per year on the ramps to and from the east. The ramps to and from the west indicate a 2-year growth rate in excess of 15% per year.

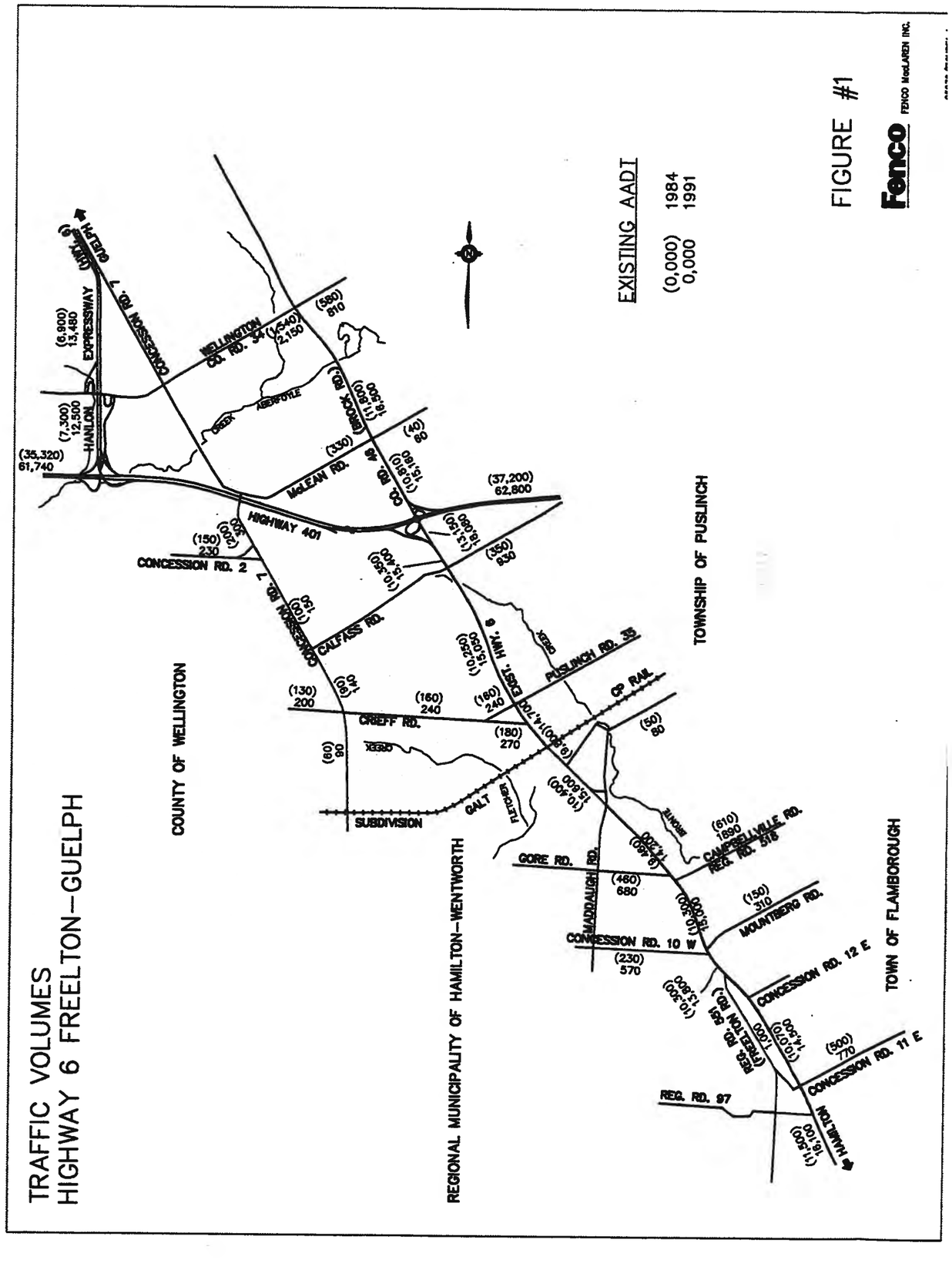
Assuming the existing count data is valid, it is clear that these growth rates are not sustainable. Hence, traffic volumes forecast for the year 2011, based on the above noted information sources, reflect a more realistic compounded growth rate in the range of 2.1% and 3.6% per year.

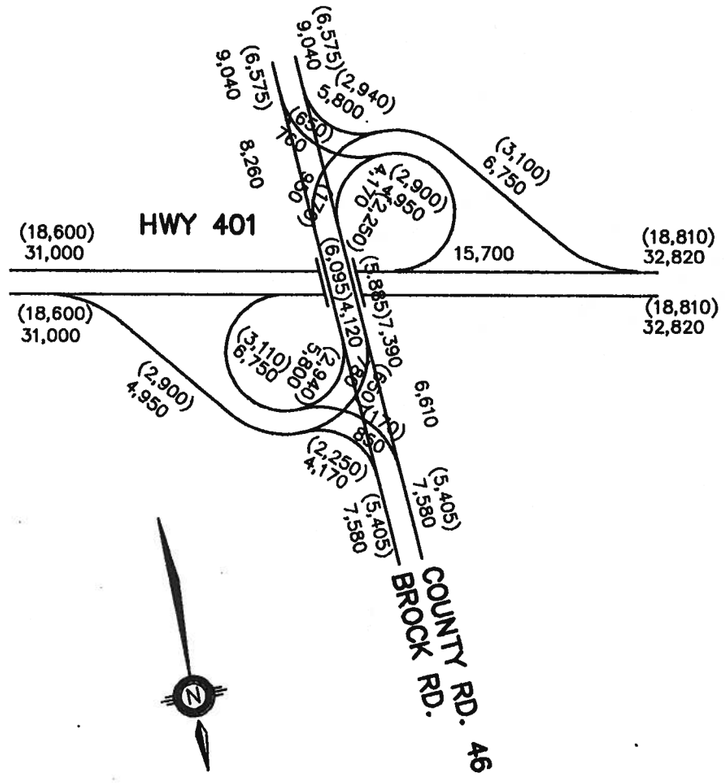
Traffic Assignments

Existing 1984 and 1991 AADT volumes are presented in Figures #1 and #1A. Highway 6 Traffic Growth Graphs are presented in Figure #2. Future 2011 AADT demand volumes assuming the "do nothing" alternative are presented in Figures #3 and #3A. Future 2011 AADT demand volumes assuming the reconstruction of Highway 6 on the preferred alignment are presented in Figures #4 and 4A.

The assignments have been completed assuming Highway 6 is upgraded to a 4 lane controlled access facility, that a 60 km/hr operational speed for old Highway 6 south of Highway 401 and Brock Road is maintained, and that the Municipal Road network is upgraded where required for those interchange designs providing direct Highway 6 interchange access.

These traffic assignments will be utilized in the Capacity and Level of Service calculations completed for this update of the Route Location and Preliminary Design Study.





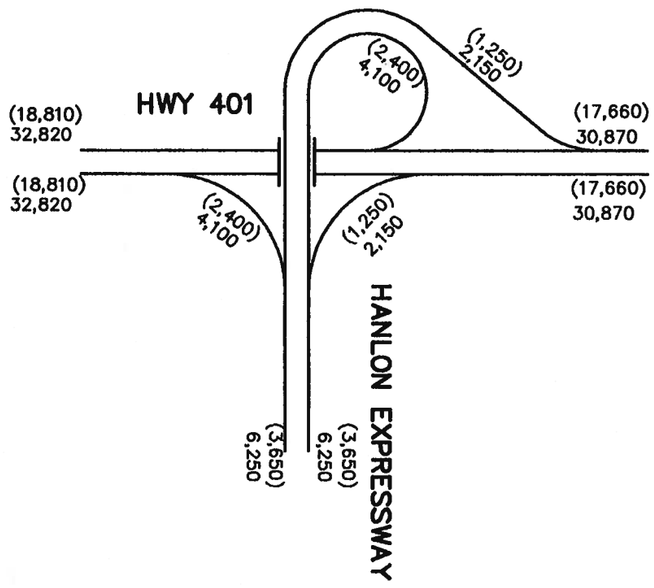


FIGURE #1A

EXISTING AADT

(0,000) 1984

0,000 1991

Fenco FENCO MACLAREN INC.
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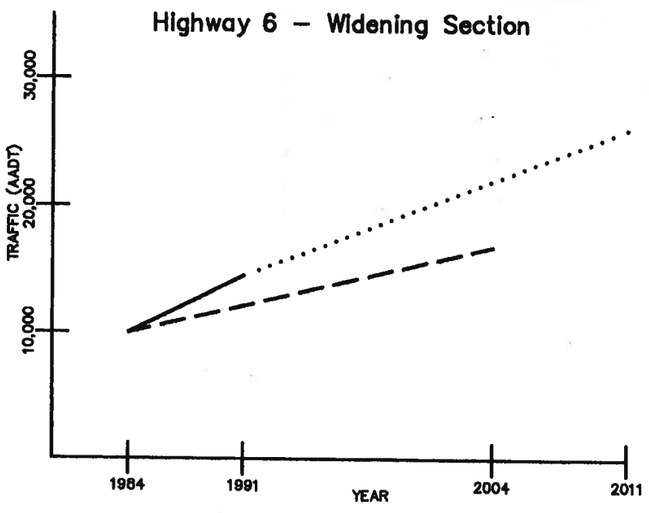
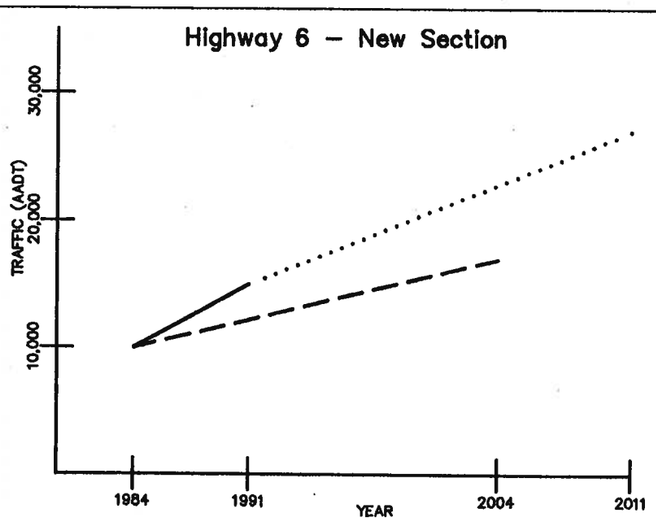
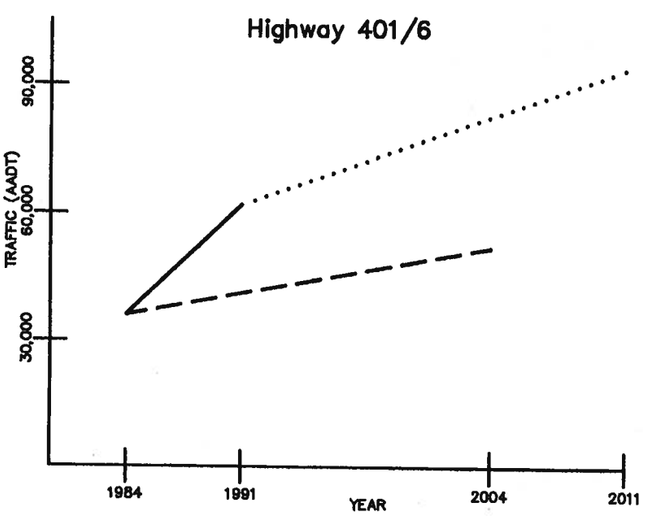
HIGHWAY 6 TRAFFIC GROWTH GRAPHS







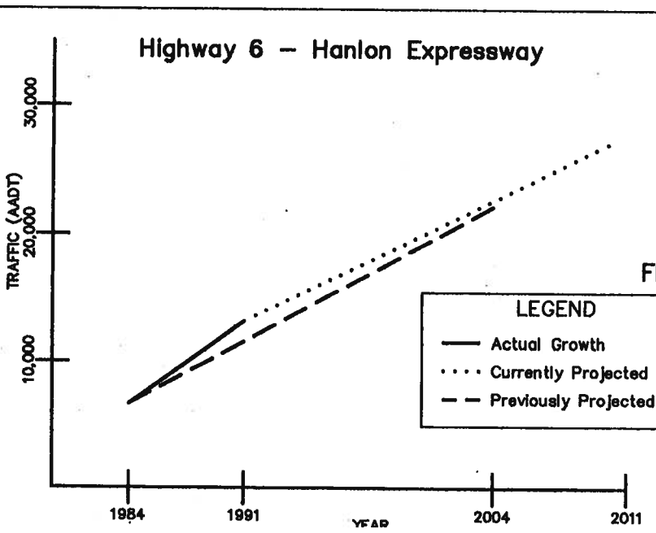


FIGURE #2

LEGEND

— Actual Growth

···· Currently Projected Growth

– – Previously Projected Growth(1984)

TRAFFIC VOLUMES
HIGHWAY 6 FREELTON–GUELPH

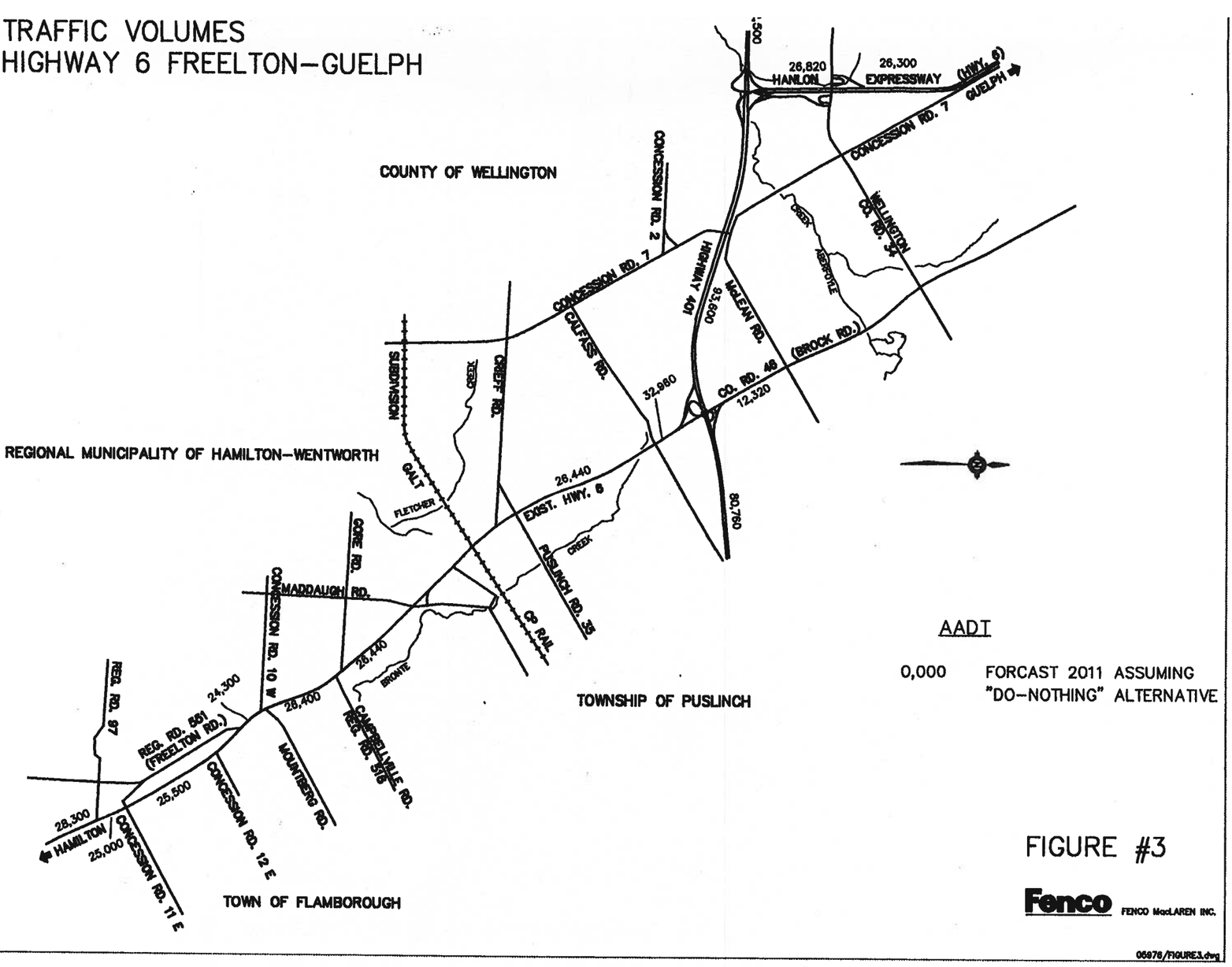


FIGURE #3

Fenco FENCO MacLAREN INC.

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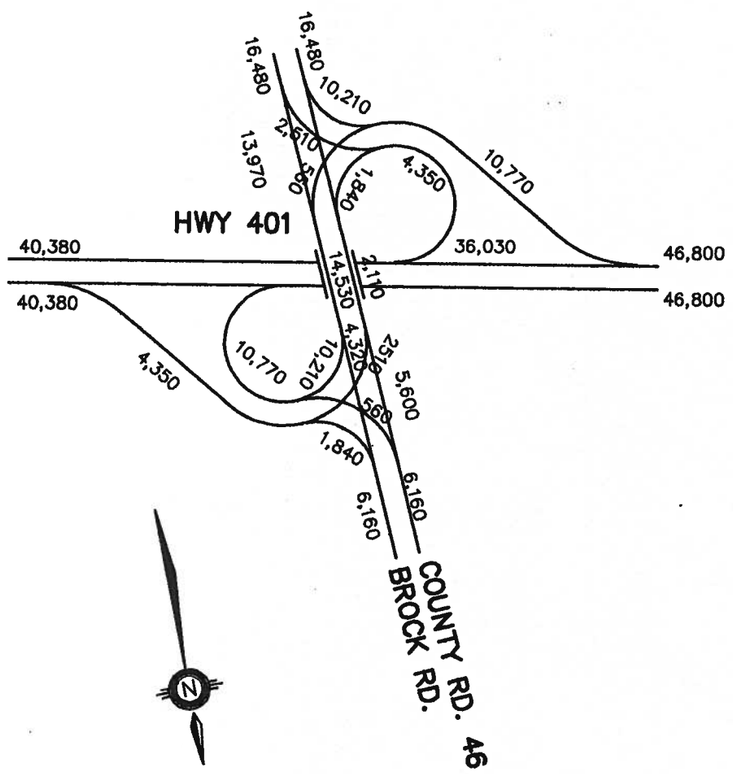

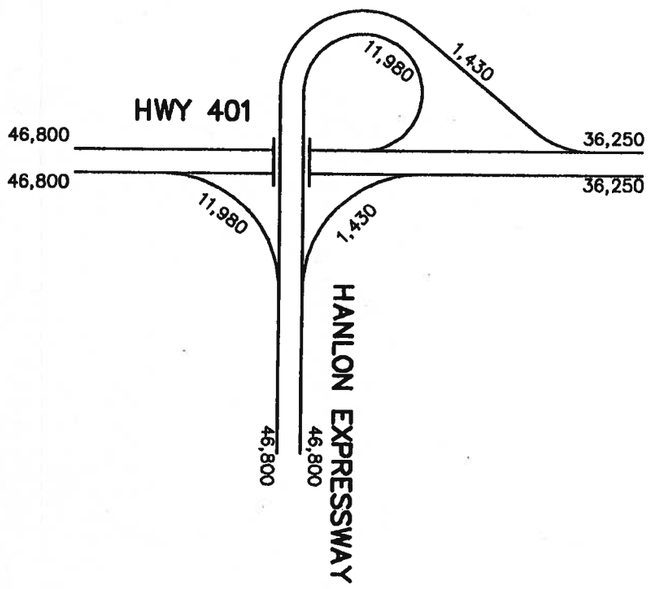

FIGURE #3A

AADT
2011 Do Nothing Alternative

Fenco FENCO MACLAREN INC.
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TRAFFIC VOLUMES
HIGHWAY 6 FREELTON–GUELPH

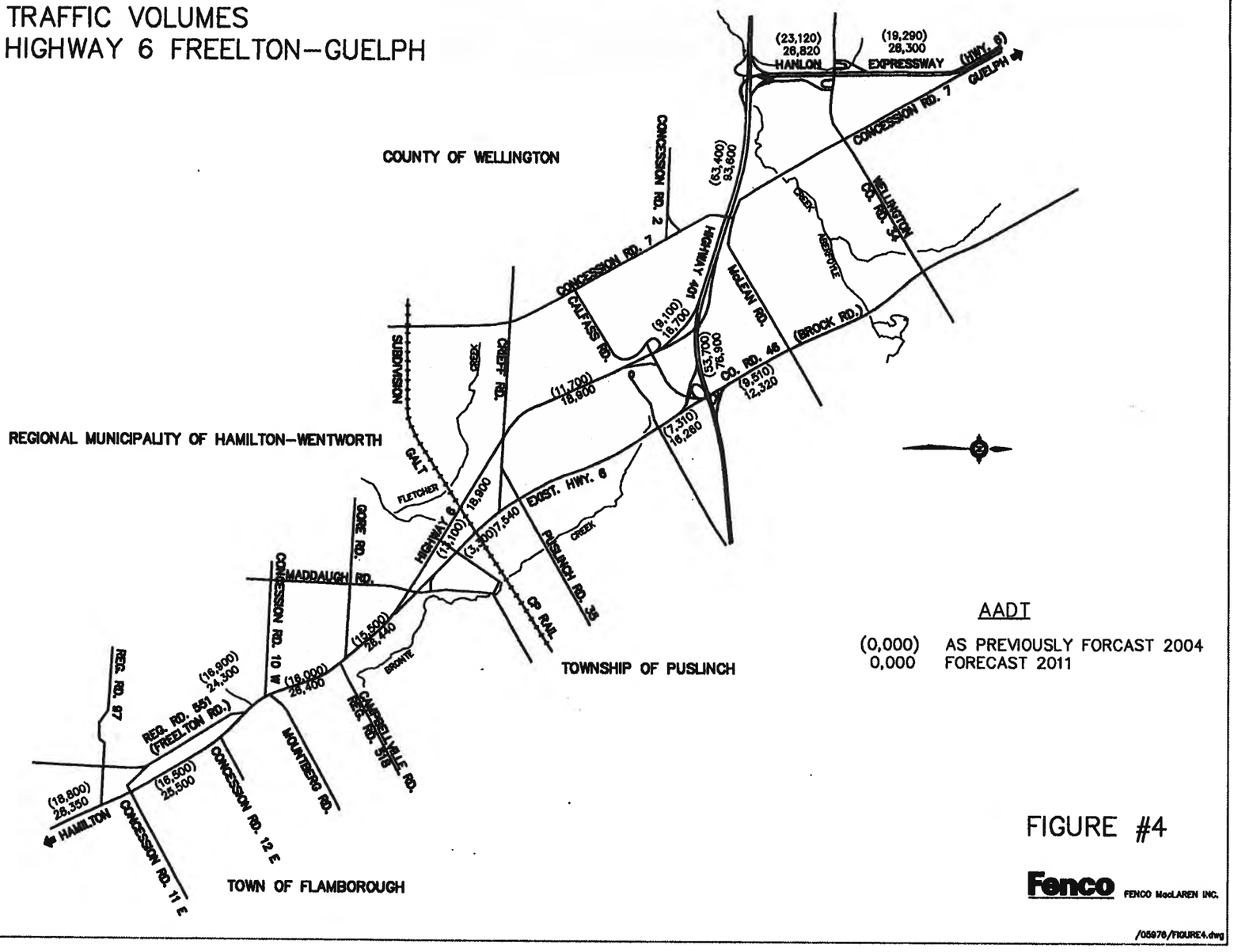


FIGURE #4

Fenco FENCO MacLAREN INC.

/05976/FIGURE4.dwg

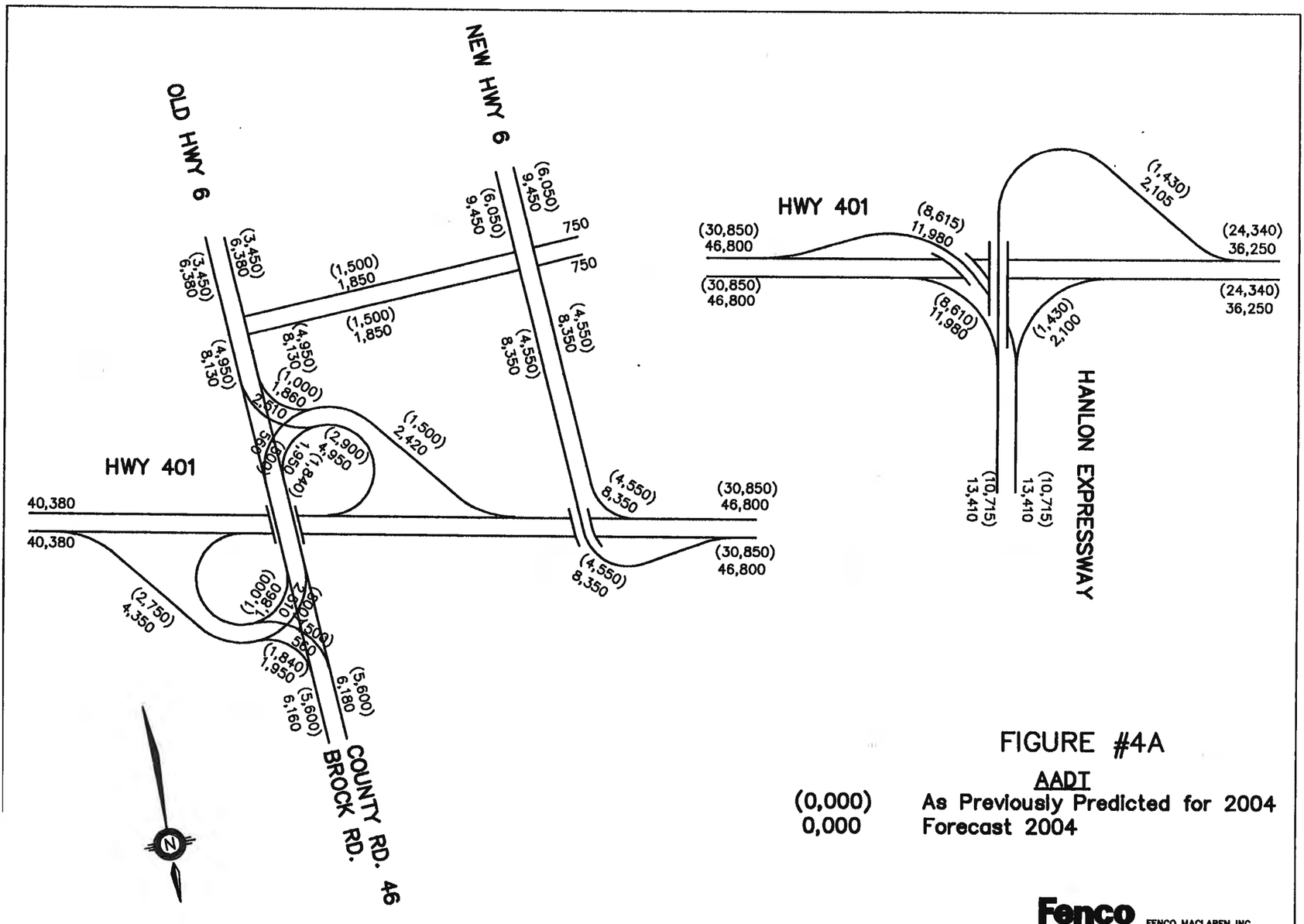


FIGURE #4A

AADT

(0,000) As Previously Predicted for 2004
0,000 Forecast 2004

Fenco FENCO MACLAREN INC.

/05976/FIGURE4A.dwg

CONCLUSIONS

Based upon the traffic volume assignments contained in this report, the following conclusions can be drawn:

1) The growth factors assumed for the AADT Traffic Volumes which were projected based upon the 1984 traffic counts have been significantly exceeded by the actual 1991 traffic counts. Based upon this greater than expected real rate of growth between 1984 and 1991, it can be concluded that the currently anticipated project schedule may be overdue.

2) The N-E Ramp at the Highway 401 - Highway 6N interchange is forecast to carry projected DHV of 1200 vph. Although this volume would not exceed the capacity of an "inner loop" type design, a directional ramp is recommended in order to maintain the continuity of the Highway 6 traffic stream, as well as to encourage the use of Highway 6N (Hanlon Expressway) by through traffic thereby reducing as much as possible vehicular demand on County Road 46. Directional ramps were also preferred to an inner loop design as motorists are transferring between high speed roadways. An inner loop would be operationally restrictive and could also introduce traffic safety concerns on the ramp. This confirms MTO's decision to construct a directional ramp for Hwy 6N to Hwy 401E traffic.

3) In the short term, an at grade intersection will carry the forecast volumes of Highway 6 N and County Road 34. In the long term, a County Road 34 grade separation will be required together with interchange access either at, or immediately north of County Road 34.

4) Utilizing the preferred Highway 6 alignment, traffic from Highway 401E to Highway 6 S will need to pass a rather circuitous route through both the Highway 401/Brock Road and Highway 6/Calfass Road Interchanges.

COUNTY OF WELLINGTON

ENGINEERING AND ROAD DEPARTMENT
GORDON J. OUGH, P.Eng., COUNTY ENGINEER
TEL: (519) 837-2600 2601
FAX: (519) 837-1909

ADMINISTRATION CENTRE
74 WOOLWICH STREET
GUELPH, ONTARIO
N1H 3T9

February 12, 1993

Fenco Engineers
Atria North-Phase 11
2235 Sheppard Ave. E.
Willowdale, Ontario
M2J 5AG

ATTENTION: Mr. M. E. Swim, P.Eng.

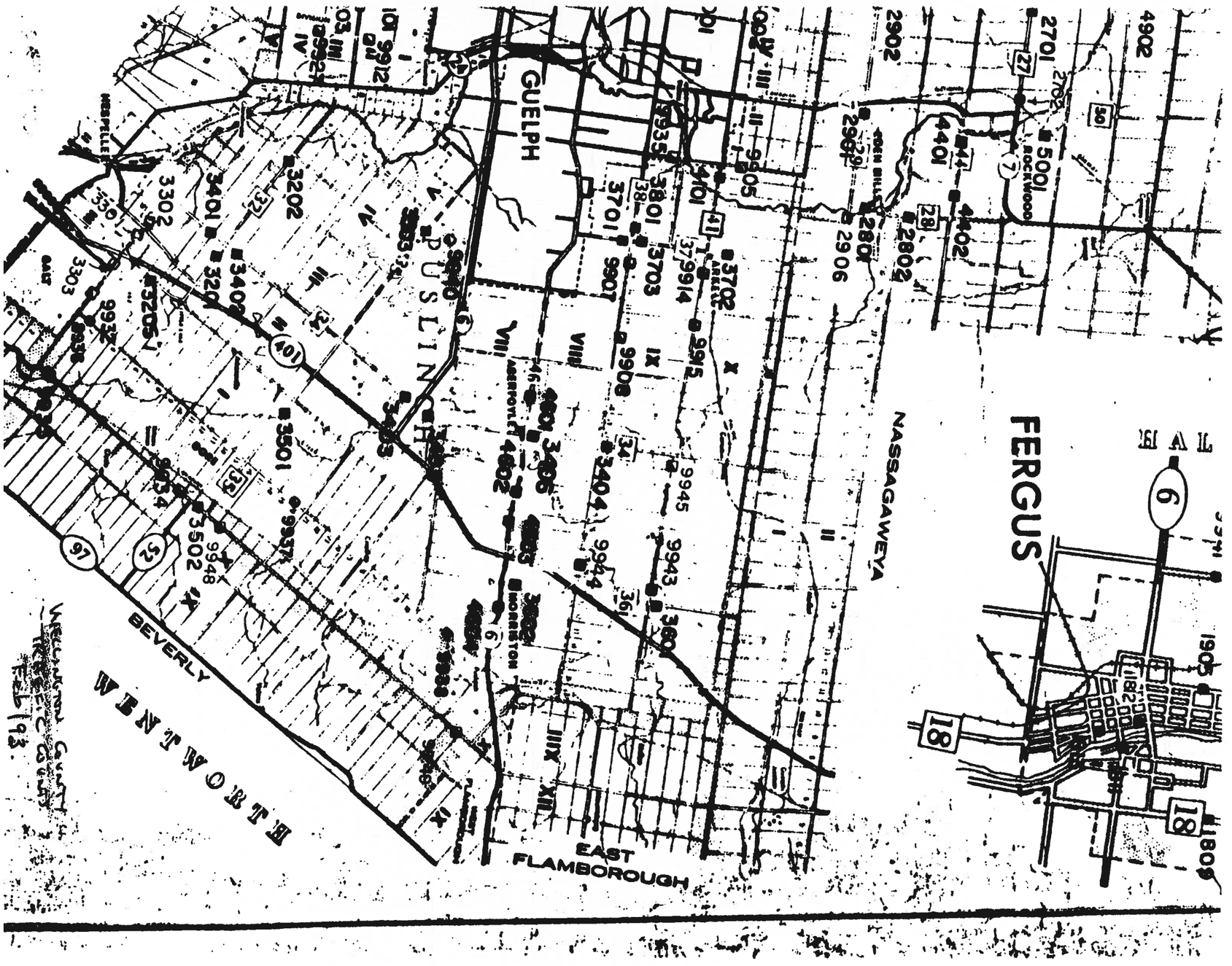
RE: Traffic Counts Highway 6 - Freelton to Guelph

Further to your letter dated February 8,1993,please find enclosed our recent AAD'T for the study area. The County did not do any counts in 1992.

Yours very truly,

R.L. Dale, C.E.T.
Engineering Technologist

RLD/sg
Encl.



STATIO	GF	68	71	75	77	78	79	81	82	83	84	85	86	87	88	89	90	91	STATI	GF 89
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3404	1.5	250		540	530		620				950			1050	1300	1400	1450	1450	3404	2.26
3503	1.5	370		690	690		800	880			1000			1150	1300	1500	1500	1750	3503	1.88
3601	1.2	170		120	150		170		170				300	300	200	200	250	250	3601	1.17
3602														450	650	500	600	700	3602	
4601	1.4				6540	6750	7090	7900	8100		8550	9750		10900	11150	11650	12100	12000	4601	1.64
4602	1.4				6570	6910	7660	7930	8370	8350	9150	10150	10900	10050	10950	12400	12200	13350	4602	1.62
4603	1.4						8060	9720	8490	10140	9050	10850		12500	13150	12350	12850	12250	4603	1.5
4604													NEW STA 1989			18450	16950	15550	4604	
9938	CRIEF RD AT HWY 6														450	500	450	500	9938	
9940	PUSLINCH RD 5												NEW STA 1988		1100	550	450	700	9940	
9949																		400	9949	

STATIO	GF	68	71	75	77	78	79	81	82	83	84	85	86	87	88	89	90	91	STATI	GF 89

PREVIOUSLY FAXED

THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH
Transportation / Environmental Services Group

Roads Department
25 Main Street West, Suite 1000
Hamilton, Ontario L8P 1H1

Tel. (416) 546-4277
Tel. (416) 546-2380
Fax (416) 546-2385

Our File No. 60.08.02

February 25, 1993

Fenco Engineers Inc.
Atria North - Phase II
2235 Sheppard Avenue East
Willowdale, Ontario
M2J 5A6

Attention: M.E. Swim, P.Eng., Project Engineer

Highway #6 - Freelton to Guelph
Route Location and Preliminary Design - Traffic Volume Data

In response to your letter of February 8, 1993, enclosed are traffic counts which were recently taken at locations requested in your letter. Also enclosed, are previous counts at the same locations to give you indications of volumes changes. A.A.D.T. and D.H.V. data and future traffic predictions are not available for these locations.

During our telephone conversation of February 15, 1993, I mentioned of also forwarding collision histories at regional road intersections with Highway #6 in the vicinity of Freelton. Unfortunately, they are not available from our data base. The Ministry of Transportation, Ontario, District Office (Burlington) may have the information.

If you have questions on this matter, please call.

Herbert (Bert) Salatandre, P.Eng.
Project Manager
Predesign and Special Projects Division

hs:dt
Encls.

Township of Puslinch

OFFICE OF CLERK AND TREASURER

(MRS.) BRENDA LAW

R.R. 3 Guelph, Ontario N1H
(County Rd. 34, Aberf
Telephone: (519) 763-

February 11th, 1993

Mr. M.E. Swim, P. Eng.
Project Engineer
Fenco Engineers
Atria North - Phase II
2235 Sheppard Avenue East
Willowdale, Ontario
M2J 5A6

Dear Sir:

Re: Highway 6 - Freelton to Guelph, Traffic Volume Data

As requested in your letter of February 8th, 1993, we are forwarded the traffic information we have available from 1991:

County Road #46	- North of County Rd. #34	11,650
	South of County Rd. #34	12,400
	McLean Rd. South to #401	12,350
	County Rd. #36 (Morriston)	500
	#34 East to Victoria Rd.	2,500
	#34 West to Hanlon Expwy.	3,100
Highway #6	- From Morriston South	15,500
	Conc. 1 - East to Crieff	500
	Gore - West of Maddaugh Rd.	400

We trust this is the information you require.

Yours truly,
TOWNSHIP OF PUSLINCH

JAMES HOWLETT
Road Superintendent

JH/cs

THIS PAPER CONTAINS A MINIMUM OF 50% RECYCLED MATERIAL

APPENDIX M

CONCEPTUAL STORMWATER MANAGEMENT PLAN

Preparation of a Conceptual Stormwater Management Plan Highway 6 Freelton to Guelph

Draft Report to

Ministry of Transportation
Ontario

March 1994

005796

Fenco MacLaren Inc.

SNC·LAVALIN

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HIGHWAY 6 FREELTON TO GUELPH
PREPARATION OF A CONCEPTUAL STORMWATER MANAGEMENT PLAN

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HIGHWAY 6 FREELTON TO GUELPH
PREPARATION OF A CONCEPTUAL STORMWATER MANAGEMENT PLAN

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1.0 INTRODUCTION

The preparation of a conceptual stormwater management (SWM) plan for the technically preferred route is one of a number of supplementary investigations in the Highway 6 Freelton to Guelph Route Planning and Environmental Assessment Study (Figure 1.1 shows the technically preferred route). The existing four-lane Highway 6 at Freelton defines the southern project limit while the north oriented speed change lanes of the proposed Hanlon Expressway/Wellington County Road 34 interchange constitute the northern end of the project.

This highway project has been divided into four basic sections which are as follows:

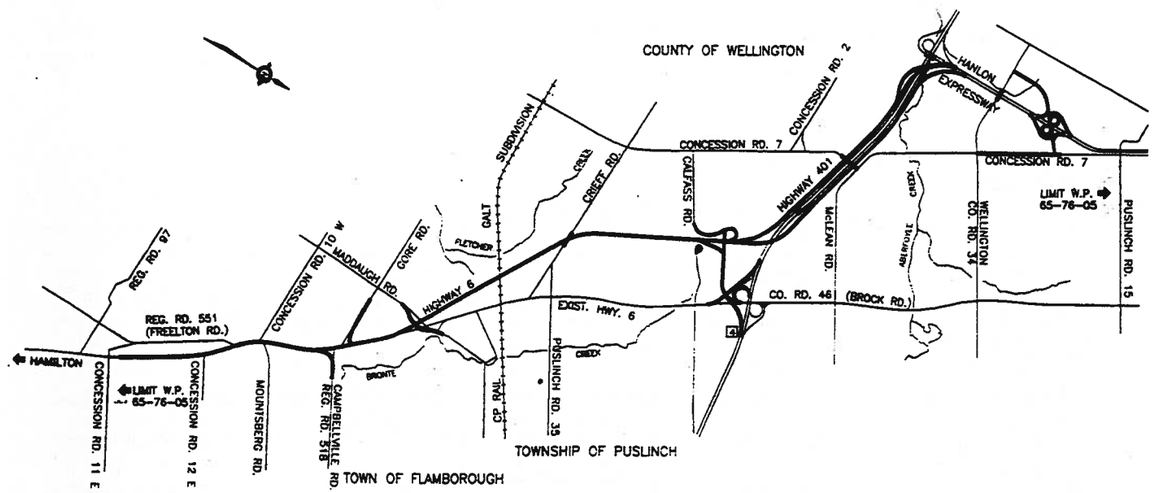
- South project limit to Maddaugh Road;
- Maddaugh Road to Highway 401;
- Highway 401 widening to Hanlon Expressway;
- Hanlon Expressway to north project limit.

Improvements to the south project limit to Maddaugh Road section calls for a widening of Highway 6 from its existing two lanes to four or five lanes depending on turning requirements. As this involves primarily a widening of an existing alignment, stormwater management considerations have been deferred to the detail design phase of the project and will not be addressed in this investigation. This approach is also considered appropriate because this section has been separated from the remainder of the project for Environmental Assessment purposes and detail design is currently underway. A conceptual SWM plan will therefore only be prepared for the latter three sections mentioned above.

The main objective of the conceptual plan preparation is to lay the groundwork for the final SWM plan. The groundwork involves the following:

- identification of environmental concerns and sensitivities related to stormwater runoff during highway operation;
- listing and screening of potential best management practices (BMPs);
- assessment of site suitability for BMPs;
- formulation of drainage strategy and the selection of a preferred concept for managing highway stormwater;
- preliminary hydrologic analysis to determine additional right-of-way (ROW) requirements.

This report presents the results and findings of this investigation.


COUNTY OF WELLINGTON
CONCESSION RD. 7
CONCESSION RD. 2
HANLON EXPRESSWAY
SUBDIVISION
CREEK
CRIEFF RD.
GALT
FLETCHER
GOREE RD.
MADDAUGH RD.
HIGHWAY 6
EXIST. HWY. 6
CREEK
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directives presented to address stormwater quality are concentrated on the control of suspended solids. Due to the direct association of other stormwater pollutants to suspended solids, nutrients, trace metals and organics may, to a certain extent, be controlled by reducing the amounts of suspended sediments. In addition, storm runoff quality control is to be approached from a volume, frequency, and duration perspective. Volume controls can be achieved by reducing the amount of impervious area, encouraging infiltration and/or restricting the rise of direct stormwater connections.

For a detention storage facility, the sizing is dependent upon the sensitivity of the receiving water body. For warmwater fisheries, the guidelines recommend a pond volume that can store the runoff from a 13 mm precipitation falling over the catchment. A pond volume using the 25 mm catchment precipitation criteria is recommended where there are coldwater fishery concerns. Recommended detention times range from 24 to 48 hours.

It is to be noted that these guidelines were developed to primarily address the stormwater quality control requirements for urban land development such as subdivisions. It does not take into account the unique concerns of a linear facility type of development such as highways. However, in the absence of more project specific criteria, the concepts, principles and theories outlined in these Interim Guidelines will be used in the initial evaluation of stormwater quality control facilities for this highway project.

3.0 SCREENING OF BMPs

3.1 Targeted Water Quality Parameter

In screening out BMPs, one has to consider the water quality parameter or pollutant that is to be targeted for control. Research studies in the U.S. have shown that a wide range of pollutants can occur in highway stormwater runoff and the MTO is currently undertaking research on highway stormwater quality in order to determine the applicability of these studies in Ontario. These pollutants can be grouped according to the following:

particulates	components include dust, dirt, stones, sand, gravel, grain, glass, plastics, metals, fine residue
heavy metals	lead, zinc, iron, copper, nickel, chromium, mercury
PCB, pesticides	chlorinated hydrocarbons, organo-phosphorus
inorganic salts	$CACl_2$, NaCl, SO_4, Br
organic matter	vegetation, dust, and dirt humus, roadway accumulations, oils, fuels
nutrients	nitrogen, phosphorus
pathogenic bacteria (indicators)	coliforms
others	asbestos, rubber, special compounds

Furthermore, these studies indicate that most of the pollutant load in highway runoff in the U.S. is carried as particles or is associated with particulates, specifically the suspended solids portion (very fine silt like portion, < 43 microns). These suspended solids constitute only a small percentage of the total particulate loading found on roadways, but they carry with them a significant percentage of the expected pollutants such as oxygen demand, nutrients, heavy metals, and pesticides. (This has been recognized in the MNR/MOEE Interim Stormwater Quality Control Guidelines for New Development, May 1991, as directives presented to address stormwater quality are concentrated on the control of suspended solids.) Therefore, removal or reduction of these solids should improve the quality of stormwater runoff from highways and urban roadways.

For the specific requirements of this project, the sensitivity of the receiving waterbody plays an important role in dictating the targeted water quality parameter. Coldwater fishery areas

will include temperature as another primary stormwater quality parameter targeted for control.

3.2 Available BMPs

For highway stormwater quality control, the following BMPs were considered:

- street cleaning
- water quality inlets
- detention ponds
- porous pavements
- vegetative controls
- retention ponds/extended detention ponds
- infiltration systems
- artificial wetlands

Each of the above measures will be described and their effectiveness with regards to highway runoff quality control assessed based on the results of available runoff pollution control studies done in highways and urban roadways. These studies, however, were undertaken in the U.S and MTO is proposing to undertake pilot monitoring projects to determine the effectiveness of these measures in Ontario.

3.2.1 Street Cleaning

Street cleaning practices, such as street sweeping or street flushing, are applicable to paved roadways, particularly those designed with a curb-and-gutter system. Their primary purpose has been to improve the appearance of streets by removing litter, dirt and other debris. As a consequence, they have been considered as an important management practice in urban areas.

While the practice has aesthetic benefits, street cleaning has not been demonstrated to be effective for highway runoff pollution control. The major portion of highway runoff pollutants is expected to be attached to the fine particles, and street cleaning only removes the large solids and coarser particles. This has been confirmed by recent U.S. studies conducted on swept and unswept streets. These studies have shown that street sweeping seems to have limited effect on runoff pollutant loading.

3.2.2 Water Quality Inlets

Water quality inlets (also known as oil/grit separators) combine storage chambers for sediment trapping and oil separation with a drainage inlet or inflow sewer for intercepting or receiving stormwater runoff. When properly designed and maintained, this measure may be effective in removing the coarser sediment particles from stormwater runoff.

In most instances however, the finer sediment particles are not effectively removed. This is because water quality inlets have small storage capacities which bring about brief residence times. As these devices are designed for high concentrations of oil and, given the expected lower concentrations of petroleum products in the runoff, they may not be effective as a primary BMP. In addition, the limited maximum contributory area requirement of this measure would result in numerous water quality inlets. Since the inlets should be cleaned at least twice a year to dispose of the trapped sediments and ensure proper inlet function, routine maintenance will be a problem and costs will be high. Most importantly, Highway 6, for the entire length of this improvement project, is designed with a rural cross-section in which highway runoff is drained by side ditches and not by storm sewers. Use of water quality inlets will contradict the basic drainage philosophy of this highway's design. Therefore, water quality inlets were not considered further for this project.

3.2.3 Detention Ponds

Detention ponds are used primarily for stormwater quantity control measures to reduce runoff peak by temporarily storing floods and later releasing them at a controlled rate. The controlled outflow rate is just enough to attenuate the peak but is still relatively fast, resulting in a short detention time (usually only a few hours). This is not sufficient to settle out the finer portion of the solids loading. Moreover, because of the relatively fast outflow rate, sediment particles that have settled out during a previous storm event may be resuspended and washed out during a subsequent event resulting in a deterioration of stormwater quality for the latter event. Detention ponds are, therefore, considered to be relatively ineffective in stormwater quality control for this highway project.

3.2.4 Porous Pavement

Porous pavements consist of a relatively thin layer of an open graded asphalt pavement over a base of crushed stone. The layer of crushed stone acts as a reservoir that temporarily stores the water until it percolates into the sub-base or moves laterally to a drainage waterway. Pollutant removal is accomplished as water infiltrates through the sub-base.

However, the structural stability of Highway 6 relies on a dry sub-base (maintenance of a dry sub-base is a key aspect of highway design). Therefore, the use of porous pavements is confined to parking lots and light vehicle, low volume roadways and is not applicable for this study.

3.2.5 Vegetative Controls

Vegetative controls utilize vegetal cover, such as grass, shrubs, etc., to mitigate the stormwater quality impacts of highway runoff. They improve the quality of highway runoff by:

- the filtering action of the vegetation;
- enhancement of sediment deposition and increased infiltration into the subsoil because of reduced runoff velocities;
- reduction of nutrient concentration by soil and vegetative processes;
- breakdown of hydrocarbons by bacterial degradation; and
- complexing of metals by soil adsorption and biological assimilation.

Vegetative controls include vegetated waterways, buffer strips, and overland flow areas. Grass is the most commonly used vegetation and the effectiveness of the vegetative control measure is dependent on the species characteristics, the density of the grass stand and slope of the grass cover. They are applicable wherever climate, topography, and soil condition allow establishment and maintenance of the grass cover, and hydraulic conditions maintain the runoff at non-erosive values, encourage infiltration, and permit settling of particles.

Pollutant removal for vegetative BMPs can be high, particularly for suspended solids and heavy metals. Some studies in the U.S. have concluded that 60 m to 80 m of grassed waterway was needed to remove the majority of the suspended solids including metals (lead in particular because of its low solubility and its strong association with particulates) from the highway runoff. Thus, the use of vegetative controls is considered to be an effective measure to mitigate the water quality impacts of highway runoff.

3.2.6 Retention Ponds/Extended Detention Ponds

Retention ponds and extended detention ponds rely primarily on temporarily storing the stormwater for a period of time sufficient to allow settling of the sediments. Retention ponds (also referred to as wet ponds) always maintain a permanent pool of water even after the runoff event. Because of the permanent pool, retention ponds have been found to perform effectively in removing pollutants. Results of research studies showed that biological processes in the permanent pool are responsible for substantial reductions in soluble nutrients. This is in addition to the sedimentation process normally occurring in the pond.

Extended detention ponds are basically detention ponds (those for peak flow control) but with modified outlet structures that extend runoff detention times. Because of this modification, sediment loading to a receiving watercourse is effectively reduced and their performance has been shown to approach that of wet ponds but without the occurrence of biological processes for soluble nutrient control. Since sediment is the water quality parameter for control, both types of storage ponds are considered equally effective and are equally acceptable.

3.2.7 Infiltration Systems

Infiltration systems rely on the infiltration characteristics of the soil to drain the runoff. The soil acts as a medium where the stormwater undergoes physical, chemical and biological removal processes as it is being drained through the soil layers. As a result, these systems have been found to be effective in removing both the particulate and the soluble pollutants. However, the inflow should be pre-treated to remove sediment and other suspended material to avoid premature clogging of the infiltration facility.

Infiltration systems include infiltration basins and trenches. An infiltration trench that relies totally on the infiltration characteristics of the underlying soil is called a complete exfiltration type infiltration trench. However, it may not always be possible to totally rely on complete exfiltration to dispose of the runoff because of concerns regarding the long-term permeability of the underlying soil, downstream seepage, or clogging between the trench and the subsoil. Hence, a partial exfiltration type infiltration trench can be used. Many current designs of this trench type utilize a perforated underdrain at the bottom of the trench to collect the runoff and direct it to a central outlet. The presence of the underdrain greatly increases the collection efficiency of the trench resulting in a much shortened residence time. This may lessen the effectiveness of the facility in controlling stormwater quality.

3.2.8 Artificial Wetlands

An artificial wetland is created by maintaining the water level at the surface of the ground through overland flow conveyance to the surface of the wetland or through a subsurface layer of gravel or sand. Wetlands are able to assimilate large quantities of suspended particulate and dissolved pollutants because of the following:

- high vegetative productivity and nutrient needs;
- high decomposition rates;
- low oxygen content in the sediments and substrates;
- large adsorption surfaces in the substrate.

They have been shown to be effective in the reduction or removal of suspended sediments and particulate matters; nitrogen and phosphorus nutrients; BOD, pathogens and some hydrocarbons; and varying amounts of trace metals. These results are accomplished through physical and chemical processes such as sedimentation, adsorption, filtration, and decomposition supplemented with biological processes occurring in the vegetation.

3.3 Short List of Available Measures

To produce a short list, each stormwater quality control measure discussed in the previous section was rated using information available from the literature. A qualitative rating system was used to evaluate their effectiveness in removing particulate pollutants. (Temperature enhancement was an additional consideration for the coldwater fishery areas.) It was not necessary to evaluate its performance with respect to the removal of the other pollutant groups because sediment is the targeted pollutant. This criterion is sufficient to produce a short list of available measures.

Table 3.1 gives the rating of available measures. The first three measures (i.e. street cleaning, water quality inlets, and detention ponds) have low ratings and were considered to be ineffective measures for this project. Porous pavements, though they have a high rating, are not applicable to this project because of structural stability considerations. The last four measures have high particulate pollutant removal ratings and are considered to be effective. Therefore, the short-listed stormwater quality control measures are:

- Vegetative Controls
- Retention/Extended Detention Ponds
- Infiltration Systems
- Artificial Wetlands

TABLE 3.1
Particulate Pollutant Removal Rating
For Available Highway BMPs
Highway 6 Conceptual SWM Plan Preparation

Measure	Rating	Remarks
1. Street Cleaning	Low	Ineffective because finer particles that contain most of the pollutant load are left on the roadway after sweeping and more applicable to curb-and-gutter system.
2. Water Quality Inlets	Low	Contradicts basic drainage design philosophy of having a rural cross-section and considered ineffective because the finer solids associated with most of the pollutant load are not removed.
3. Detention Ponds	Low to Medium	Ineffective because detention time is inadequate to settle out the smaller fractions of suspended solids associated with pollutants.
4. Porous Pavements	High	Not applicable to high volume traffic highways because of structural stability considerations.
5. Vegetative Controls	High	Efficiency varies with channel length, filter strip width or overland flow length, vegetation density, discharge, flow depth, and soils.
6. Retention/Extended Detention Ponds	High	Effectiveness varies with the ratio of pond volume to storm runoff volume and detention time.
7. Infiltration System	High	Efficiency varies with the ratio of storage to storm runoff volume. Applicable in areas with a low groundwater table and relatively permeable soils.
8. Artificial Wetlands	High	Effectiveness varies with the ratio of wetland storage to storm runoff volume, type of wetland, emergent vegetation, soil types.

4.0 CONCEPTUAL SWM PLAN FORMULATION: MADDAUGH ROAD TO HIGHWAY 401

This section of the Highway 6 improvement project is comprised of a four-lane roadway with a rural cross-section. A typical roadway cross-section is shown in Figure 4.1. From Maddaugh Road to Crieff Road, the proposed Highway 6 will have 4 x 3.75 m lanes with a 1.0 m flush median and 3.0 m shoulders with 0.50 m partially paved. From Crieff Road to Highway 401, the new Highway 6 will include a concrete median barrier

4.1 Site Characteristics for BMP Suitability

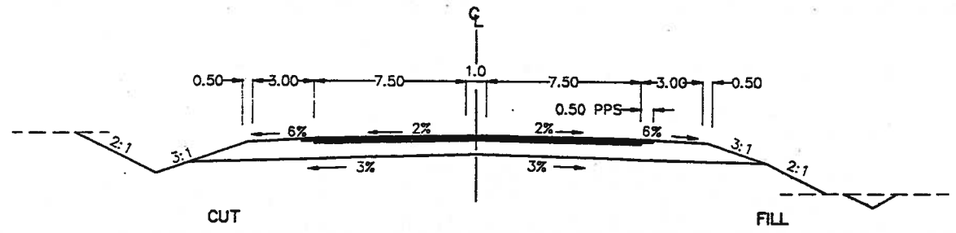
The suitability of a particular BMP is dependent upon certain factors that would indicate site capabilities and restrictions. Factors that can preclude the use of a particular type of BMP include soil type, slope, depth to groundwater table, and proximity to bedrock. Other factors that would give a BMP a low priority for consideration because of the need for special designs or trade-offs include space consumption, land use restrictions, and thermal impact considerations.

The site suitability characteristics of this section are displayed in Figure 4.2. The predominant soils in the area belong to the "A" type hydrologic soil group. This stretches from Highway 401 southerly to a location just north of the CP Rail Galt Subdivision (about Sta 26+000). The soil type changes to a "BC" hydrologic soils group south of this location. The drainage ditches generally follow the highway profile (i.e. north to south gradient) except at the overpass structure at the CP Rail line. Longitudinal slopes of the drainage ditches range from almost flat (between Fielding Lane and CP Rail line) to a maximum of about 1.8% (for a distance of about 200 m north of the rail line). For the most length, the longitudinal slope is 0.9%.

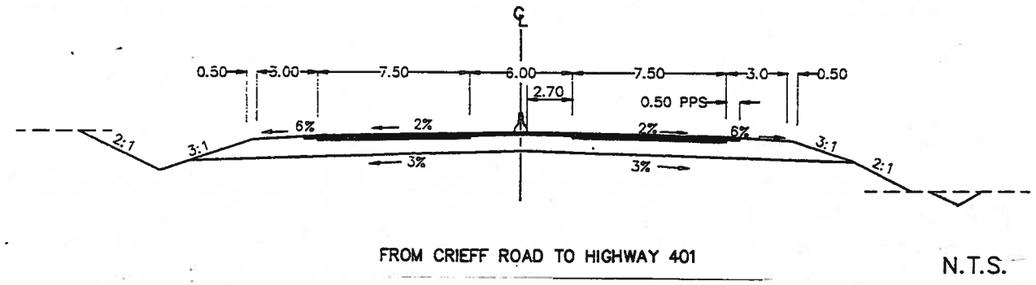
Static overburden groundwater levels are at El. 290 m in the vicinity of the CP Rail crossing and El. 300 m in the Crieff Road area. This gives a depth to water table of about 8 m and 3 m, respectively. The depth to water table near Highway 401 is in the order of 15 m.

The bedrock in this section of Highway 6 generally lies at about El. 290 m. This gives a depth to bedrock of approximately 8-10 m at the southern portion, to about 30 m near Highway 401.

The Highway 6 ROW is limited as it allows only for the paved roadway, its shoulders, lateral allowance for excavations and embankments, and drainage ditches. Space availability for SWM/BMP facilities may not be a problem as additional ROW may be negotiated with



FROM MADDAUGH ROAD TO CRIEFF ROAD



FROM CRIEFF ROAD TO HIGHWAY 401

N.T.S.

PRELIMINARY

FIGURE 4.1
TYPICAL ROADWAY CROSS-SECTION
MADDAUGH ROAD TO HIGHWAY 401

landowners in the area whose properties have been severed by the proposed highway. Opportunities for additional ROW acquisition appear to be better on the west side of the highway where these smaller severed parcels of land will be located. This will, however, entail additional costs to the project.

Current land uses or sensitive areas that may restrict the siting of BMPs in this section include woodlots (if additional clearing of trees will be required) and major upland recharge areas because of possible contamination of groundwater resources.

This section of the Highway 6 improvement project encroaches on the eastern most portion of the Fletcher Creek Swamp Forest. This provincially significant wetland and regionally significant ANSI is an important discharge area for coldwater fisheries. Hence, BMPs that increase water temperatures should be given a low priority for this area.

4.2 Drainage Strategy and Selection of the Preferred SWM Concept

The drainage strategy envisaged for this section is to retain existing flow patterns so as not to adversely affect the hydrology/hydrogeology of the area. An examination of the drainage mosaic for the area revealed a number of depressions. These depressions are subcatchments that do not have surface water outlets. Runoff from these areas is most probably drained by infiltration into the soil.

Figure 4.2 also shows the subcatchments associated with the highway drainage. In order to maintain existing drainage patterns, subcatchments 301 and 302, 303 and 304, and 305 and 305 will drain to their respective depressions, while subcatchments 307 to 310 will drain towards the Fletcher Creek Swamp Forest.

The preferred conceptual SWM plan for the Maddaugh Road to Highway 401 section of the proposed Highway 6 is shown in Figure 4.3. For subcatchments 301 to 306, the recommended BMPs are as follows:

- use of grass buffer strips in the embankment and excavated slope faces as well as in the diamond and loop areas to filter the surface runoff from the pavement;
- use of grass-lined ditches and channels to collect overland flows and convey such flows, and at the same time provide treatment of stormwater; and,
- utilize infiltration basins to dispose of the highway stormwater.

The recommended BMPs for subcatchments 307 to 310 have been confined to:

- use of grass buffer strips in the embankment and excavated slope faces to filter the surface runoff from the pavement; and,
- use of grass-lined ditches and channels to collect overland flows and convey the flows to the Fletcher Creek Swamp Forest while providing treatment of stormwater.

Infiltration systems are not recommended for subcatchments 307 and 308 to avoid possible contamination of groundwater since a significant portion of the subcatchment lies in a major upland groundwater recharge area. They are also unsuitable for subcatchments 309 and 310 because of high groundwater levels in this area. Furthermore, use of artificial wetlands or retention/extended detention ponds are also not recommended because of space availability constraints and the temperature increasing potential of this particular BMP (Fletcher Creek Swamp Forest is a significant coldwater fishery area).

5.0 CONCEPTUAL SWM PLAN FORMULATION: HIGHWAY 401 WIDENING TO HANLON EXPRESSWAY

Highway 401 will be widened to six lanes towards the median with a concrete median barrier separating the eastbound and westbound lanes. It is assumed that this will be in place when a mini core-collector system will be introduced for this Highway 6 project. The core-collector system will include protection for three-lane collectors as shown in Figure 5.1.

5.1 Site Characteristics for BMP Suitability

Figure 5.2 describes the site suitability characteristics of this section of the Highway 6 improvement project. The soils in the area is predominantly of the "A" type hydrologic soil group. A "B" type soil is also present nearer the Hanlon Expressway interchange.

The drainage is closely tied in with the existing Highway 401 profile. Highway 401 has a shallow profile with slopes not exceeding 1.7%.

Static overburden groundwater levels are at El. 310 m in the existing Highway 401/Highway 6 interchange to about El. 305 m in the vicinity of the Highway 401/Hanlon Expressway interchange. This gives a depth to water table of about 10 m at the eastern end to about 1 m at the western end of this section of the Highway 6 project.

The bedrock surface is approximately 20 m below the ground surface at the east end, 10 m below the ground surface at the middle portion, and 15 m below the ground surface at the west end of the section.

For siting possible BMPs, space is available at the South-West ramp area. Negotiations can also be entered into with existing landowners in the area for additional ROW to site possible BMPs. Additional ROW acquisition, however, may not be possible for an area south of Highway 401 near the Hanlon Expressway interchange (University of Guelph lands) where a sand and gravel pit is proposed.

Sensitive areas that may restrict the use or siting of BMPs in this section include the recharge area along Highway 401 and the provincially significant Galt/Mill Creek wetlands in the Highway 401/Hanlon Expressway interchange area.

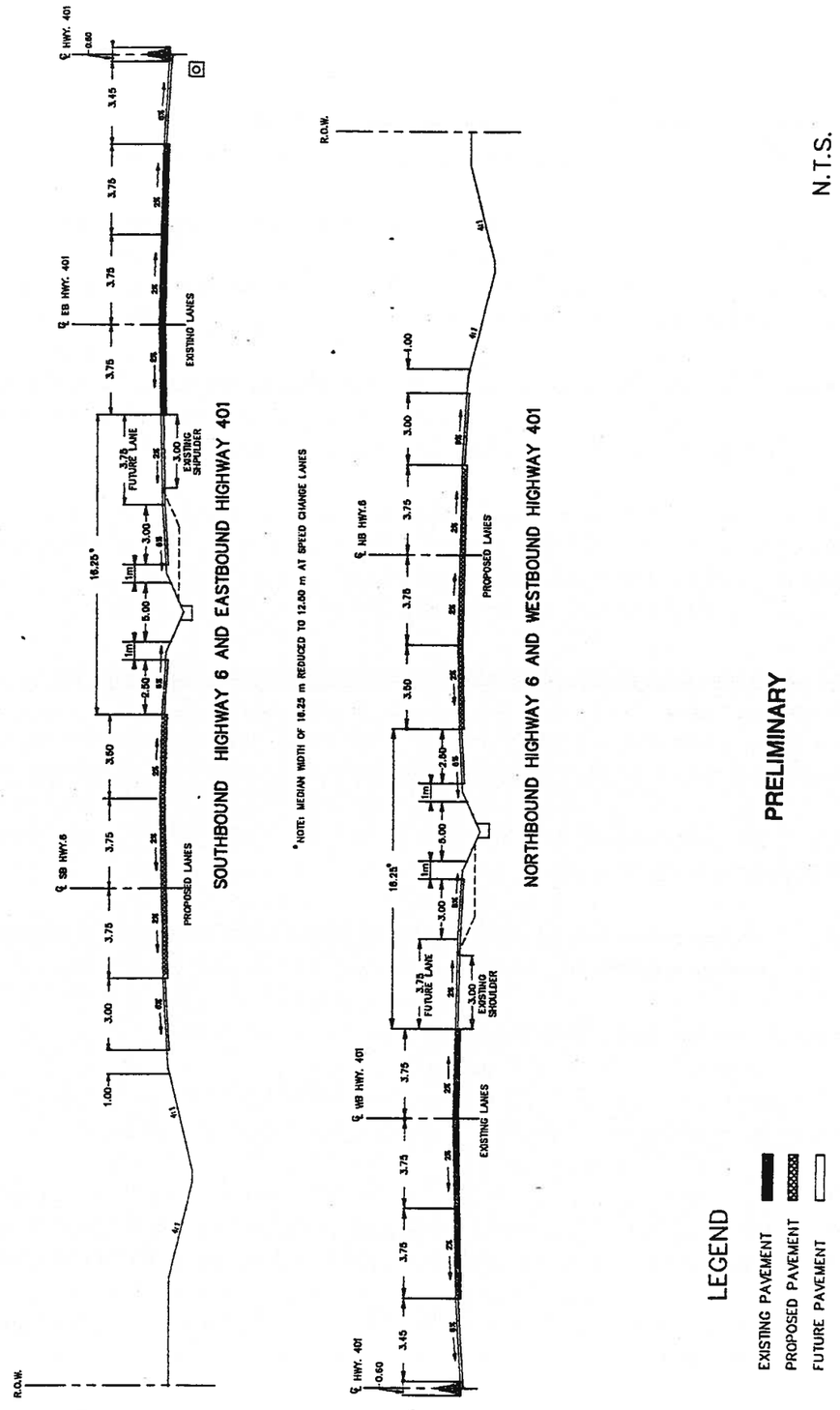


FIGURE 5.1
TYPICAL ROADWAY CROSS-SECTION
HIGHWAY 401 WIDENING TO HANLON EXPRESSWAY

5.2 Drainage Strategy and Selection of the Preferred SWM Concept

The drainage strategy for this section is dependent on the drainage plans for the initial widening of Highway 401. Drainage plans for this initial widening have not yet been finalized except over the western half of the section (i.e., from Sta. 20 + 500 m westward). In this segment, the inner lanes will be drained by a median sewer while drainage of the outer lanes will be accomplished by side ditches. It would therefore be a reasonable to assume that the drainage for the initial Highway 401 widening from Sta 20 + 500 m eastward will follow the same strategy as the western segment. However, it was learned that the sizing of the median sewer for the western segment widening did not take into account the future widening for the eastern segment. It is, therefore, suggested that this be reviewed to ensure integration of future expansion plans.

As revealed by the drainage mosaic for this section, runoff from a significant portion of the existing Highway 401 ROW is directed towards depressions which are drained by infiltration. The preferred SWM concept will also utilize this scheme but with the runoff drained by the median sewer and well as the core-collector ditches being directed towards a central BMP facility before being discharged to Aberfoyle Creek.

The preferred plan is displayed in Figure 5.3. For subcatchments 401, 402, 403, 404, and 410, the recommended BMPs are as follows:

- use of grass buffer strips in the embankment and excavated slope faces to filter surface runoff from the pavement;
- use of grass-lined ditches and channels to collect overland flows and convey such flows and at the same time provide treatment of stormwater; and,
- utilize infiltration basins to dispose of highway stormwater.

It is to be noted that although subcatchments 403, 404 and 410 are located in a groundwater recharge area, infiltration systems are the recommended BMPs. This is because of the goal of maintaining the existing drainage pattern so as to minimize the impact on the hydrology/hydrogeology of the area. These subcatchments are small and their runoff has been pre-treated by vegetative BMPs, thereby reducing the potential for groundwater contamination.

For subcatchments 405 and 406, the recommended BMPs are as follows:

- use of vegetative controls as discussed above; and,
- use of what could be a combination of an extended detention/infiltration pond for stormwater treatment.

The recommended BMP for subcatchments 407 and 408 is an extended detention/infiltration pond. No vegetated controls provide pre-treatment because the subcatchments are drained by storm sewers that directly discharge to the proposed pond.

Concerns have been raised regarding possible seepage problems from the pond to the proposed sand and gravel pit. Aggregate removal will be done using the wet extraction (dragline) process and the water level in the pit will be maintained at about El. 305.5 m. With the pond level at about El. 307 m, seepage problems are not anticipated.

For subcatchments 409, 411 and 412 as well as the rest of the highway improvements in this section, the recommended BMPs are confined to vegetative controls because of space availability constraints and sensitive area restrictions.

6.0 CONCEPTUAL SWM PLAN FORMULATION: HANLON EXPRESSWAY TO NORTH PROJECT LIMIT

The proposed lane expansion for the Hanlon Expressway between Highway 401 and the proposed County Road 34 interchange is exhibited in Figure 6.1. Widening will be towards the outer lanes with a 15.2 m wide rural median being maintained.

6.1 Site Characteristics for BMP Suitability

Suitability characteristics of this particular Highway 6 section are presented in Figure 6.2. The soils in the area are predominantly within the "A" type hydrologic soil group with a pocket of "B" type soil in the Galt/Mill Creek Tributary wetland area.

As in the Highway 401 widening section, drainage in this section is closely tied with the existing Hanlon Expressway profile which is shallow. However, the profile of County Road 34 is steeper, with a maximum gradient of about 3.3 % in the excavated portions.

Static overburden groundwater level (El. 310 m and El. 320 m) contours are plotted in Figure 6.2. This gives a depth to groundwater table of about 2 m in the County Road 34 Connecting Road area, 8 m in the proposed interchange area, and 20 m in the vicinity of the north project limit.

Bedrock lies at approximately El. 300 m under most of the Hanlon Expressway alignment (i.e. more than 10 m depth to bedrock).

For siting BMPs, the proposed interchange area provides ample space. The woodlot and wetlands areas of the Galt/Mill Creek system, however, will restrict the location of BMPs because of their environmentally sensitive nature.

6.2 Drainage Strategy and Selection of the Preferred SWM Concept

The drainage strategy for this section is to direct runoff towards the south as in the existing condition. The development of this section is centred on the County Road 34/Hanlon Expressway interchange and its associated Connecting Road. Thus, the conceptual SWM plan will focus on these two construction areas. Although there will be construction on the Hanlon Expressway, stormwater impacts will not be as significant because the widening work for this project will only involve the northbound lanes.

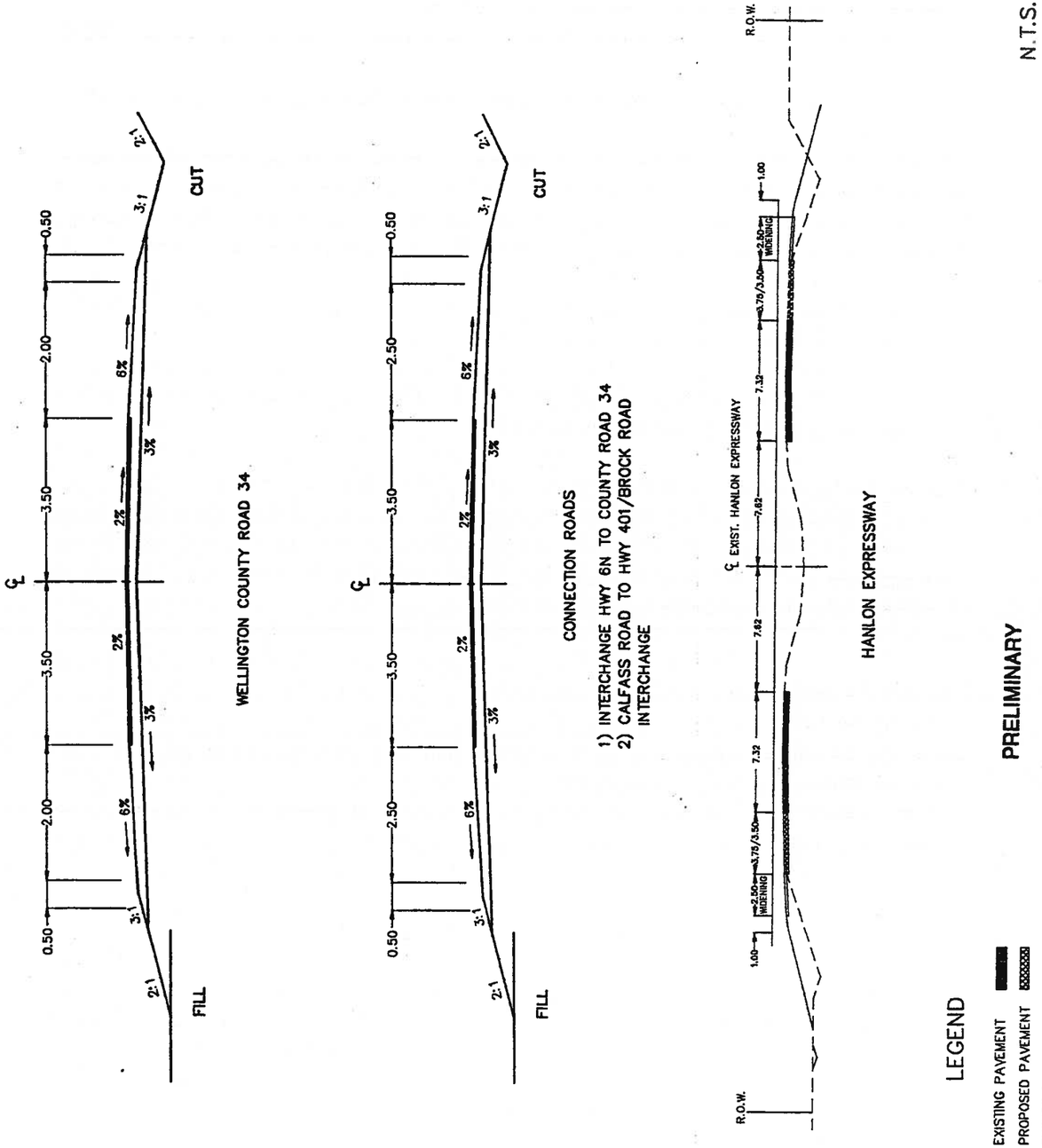


FIGURE 6.1
TYPICAL ROADWAY CROSS-SECTION
HANLON EXPRESSWAY TO NORTH PROJECT LIMIT

For the interchange area, the best location for a BMP is the southern most tip of West-South and South-East ramp diamonds. This will include the treatment of stormwater from a significant portion of this Highway 6 section. A BMP facility for each of the ramp diamonds appears to be the best arrangement because this avoids conveying the stormwater across the existing Hanlon Expressway for treatment. Thus, the preferred conceptual SWM plan for this area (subcatchments 501 and 502 in Figure 6.3) involves the following BMPs:

- use of grass buffer strips in the embankment and excavated slope faces as well as in the diamond and loop areas to filter surface runoff from the pavement;
- use of grass-lined ditches and channels to collect overland flows, convey such flow and provide stormwater treatment; and,
- utilize infiltration basins to provide further treatment of stormwater.

For these subcatchments, an infiltration type BMP was chosen to address GRCA concerns regarding increased runoff quantities and MNR concerns regarding potential increases in the temperature of water flowing to the sensitive Galt/Mill Creek wetlands. Moreover, site characteristics make infiltration basins a suitable BMP for this area.

For the County Road 34 Connecting Road, the recommended conceptual SWM plan consists of vegetative BMPs (i.e. grass-lined buffer strips and grass-lined ditches and channel for collection, conveyance and treatment of stormwater ensuing from the area). Limited available space, high static overburden groundwater table, deep excavations, and temperature increase concerns led to the use of vegetative BMPs as the most suitable treatment.

7.0 SPACE REQUIREMENTS FOR RECOMMENDED BMPs

A hydrologic analysis was performed to determine a preliminary sizing and space requirements of the BMPs recommended in the conceptual SWM plan for each of the three Highway 6 sections. The criteria used for the preliminary sizing are as follows:

- For infiltration basins in depressions such as those recommended in the sections of Highway 6 from Maddaugh Road to Highway 401 and from the Highway 401 widening to the Hanlon Expressway, the facility is sized to capture/store the runoff for a 10-year 24-hour duration storm falling over the catchment. The 10-year storm is generally used for minor drainage system design.
- For infiltration basins with a surface water outlet (such as the ones recommended on the Hanlon Expressway to the north project limit section) volume requirements were determined using the 25 mm precipitation criterion.
- The 25 mm precipitation criterion was also used to determine the storage requirements for the extended detention/infiltration pond recommended for the Highway 401 widening to the Hanlon Expressway section.

Results of the hydrologic analysis revealed the following storage volume requirements:

BMP Facility	Volume Required (m^3)	Additional ROW Required
Infiltration Basin 1	2850	YES
Infiltration Basin 2	7250	YES
Infiltration Basin 3	5050	YES
Infiltration Basin 4	4750	NO
Infiltration Basin 5	2450	YES
Infiltration Basin 6	550	YES
Infiltration Basin 7	1200	YES
Infiltration Basin 8	500	YES
Extended Detention/ Infiltration Pond	1300	NO

BMP Facility	Volume Required (m^3)	Additional ROW Required
Infiltration Basin 9	200	NO
Infiltration Basin 10	200	NO

Additional ROW requirements for infiltration basins are illustrated in the preferred conceptual SWM plan shown in Figures 4.3, 5.3 and 6.3. The areal space requirements for these BMPs have been determined assuming a storage depth of about 0.5 m to 1.0 m with side slopes of 4:1.

8.0 SUMMARY CONCLUSIONS AND RECOMMENDATIONS

1. The preparation of a conceptual SWM plan for the technically preferred route is one of a number of supplementary investigations in the Highway 6 Freelton to Guelph Route Planning and Environmental Assessment Study.

2. The main objective of this conceptual SWM plan preparation is to lay the groundwork for the final SWM plan. The scope of this work is outlined in Section 1.0.

3. A conceptual SWM plan will be prepared for the Maddaugh Road to Highway 401, Highway 401 widening to Hanlon Expressway, and Hanlon Expressway to north project limit sections of this improvement project. Stormwater management considerations for the south project limit to Maddaugh Road section have been deferred to the detail design phase.

4. The MNR, MOEE, and the GRCA have expressed specific concerns regarding the impacts of stormwater runoff from Highway 6 during its operation. These concerns have been presented in Section 2.1.

5. Criteria to control the quality of stormwater is suggested in the MNR/MOEE Interim Stormwater Quality Control Guidelines for New Development, May 1991. The philosophy adopted in this guideline is summarized in Section 2.2. It is to be noted that these guidelines do not take into account the unique concerns of a linear facility development such as highways as they have been formulated to primarily address urban land development (such as subdivisions) concerns.

6. The targeted water quality parameter is suspended sediments because they carry with them a significant percentage of the other expected highway pollutants (Section 3.1). Temperature control is also included as a target water quality parameter in significant coldwater fishery areas.

7. Several BMPs were considered in the long list for highway stormwater quality control. They are discussed in Section 3.2. A quantitative rating system was used to evaluate and short list of available BMPs. The short-listed BMPs are Vegetative Controls, Retention/Extended Detention Ponds, Infiltration Systems, and Artificial Wetlands.

8. A conceptual SWM plan was formulated for each of the three Highway 6 sections. In the conceptual plan formulation, the site characteristics were described (Sections 4.1, 5.1, and 6.1) and are displayed in Figures 4.2, 5.2, and 6.2.

9. The preferred conceptual SWM plan for each of the three Highway 6 sections is shown in Figures 4.3, 5.3, and 6.3. The plan will make it possible to treat 100% of the runoff from the paved roadway through one or a combination of the following recommended BMPs:

   - use of grass buffer strips in the embankment and excavated slope faces as well as in the diamond and loop areas to filter surface runoff from the pavement;
   - use of grass-lined ditches and channels to collect overland flow, convey such flows, and at the same time provide stormwater treatment; and,
   - utilize infiltration basins or extended detention/infiltration ponds for final treatment and disposition of highway stormwater.

10. Additional ROW will be required to locate the recommended SWM facilities. A hydrologic analysis was performed to determine the preliminary sizing of these facilities. The criteria used and the volume requirements are discussed and presented in Section 7.0 Space requirements for additional ROW are shown in Figures 4.3 and 5.3. Sufficient space is available in the diamond and loop ramp areas for those BMPs proposed to be situated at these locations.

11. It is recommended that provisions for acquiring additional ROW be included in the design phases of this project.

12. It is suggested that a sub-surface investigation be conducted to verify/confirm suitability of infiltration BMPs at the proposed locations of these facilities.

13. It is suggested that the Highway 401 median storm sewer design from Sta 20+500 easterly be reviewed to confirm compatibility with the SWM strategy proposed herein.

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appendix

OTTHYMO.89 Output

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================================================================================

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  LICENSED TO:  MacLaren Plansearch, Willowdale

  Input   filename: HW6BPA1.DAT
  Output  filename: HW6BPA1.OUT
  Summary filename: HW6BPA1.SUM



DATE: 06-24-1960                    TIME: 11:57:00

COMMENTS: _____________________________________________

--------------------------------------------------------------------------------
*HWY6 PROPOSED STUDY - (005796-A100-140321) NOV 93
*FROM HWY 401 TO CP RAIL GALT SUBDIVISION
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

--------------------
|DEFAULT VALUES    |
--------------------
     fname :C:HWY6.VAL
--------------------------------------------------------------------------------
*
* 24 HR SCS TYPE II DISTRIBUTION (1:10 YEAR STORM)
*
--------------------
| MASS STORM       |    Filename: C:SCS24HII.MST
| Ptotal= 73.70 mm |    Comments: SCS 24 HOUR TYPE II STORM DISTRIBUTION
--------------------

                     Duration of storm    = 24.00 hrs
                     Mass curve time step = 60.00 min

| TIME | RAIN | TIME | RAIN | TIME | RAIN | TIME | RAIN |
|  hrs | mm/hr|  hrs | mm/hr|  hrs | mm/hr|  hrs | mm/hr|
| 1.00 |  .74 | 7.00 | 1.47 | 13.00| 7.37 | 19.00| 1.47 |
| 2.00 |  .74 | 8.00 | 1.47 | 14.00| 4.42 | 20.00| 1.47 |
| 3.00 |  .74 | 9.00 | 2.21 | 15.00| 2.21 | 21.00|  .74 |
| 4.00 |  .74 |10.00 | 2.21 | 16.00| 2.21 | 22.00|  .74 |
| 5.00 | 1.47 |11.00 |15.48 | 17.00| 1.47 | 23.00|  .74 |
| 6.00 | 1.47 |12.00 |19.90 | 18.00| 1.47 | 24.00|  .74 |

*
--------------------
| DESIGN           |    Area    (ha)=   8.00   Curve Number   (CN)= 62.0
| NASHYD   (0301)  |    Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
|ID= 1 DT= 5.0 min |    U.H. Tp(hrs)=    .20
--------------------

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.

    Unit Hyd Qpeak  (cms)=   1.528

    PEAK FLOW       (cms)=    .157 (i)
    TIME TO PEAK    (hrs)=  12.000
    RUNOFF VOLUME    (mm)=  20.994
    TOTAL RAINFALL   (mm)=  73.700
    RUNOFF COEFFICIENT   =    .285

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| PRINT HYD (0301) |    AREA       (ha)=   8.00
| ID= 1   PCYC=298 |    QPEAK     (cms)=    .16 (i)
| DT= 5.0 min      |    TPEAK     (hrs)=  12.00
--------------------    VOLUME     (mm)=  20.99
```

```
    (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
*
--------------------
| DESIGN           |    Area    (ha)=   5.30   Curve Number   (CN)= 63.0
| NASHYD   (0302)  |    Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
|ID= 2 DT= 5.0 min |    U.H. Tp(hrs)=    .20
--------------------

    Unit Hyd Qpeak  (cms)=   1.012

    PEAK FLOW       (cms)=    .107 (i)
    TIME TO PEAK    (hrs)=  12.000
    RUNOFF VOLUME    (mm)=  21.620
    TOTAL RAINFALL   (mm)=  73.700
    RUNOFF COEFFICIENT   =    .293

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| PRINT HYD (0302) |    AREA       (ha)=   5.30
| ID= 2   PCYC=297 |    QPEAK     (cms)=    .11 (i)
| DT= 5.0 min      |    TPEAK     (hrs)=  12.00
--------------------    VOLUME     (mm)=  21.62

    (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
***********
*AT BMP 1
***********

--------------------
| ADD HYD   (0901) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
                       ID1= 1 (0301):    8.00     .16    12.00    20.99
                     + ID2= 2 (0302):    5.30     .11    12.00    21.62
                       ================================================
                       ID = 3 (0901):   13.30     .26    12.00    21.24

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| PRINT HYD (0901) |    AREA       (ha)=  13.30
| ID= 3   PCYC=298 |    QPEAK     (cms)=    .26 (i)
| DT= 5.0 min      |    TPEAK     (hrs)=  12.00
--------------------    VOLUME     (mm)=  21.24

    (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
*
--------------------
| DESIGN           |    Area    (ha)=  10.00   Curve Number   (CN)= 66.0
| NASHYD   (0303)  |    Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
|ID= 1 DT= 5.0 min |    U.H. Tp(hrs)=    .20
--------------------

    Unit Hyd Qpeak  (cms)=   1.910

    PEAK FLOW       (cms)=    .222 (i)
    TIME TO PEAK    (hrs)=  12.000
    RUNOFF VOLUME    (mm)=  23.606
    TOTAL RAINFALL   (mm)=  73.700
    RUNOFF COEFFICIENT   =    .320

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| PRINT HYD (0303) |    AREA       (ha)=  10.00
| ID= 1   PCYC=298 |    QPEAK     (cms)=    .22 (i)
| DT= 5.0 min      |    TPEAK     (hrs)=  12.00
--------------------    VOLUME     (mm)=  23.61
```

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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*

DESIGN NASHYD (0304) ID= 2 DT= 5.0 min	Area (ha)= 19.50 Curve Number (CN)= 68.0 Ia (mm)= 5.00 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= .20

Unit Hyd Qpeak (cms)= 3.724

PEAK FLOW (cms)= .459 (i)
TIME TO PEAK (hrs)= 12.000
RUNOFF VOLUME (mm)= 25.026
TOTAL RAINFALL (mm)= 73.700
RUNOFF COEFFICIENT = .340

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

PRINT HYD (0304) ID= 2 PCYC=299 DT= 5.0 min	AREA (ha)= 19.50 QPEAK (cms)= .46 (i) TPEAK (hrs)= 12.00 VOLUME (mm)= 25.03

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

****
*AT BMP 2
****

ADD HYD (0902) 1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0303):	10.00	.22	12.00	23.61
+ ID2= 2 (0304):	19.50	.46	12.00	25.03
ID = 3 (0902):	29.50	.68	12.00	24.54

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

PRINT HYD (0902) ID= 3 PCYC=299 DT= 5.0 min	AREA (ha)= 29.50 QPEAK (cms)= .68 (i) TPEAK (hrs)= 12.00 VOLUME (mm)= 24.54

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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*

DESIGN NASHYD (0305) ID= 1 DT= 5.0 min	Area (ha)= 4.00 Curve Number (CN)= 55.0 Ia (mm)= 5.00 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= .17

Unit Hyd Qpeak (cms)= .915

PEAK FLOW (cms)= .065 (i)
TIME TO PEAK (hrs)= 12.000
RUNOFF VOLUME (mm)= 17.002
TOTAL RAINFALL (mm)= 73.700
RUNOFF COEFFICIENT = .231

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

PRINT HYD (0305) ID= 1 PCYC=295 DT= 5.0 min	AREA (ha)= 4.00 QPEAK (cms)= .06 (i) TPEAK (hrs)= 12.00 VOLUME (mm)= 17.00

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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*

DESIGN NASHYD (0306) ID= 2 DT= 5.0 min	Area (ha)= 17.90 Curve Number (CN)= 67.0 Ia (mm)= 5.00 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= .17

Unit Hyd Qpeak (cms)= 4.094

PEAK FLOW (cms)= .415 (i)
TIME TO PEAK (hrs)= 12.000
RUNOFF VOLUME (mm)= 24.260
TOTAL RAINFALL (mm)= 73.700
RUNOFF COEFFICIENT = .329

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

PRINT HYD (0306) ID= 2 PCYC=297 DT= 5.0 min	AREA (ha)= 17.90 QPEAK (cms)= .42 (i) TPEAK (hrs)= 12.00 VOLUME (mm)= 24.26

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

****
*AT BMP 3
****

ADD HYD (0903) 1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0305):	4.00	.06	12.00	17.00
+ ID2= 2 (0306):	17.90	.42	12.00	24.26
ID = 3 (0903):	21.90	.48	12.00	22.93

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

PRINT HYD (0903) ID= 3 PCYC=297 DT= 5.0 min	AREA (ha)= 21.90 QPEAK (cms)= .48 (i) TPEAK (hrs)= 12.00 VOLUME (mm)= 22.93

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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FINISH

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       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    I N T E R H Y M O
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  Summary filename: HW6CPA1.SUM



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COMMENTS: _____________________________________________

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*HWY 6 ALONG THE 401 - (005796-A100-140321) DEC 93
*PROPOSED CONDITION (WITH WIDENING)
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

--------------------
|DEFAULT VALUES    |
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--------------------------------------------------------------------------------
*
* 24 HR SCS TYPE II DISTRIBUTION (1:10 YEAR STORM)
*
--------------------
| MASS STORM       |    Filename: C:SCS24HII.MST
| Ptotal= 73.70 mm |    Comments: SCS 24 HOUR TYPE II STORM DISTRIBUTION (
--------------------

                          Duration of storm    = 24.00 hrs
                          Mass curve time step = 60.00 min

      TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
       hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
      1.00     .74 |  7.00    1.47 | 13.00    7.37 | 19.00    1.47
      2.00     .74 |  8.00    1.47 | 14.00    4.42 | 20.00    1.47
      3.00     .74 |  9.00    2.21 | 15.00    2.21 | 21.00     .74
      4.00     .74 | 10.00    2.21 | 16.00    2.21 | 22.00     .74
      5.00    1.47 | 11.00   15.48 | 17.00    1.47 | 23.00     .74
      6.00    1.47 | 12.00   19.90 | 18.00    1.47 | 24.00     .74

*
--------------------
| DESIGN           |
| NASHYD   (0401)  |    Area    (ha)=  21.80   Curve Number   (CN)= 64.0
|ID= 1 DT= 5.0 min |    Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=    .10

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.

    Unit Hyd Qpeak  (cms)=   8.327

    PEAK FLOW       (cms)=    .468 (i)
    TIME TO PEAK    (hrs)=  12.000
    RUNOFF VOLUME    (mm)=  21.728
    TOTAL RAINFALL   (mm)=  73.700
    RUNOFF COEFFICIENT   =    .295

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| PRINT HYD (0401) |    AREA       (ha)=  21.80
| ID= 1   PCYC=294 |    QPEAK     (cms)=    .47 (i)
| DT= 5.0 min      |    TPEAK     (hrs)=  12.00
--------------------    VOLUME     (mm)=  21.73

    (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
*
--------------------
| DESIGN           |
| NASHYD   (0402)  |    Area    (ha)=   9.70   Curve Number   (CN)= 70.0
|ID= 2 DT= 5.0 min |    Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=    .08

    Unit Hyd Qpeak  (cms)=   4.464

    PEAK FLOW       (cms)=    .244 (i)
    TIME TO PEAK    (hrs)=  12.000
    RUNOFF VOLUME    (mm)=  25.253
    TOTAL RAINFALL   (mm)=  73.700
    RUNOFF COEFFICIENT   =    .343

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| PRINT HYD (0402) |    AREA       (ha)=   9.70
| ID= 2   PCYC=292 |    QPEAK     (cms)=    .24 (i)
| DT= 5.0 min      |    TPEAK     (hrs)=  12.00
--------------------    VOLUME     (mm)=  25.25

    (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
*
--------------------
| DESIGN           |
| NASHYD   (0403)  |    Area    (ha)=   2.30   Curve Number   (CN)= 67.0
|ID= 1 DT= 5.0 min |    Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=    .13

    Unit Hyd Qpeak  (cms)=    .661

    PEAK FLOW       (cms)=    .054 (i)
    TIME TO PEAK    (hrs)=  12.000
    RUNOFF VOLUME    (mm)=  24.130
    TOTAL RAINFALL   (mm)=  73.700
    RUNOFF COEFFICIENT   =    .327

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| PRINT HYD (0403) |    AREA       (ha)=   2.30
| ID= 1   PCYC=293 |    QPEAK     (cms)=    .05 (i)
| DT= 5.0 min      |    TPEAK     (hrs)=  12.00
--------------------    VOLUME     (mm)=  24.13

    (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
*
--------------------
| DESIGN           |
| NASHYD   (0404)  |    Area    (ha)=   3.70   Curve Number   (CN)= 77.0
|ID= 1 DT= 5.0 min |    Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=    .30

    Unit Hyd Qpeak  (cms)=    .471

    PEAK FLOW       (cms)=    .108 (i)
    TIME TO PEAK    (hrs)=  12.000
    RUNOFF VOLUME    (mm)=  32.632
    TOTAL RAINFALL   (mm)=  73.700
    RUNOFF COEFFICIENT   =    .443

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| PRINT HYD (0404) |    AREA       (ha)=   3.70
| ID= 1   PCYC=302 |    QPEAK     (cms)=    .11 (i)
| DT= 5.0 min      |    TPEAK     (hrs)=  12.00
--------------------
```

---------- VOLUME (mm)= 32.63

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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*

DESIGN NASHYD (0410) ID= 1 DT= 5.0 min	Area (ha)= 1.70 Curve Number (CN)= 73.0 Ia (mm)= 5.00 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= .12

Unit Hyd Qpeak (cms)= .541

PEAK FLOW (cms)= .048 (i)
TIME TO PEAK (hrs)= 12.000
RUNOFF VOLUME (mm)= 28.630
TOTAL RAINFALL (mm)= 73.700
RUNOFF COEFFICIENT = .388

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

PRINT HYD (0410) ID= 1 PCYC=293 DT= 5.0 min	AREA (ha)= 1.70 QPEAK (cms)= .05 (i) TPEAK (hrs)= 12.00 VOLUME (mm)= 28.63

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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*

*

* 24 HR SCS TYPE II DISTRIBUTION (25 MM PRECIPITATION)

*

MASS STORM Ptotal= 25.00 mm	Filename: C:SCS24HII.MST Comments: SCS 24 HOUR TYPE II STORM DISTRIBUTION (Duration of storm = 24.00 hrs Mass curve time step = 60.00 min

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
1.00	.25	7.00	.50	13.00	2.50	19.00	.50
2.00	.25	8.00	.50	14.00	1.50	20.00	.50
3.00	.25	9.00	.75	15.00	.75	21.00	.25
4.00	.25	10.00	.75	16.00	.75	22.00	.25
5.00	.50	11.00	5.25	17.00	.50	23.00	.25
6.00	.50	12.00	6.75	18.00	.50	24.00	.25

*

DESIGN NASHYD (0405) ID= 1 DT= 5.0 min	Area (ha)= 4.80 Curve Number (CN)= 70.0 Ia (mm)= 5.00 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= .42

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

Unit Hyd Qpeak (cms)= .437

PEAK FLOW (cms)= .012 (i)
TIME TO PEAK (hrs)= 12.167
RUNOFF VOLUME (mm)= 3.102
TOTAL RAINFALL (mm)= 25.000
RUNOFF COEFFICIENT = .124

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

PRINT HYD (0405) ID= 1 PCYC=301 DT= 5.0 min	AREA (ha)= 4.80 QPEAK (cms)= .01 (i) TPEAK (hrs)= 12.17 VOLUME (mm)= 3.10

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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*

DESIGN NASHYD (0406) ID= 2 DT= 5.0 min	Area (ha)= 4.30 Curve Number (CN)= 80.0 Ia (mm)= 5.00 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= .47

Unit Hyd Qpeak (cms)= .349

PEAK FLOW (cms)= .016 (i)
TIME TO PEAK (hrs)= 12.167
RUNOFF VOLUME (mm)= 4.788
TOTAL RAINFALL (mm)= 25.000
RUNOFF COEFFICIENT = .192

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

PRINT HYD (0406) ID= 2 PCYC=304 DT= 5.0 min	AREA (ha)= 4.30 QPEAK (cms)= .02 (i) TPEAK (hrs)= 12.17 VOLUME (mm)= 4.79

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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*

ADD HYD (0901) 1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0405):	4.80	.01	12.17	3.10
+ ID2= 2 (0406):	4.30	.02	12.17	4.79
ID = 3 (0901):	9.10	.03	12.17	3.90

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

PRINT HYD (0901) ID= 3 PCYC=304 DT= 5.0 min	AREA (ha)= 9.10 QPEAK (cms)= .03 (i) TPEAK (hrs)= 12.17 VOLUME (mm)= 3.90

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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*

DESIGN STANDHYD (0407) ID= 1 DT= 5.0 min	Area (ha)= 4.30 Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	3.87	.43	
Dep. Storage	(mm)=	.80	1.50	
Average Slope	(%)=	.75	.75	
Length	(m)=	169.31	40.00	
Mannings n	=	.013	.250	
Max.eff.Inten.	(mm/hr)=	6.75	1.10	
over	(min)	10.00	70.00	
Storage Coeff.	(min)=	11.23 (ii)	68.85 (ii)	
Unit Hyd. Tpeak	(min)=	10.00	70.00	
Unit Hyd. peak	(cms)=	.10	.02	
				TOTALS
PEAK FLOW	(cms)=	.07	.00	.07 (iii)
TIME TO PEAK	(hrs)=	12.00	12.92	12.00
RUNOFF VOLUME	(mm)=	24.20	3.72	22.14
TOTAL RAINFALL	(mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT	=	.97	.15	.89

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 67.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

PRINT HYD (0407)	AREA (ha)= 4.30
ID= 1 PCYC=299	QPEAK (cms)= .07 (i)
DT= 5.0 min	TPEAK (hrs)= 12.00
	VOLUME (mm)= 22.14

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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*

ADD HYD (0902)		AREA	QPEAK	TPEAK	R.V.
3 + 1 = 4		(ha)	(cms)	(hrs)	(mm)
	ID1= 3 (0901):	9.10	.03	12.17	3.90
	+ ID2= 1 (0407):	4.30	.07	12.00	22.14
	ID = 4 (0902):	13.40	.10	12.00	9.75

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

PRINT HYD (0902)	AREA (ha)= 13.40
ID= 4 PCYC=304	QPEAK (cms)= .10 (i)
DT= 5.0 min	TPEAK (hrs)= 12.00
	VOLUME (mm)= 9.75

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---

*

FINISH

```
 OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    I N T E R H Y M O
O   O    T      T    H   H   Y Y   MM MM  O   O   * * * 1989b * * *
O   O    T      T    HHHHH    Y    M M M  O   O
O   O    T      T    H   H    Y    M   M  O   O
 OOO     T      T    H   H    Y    M   M   OOO    cH-315441600000
```

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LICENSED TO: MacLaren Plansearch, Willowdale

Input filename: HW6DPA1.DAT
Output filename: HW6DPA1.OUT
Summary filename: HW6DPA1.SUM

DATE: 06-24-1960 TIME: 11:57:00

COMMENTS: _____

---

*HWY6 ALONG THE HANLON - (005796-A100-140321) DEC 93
*PROPOSED CONDITION (WITH WIDENING)
****
** SIMULATION NUMBER: 1 **
****

DEFAULT VALUES

fname :C:HWY6.VAL

---

*
* 24 HR SCS TYPE II DISTRIBUTION (TOTAL PRECIPITATION = 25 mm)
*

MASS STORM	Filename: C:SCS24HII.MST
Ptotal= 25.00 mm	Comments: SCS 24 HOUR TYPE II STORM DISTRIBUTION (

Duration of storm = 24.00 hrs
Mass curve time step = 60.00 min

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
1.00	.25	7.00	.50	13.00	2.50	19.00	.50
2.00	.25	8.00	.50	14.00	1.50	20.00	.50
3.00	.25	9.00	.75	15.00	.75	21.00	.25
4.00	.25	10.00	.75	16.00	.75	22.00	.25
5.00	.50	11.00	5.25	17.00	.50	23.00	.25
6.00	.50	12.00	6.75	18.00	.50	24.00	.25

*

DESIGN NASHYD (0501)	Area (ha)= 8.90	Curve Number (CN)= 62.0
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= .25	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

Unit Hyd Qpeak (cms)= 1.360

PEAK FLOW (cms)= .018 (i)
TIME TO PEAK (hrs)= 12.000
RUNOFF VOLUME (mm)= 2.275
TOTAL RAINFALL (mm)= 25.000
RUNOFF COEFFICIENT = .091

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

PRINT HYD (0501)	AREA (ha)= 8.90
ID= 1 PCYC=297	QPEAK (cms)= .02 (i)
DT= 5.0 min	TPEAK (hrs)= 12.00
	VOLUME (mm)= 2.27

```
     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
*
--------------------
| DESIGN           |
| NASHYD    (0502) |   Area    (ha)=  11.20   Curve Number   (CN)= 54.0
|ID= 2 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .20

     Unit Hyd Qpeak  (cms)=   2.139

     PEAK FLOW       (cms)=    .018 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=   1.689
     TOTAL RAINFALL   (mm)=  25.000
     RUNOFF COEFFICIENT   =    .068

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| PRINT HYD (0502) |   AREA       (ha)=  11.20
| ID= 2   PCYC=295 |   QPEAK     (cms)=    .02 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=  12.00
--------------------   VOLUME     (mm)=   1.69

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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*

 FINISH
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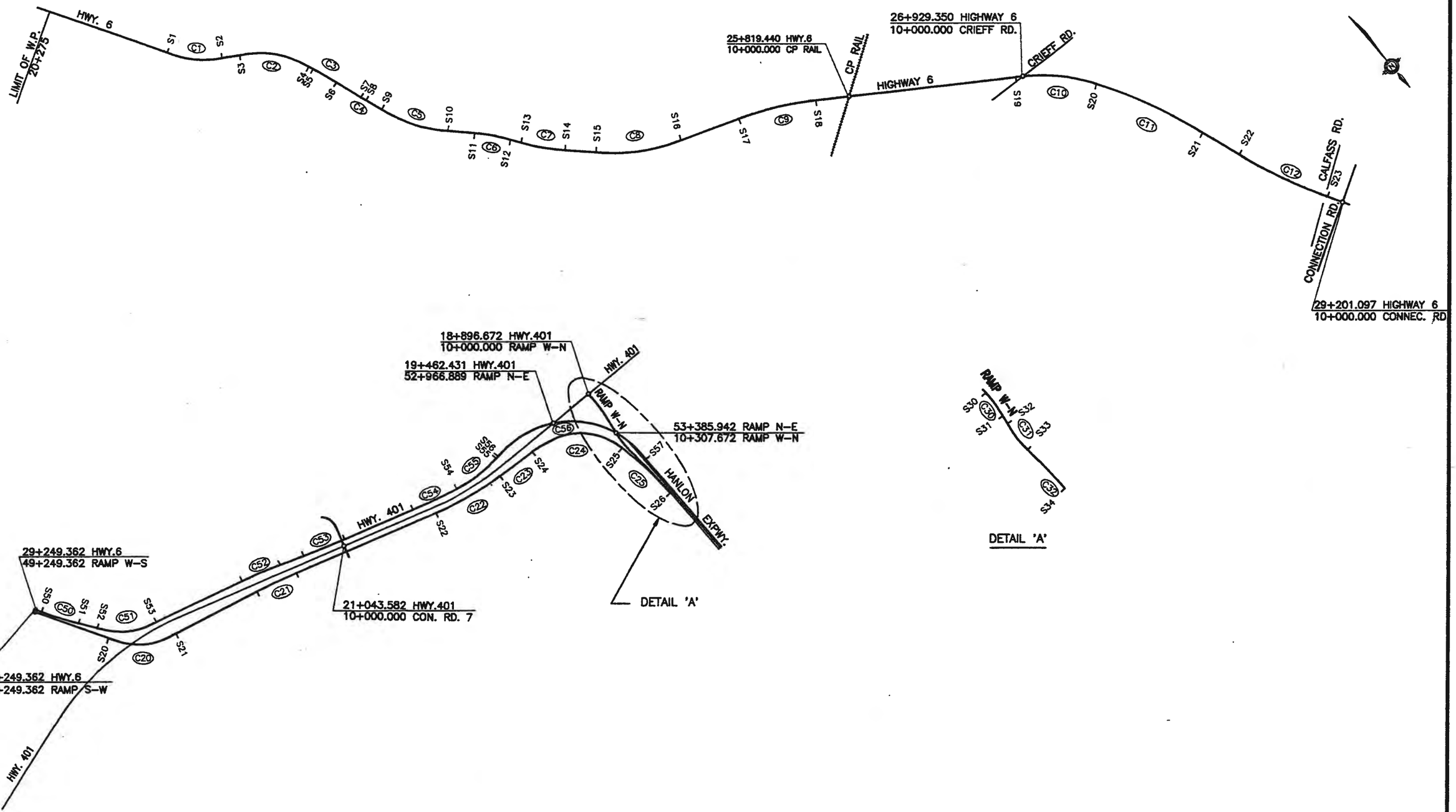
APPENDIX N

CALCULATED ALIGNMENT



HIGHWAY 6

FREELTON TO GUELPH
Environmental Assessment
& Preliminary Design Report

HIGHWAY 6 - SOUTH OF HIGHWAY 401

Desc.	Station	Spiral/Curve Data			Northing	Easting
PI	20+230.059				4806900.0000	261088.0000
	Length:	1080.541	Course:	314-02-15		
PI	21+310.600				4807651.1156	260311.2151
	Length:	537.302	Course:	286-40-40		
	Delta:	27-21-35				
		Tangent Data				
	20+230.059				4806900.0000	261088.0000
	21+124.505				4807521.7554	260444.9961
	Length:	894.446	Course:	314-02-15		
		Spiral Curve Data: CLOTHOID				
TS	21+124.505				4807521.7554	260444.9961
SPI					4807564.4043	260400.8897
SC	21+216.505				4807583.9035	260377.1964
	Length:	92.000	L Tan:	61.354		
	Radius:	-575.000	S Tan:	30.685		
	Theta:	4-35-01	P:	0.613		
	X:	91.941	K:	45.990		
	Y:	2.452	A:	230.000		
	Chord:	91.974	Course:	312-30-35		
		Circular Curve Data C 1				
SC	21+216.505				4807583.9035	260377.1964
RP					4807139.9249	260011.8090
CS	21+399.077				4807675.7878	260220.3179
	Delta:	18-11-33	Type:	LEFT		
	Radius:	575.000	DOC:	09-57-52		
	Length:	182.572	Tangent:	92.061		
	Mid-Ord:	7.231	External:	7.323		
	Chord:	181.806	Course:	300-21-28		
		Spiral Curve Data: CLOTHOID				
SC	21+399.077				4807675.7878	260220.3179
SPI					4807686.9150	260191.7211
ST	21+491.077				4807704.5229	260132.9481
	Length:	92.000	L Tan:	61.354		
	Radius:	575.000	S Tan:	30.685		
	Theta:	4-35-01	P:	0.613		
	X:	91.941	K:	45.990		

	Y:	2.452	A:	230.000		
	Chord:	91.974	Course:	288-12-20		
PI	21+842.284				4807805.3155	259796.5150
	Length:	354.523	Course:	322-54-40		
	Delta:	36-14-00				
		Tangent Data				
	21+491.077				4807704.5229	260132.9481
	21+607.969				4807738.0697	260020.9732
	Length:	116.892	Course:	286-40-40		
		Spiral Curve Data: CLOTHOID				
TS	21+607.969				4807738.0697	260020.9732
SPI					4807755.6776	259962.2002
SC	21+699.969				4807766.8048	259933.6034
	Length:	92.000	L Tan:	61.354		
	Radius:	575.000	S Tan:	30.685		
	Theta:	4-35-01	P:	0.613		
	X:	91.941	K:	45.990		
	Y:	2.452	A:	230.000		
	Chord:	91.974	Course:	288-12-20		
		Circular Curve Data C 2				
SC	21+699.969				4807766.8048	259933.6034
RP					4808302.6677	260142.1123
CS	21+971.594				4807920.3660	259712.6121
	Delta:	27-03-58	Type:	RIGHT		
	Radius:	575.000	DOC:	09-57-52		
	Length:	271.625	Tangent:	138.396		
	Mid-Ord:	15.965	External:	16.421		
	Chord:	269.106	Course:	304-47-40		
		Spiral Curve Data: CLOTHOID				
SC	21+971.594				4807920.3660	259712.6121
SPI					4807943.2866	259692.2103
ST	22+063.594				4807992.2287	259655.2106
	Length:	92.000	L Tan:	61.354		
	Radius:	-575.000	S Tan:	30.685		
	Theta:	4-35-01	P:	0.613		
	X:	91.941	K:	45.990		
	Y:	2.452	A:	230.000		
	Chord:	91.974	Course:	321-23-00		
PI	22+183.802				4808088.1185	259582.7190
	Length:	290.386	Course:	326-22-30		
	Delta:	3-27-50				

		Tangent Data			
	22+063.594			4807992.2287	259655.2106
	22+096.919			4808018.8122	259635.1138
	Length:	33.325	Course:	322-54-40	
		Spiral Curve Data: CLOTHOID			
TS	22+096.919			4808018.8122	259635.1138
SPI				4808046.8982	259613.8811
SC	22+149.732			4808061.0802	259603.4510
	Length:	52.812	L Tan:	35.209	
	Radius:	2000.000	S Tan:	17.604	
	Theta:	0-45-23	P:	0.058	
	X:	52.812	K:	26.406	
	Y:	0.232	A:	325.000	
	Chord:	52.812	Course:	323-09-48	
		Circular Curve Data C 3			
SC	22+149.732			4808061.0802	259603.4510
RP				4809246.0180	261214.6376
CS	22+217.832			4808116.6174	259564.0455
	Delta:	01-57-03	Type:	RIGHT	
	Radius:	2000.000	DOC:	02-51-53	
	Length:	68.100	Tangent:	34.053	
	Mid-Ord:	0.290	External:	0.290	
	Chord:	68.097	Course:	324-38-35	
		Spiral Curve Data: CLOTHOID			
SC	22+217.832			4808116.6174	259564.0455
SPI				4808131.1463	259554.1043
ST	22+270.644			4808160.4638	259534.6073
	Length:	52.813	L Tan:	35.209	
	Radius:	-2000.000	S Tan:	17.604	
	Theta:	0-45-23	P:	0.058	
	X:	52.812	K:	26.406	
	Y:	0.232	A:	325.000	
	Chord:	52.812	Course:	326-07-22	
PI	22+474.147			4808329.9167	259421.9165
	Length:	364.891	Course:	325-29-45	
	Delta:	0-52-45			
		Tangent Data			
	22+270.644			4808160.4638	259534.6073
	22+454.967			4808313.9453	259432.5379
	Length:	184.322	Course:	326-22-30	

		Circular Curve Data C 4			
PC	22+454.967			4808313.9453	259432.5379
RP				4806929.5580	257350.8387
PT	22+493.328			4808345.7234	259411.0512
	Delta:	00-52-45	Type:	LEFT	
	Radius:	2500.000	DOC:	02-17-31	
	Length:	38.361	Tangent:	19.181	
	Mid-Ord:	0.074	External:	0.074	
	Chord:	38.361	Course:	325-56-07	
PI	22+839.038			4808630.6179	259215.2181
	Length:	527.636	Course:	300-27-50	
	Delta:	25-01-55			
		Tangent Data			
	22+493.328			4808345.7234	259411.0512
	22+610.518			4808442.2982	259344.6668
	Length:	117.190	Course:	325-29-45	
		Spiral Curve Data: CLOTHOID			
TS	22+610.518			4808442.2982	259344.6668
SPI				4808485.9959	259314.6295
SC	22+690.047			4808507.1204	259298.6041
	Length:	79.529	L Tan:	53.026	
	Radius:	-850.000	S Tan:	26.515	
	Theta:	2-40-49	P:	0.310	
	X:	79.512	K:	39.762	
	Y:	1.240	A:	260.000	
	Chord:	79.522	Course:	324-36-09	
		Circular Curve Data C 5			
SC	22+690.047			4808507.1204	259298.6041
RP				4807993.3935	258621.4153
CS	22+981.874			4808705.0952	259086.1524
	Delta:	19-40-16	Type:	LEFT	
	Radius:	850.000	DOC:	06-44-26	
	Length:	291.827	Tangent:	147.364	
	Mid-Ord:	12.493	External:	12.680	
	Chord:	290.396	Course:	312-58-48	
		Spiral Curve Data: CLOTHOID			
SC	22+981.874			4808705.0952	259086.1524
SPI				4808719.5925	259063.9512
ST	23+061.404			4808746.4763	259018.2458
	Length:	79.529	L Tan:	53.026	
	Radius:	850.000	S Tan:	26.515	
	Theta:	2-40-49	P:	0.310	
	X:	79.512	K:	39.762	
	Y:	1.240	A:	260.000	

	Chord:	79.522	Course:	301-21-26	

PI	23+360.520			4808898.1266	258760.4232
	Length:	332.934	Course:	310-40-30	
	Delta:	10-12-40			

Tangent Data

	23+061.404			4808746.4763	259018.2458
	23+243.691			4808838.8950	258861.1235
	Length:	182.287	Course:	300-27-50	

Spiral Curve Data: CLOTHOID

TS	23+243.691			4808838.8950	258861.1235
SPI				4808865.0104	258816.7245
SC	23+320.948			4808879.0362	258795.1211
	Length:	77.257	L Tan:	51.510	
	Radius:	875.000	S Tan:	25.757	
	Theta:	2-31-46	P:	0.284	
	X:	77.242	K:	38.626	
	Y:	1.137	A:	260.000	
	Chord:	77.250	Course:	301-18-25	

Circular Curve Data C 6

SC	23+320.948			4808879.0362	258795.1211
RP				4809612.9285	259271.5947
CS	23+399.631			4808924.7899	258731.1409
	Delta:	05-09-08	Type:	RIGHT	
	Radius:	875.000	DOC:	06-32-53	
	Length:	78.683	Tangent:	39.368	
	Mid-Ord:	0.884	External:	0.885	
	Chord:	78.657	Course:	305-34-10	

Spiral Curve Data: CLOTHOID

SC	23+399.631			4808924.7899	258731.1409
SPI				4808940.6991	258710.8843
ST	23+476.888			4808974.2717	258671.8182
	Length:	77.257	L Tan:	51.510	
	Radius:	-875.000	S Tan:	25.757	
	Theta:	2-31-46	P:	0.284	
	X:	77.242	K:	38.626	
	Y:	1.137	A:	260.000	
	Chord:	77.250	Course:	309-49-55	

PI	23+692.994			4809115.1224	258507.9196
	Length:	706.867	Course:	299-31-15	
	Delta:	11-09-15			

Tangent Data

	23+476.888			4808974.2717	258671.8182
	23+547.805			4809020.4929	258618.0336
	Length:	70.917	Course:	310-40-30	

Spiral Curve Data: CLOTHOID

TS	23+547.805			4809020.4929	258618.0336
SPI				4809049.0680	258584.7827
SC	23+613.566			4809062.8749	258567.7549
	Length:	65.761	L Tan:	43.842	
	Radius:	-1150.000	S Tan:	21.922	
	Theta:	1-38-17	P:	0.157	
	X:	65.755	K:	32.880	
	Y:	0.627	A:	275.000	
	Chord:	65.758	Course:	310-07-44	

Circular Curve Data C 7

SC	23+613.566			4809062.8749	258567.7549
RP				4808169.6223	257843.4624
CS	23+771.684			4809153.7171	258438.4896
	Delta:	07-52-40	Type:	LEFT	
	Radius:	1150.000	DOC:	04-58-56	
	Length:	158.118	Tangent:	79.184	
	Mid-Ord:	2.716	External:	2.723	
	Chord:	157.993	Course:	305-05-52	

Spiral Curve Data: CLOTHOID

SC	23+771.684			4809153.7171	258438.4896
SPI				4809165.0598	258419.7302
ST	23+837.444			4809186.6628	258381.5795
	Length:	65.761	L Tan:	43.842	
	Radius:	1150.000	S Tan:	21.922	
	Theta:	1-38-17	P:	0.157	
	X:	65.755	K:	32.880	
	Y:	0.627	A:	275.000	
	Chord:	65.758	Course:	300-04-01	

PI	24+399.1217			4809463.4238	257892.8208
	Length:	951.0486	Course:	N 84-35-44.00 W	
	Delta:	24-06-59.00			

Tangent Data

	24+040.0950			4809286.5169	258205.2374
	24+110.0822			4809321.0024	258144.3362
	Length:	69.9872	Course:	N 60-28-45.00 W	

Spiral Curve Data: CLOTHOID

TS	24+110.0822			4809321.0024	258144.3362
SPI				4809342.4648	258106.4337
SC	24+175.4155			4809352.6765	258087.1968
	Length:	65.3333	L Tan:	43.5572	
	Radius:	-1200.0000	S Tan:	21.7793	
	Theta:	1-33-34.98	P:	0.1482	
	X:	65.3285	K:	32.6658	
	Y:	0.5928	A:	279.9999	
	Chord:	65.3311	Course:	N 60-59-56.65 W	

Circular Curve Data **C 8**

SC	24+175.4155			4809352.6765	258087.1968
RP				4808292.7573	257524.5501
CS	24+615.1747			4809483.9039	257670.0483
	Delta:	20-59-49.03	Type:	LEFT	
	Radius:	1200.0000	DOC:	04-46-28.73	
	Length:	439.7592	Tangent:	222.3739	
	Mid-Ord:	20.0883	External:	20.4303	
	Chord:	437.3025	Course:	N 72-32-14.50 W	

Spiral Curve Data: CLOTHOID

SC	24+615.1747			4809483.9039	257670.0483
SPI				4809486.5446	257648.4297
ST	24+680.5080			4809490.6471	257605.0661
	Length:	65.3333	L Tan:	43.5572	
	Radius:	1200.0000	S Tan:	21.7793	
	Theta:	1-33-34.98	P:	0.1482	
	X:	65.3285	K:	32.6658	
	Y:	0.5928	A:	279.9999	
	Chord:	65.3311	Course:	N 84-04-32.35 W	

PI	25+342.5170			4809552.9988	256945.9999
	Length:	1603.1440	Course:	N 71-16-56.00 W	
	Delta:	13-18-48.00			

Tangent Data

	24+680.5080			4809490.6471	257605.0661
	25+078.4705			4809528.1294	257208.8727
	Length:	397.9625	Course:	N 84-35-44.00 W	

Spiral Curve Data: CLOTHOID

TS	25+078.4705			4809528.1294	257208.8727
SPI				4809531.9754	257168.2203
SC	25+139.7205			4809534.2094	257147.9258
	Length:	61.2500	L Tan:	40.8338	
	Radius:	2000.0000	S Tan:	20.4171	
	Theta:	0-52-38.43	P:	0.0782	
	X:	61.2486	K:	30.6248	
	Y:	0.3126	A:	350.0000	
	Chord:	61.2494	Course:	N 84-18-11.19 W	

Circular Curve Data **C 9**

SC	25+139.7205			4809534.2094	257147.9258
RP				4811522.2010	257366.7625
CS	25+543.1935			4809618.3741	256754.0281
	Delta:	11-33-31.14	Type:	RIGHT	
	Radius:	2000.0000	DOC:	02-51-53.24	
	Length:	403.4730	Tangent:	202.4235	
	Mid-Ord:	10.1658	External:	10.2177	
	Chord:	402.7892	Course:	N 77-56-20.00 W	

Spiral Curve Data: CLOTHOID

SC	25+543.1935			4809618.3741	256754.0281
SPI				4809624.6293	256734.5928
ST	25+604.4435			4809637.7331	256695.9186
	Length:	61.2500	L Tan:	40.8338	
	Radius:	-2000.0000	S Tan:	20.4171	
	Theta:	0-52-38.43	P:	0.0782	
	X:	61.2486	K:	30.6248	
	Y:	0.3126	A:	350.0000	
	Chord:	61.2494	Course:	N 71-34-28.81 W	

PI	26+943.5409			4810067.4587	255427.6450
	Length:	21.7793	Course:	N 69-43-20.88 W	
	Delta:	1-33-35.12			

Tangent Data

	25+604.4435			4809637.7331	256695.9186
	26+899.9837			4810053.4809	255468.8985
	Length:	1295.5402	Course:	N 71-16-56.00 W	

Spiral Curve Data: CLOTHOID

TS	26+899.9837			4810053.4809	255468.8985
SPI				4810067.4587	255427.6450
SC	26+965.3170			4810075.0067	255407.2155
	Length:	65.3333	L Tan:	43.5572	
	Radius:	1199.9699	S Tan:	21.7793	
	Theta:	1-33-35.12	P:	0.1482	
	X:	65.3284	K:	32.6658	
	Y:	0.5928	A:	279.9964	
	Chord:	65.3311	Course:	N 70-45-44.30 W	

PI	26+965.3170			4810075.0067	255407.2155
	Length:	233.6645	Course: N 69-43-21.00 W		
	Delta:	0-00-00.12			
PI	27+198.9815			4810155.9872	255188.0324
	Length:	607.0011	Course: N 47-42-08.02 W		
	Delta:	22-01-12.98			

Circular Curve Data C 10

PC	26+965.3170			4810075.0067	255407.2155
RP				4811200.6368	255823.0963
CS	27+399.0744			4810294.8190	255036.0169
	Delta:	20-42-37.40	Type:	RIGHT	
	Radius:	1200.0000	DOC:	04-46-28.73	
	Length:	433.7574	Tangent:	219.2713	
	Mid-Ord:	19.5452	External:	19.8688	
	Chord:	431.3999	Course: N 59-22-02.30 W		

Compound Spiral Curve Data

CS	27+399.0744			4810294.8190	255036.0169
SPI				4810305.8362	255023.3375
ST	27+438.2660			4810320.9084	255006.7721
PI	27+800.2074			4810564.4891	254739.0596
	Length:	986.2818	Course: N 33-57-13.00 W		
	Delta:	13-44-55.02			

Circular Curve Data C 11

PC	27+438.2660			4810320.9084	255006.7721
RP				4812539.8802	257025.7234
CS	28+124.3886			4810836.4244	254556.2623
	Delta:	13-06-14.32	Type:	RIGHT	
	Radius:	3000.0000	DOC:	01-54-35.49	
	Length:	686.1226	Tangent:	344.5646	
	Mid-Ord:	19.5938	External:	19.7226	
	Chord:	684.6282	Course: N 41-09-00.86 W		

Spiral Curve Data: CLOTHOID

SC	28+124.3886			4810836.4244	254556.2623
SPI				4810854.9473	254543.4850
ST	28+191.8951			4810892.2782	254518.3490
	Length:	67.5065	L Tan:	45.0046	
	Radius:	-3000.0000	S Tan:	22.5024	
	Theta:	0-38-40.70	P:	0.0633	
	X:	67.5056	K:	33.7531	
	Y:	0.2532	A:	50.0215	
	Chord:	67.5061	Course: N 34-10-06.57 W		

PI	28+783.0074			4811382.6000	254188.2000
	Length:	468.2228	Course: N 45-07-27.00 W		
	Delta:	11-10-14.00			

Tangent Data

	28+191.8951			4810892.2782	254518.3490
	28+461.6123			4811116.0059	254367.7061
	Length:	269.7172	Course: N 33-57-13.00 W		

Spiral Curve Data: CLOTHOID

TS	28+461.6123			4811116.0059	254367.7061
SPI				4811146.9921	254346.8421
SC	28+517.6456			4811162.3872	254336.2659
	Length:	56.0333	L Tan:	37.3557	
	Radius:	-3000.0000	S Tan:	18.6779	
	Theta:	0-32-06.28	P:	0.0436	
	X:	56.0328	K:	28.0166	
	Y:	0.1744	A:	410.0000	
	Chord:	56.0331	Course: N 34-07-55.09 W		

Circular Curve Data C 12

SC	28+517.6456			4811162.3872	254336.2659
RP				4809463.6565	251863.5519
CS	29+046.5012			4811569.7088	254000.0312
	Delta:	10-06-01.43	Type:	LEFT	
	Radius:	3000.0000	DOC:	01-54-35.49	
	Length:	528.8556	Tangent:	265.1147	
	Mid-Ord:	11.6461	External:	11.6915	
	Chord:	528.1711	Course: N 39-32-20.00 W		

Spiral Curve Data: CLOTHOID

SC	29+046.5012			4811569.7088	254000.0312
SPI				4811583.0105	253986.9190
ST	29+102.5345			4811609.3677	253960.4473
	Length:	56.0333	L Tan:	37.3557	
	Radius:	3000.0000	S Tan:	18.6779	
	Theta:	0-32-06.28	P:	0.0436	
	X:	56.0328	K:	28.0166	
	Y:	0.1744	A:	410.0000	
	Chord:	56.0331	Course: N 44-56-44.91 W		

PI	29+249.3621			4811712.9652	253856.3998

Tangent Data

	29+102.5345			4811609.3677	253960.4473
	29+249.3621			4811712.9652	253856.3998
	Length:	146.8276	Course: N 45-07-27.00 W		

HIGHWAY 6 (NORTHBOUND) - PARALLEL TO HIGHWAY 401

Desc.	Station	Spiral/Curve Data			Northing	Easting
PI	29+249.3621				4811717.3942	253860.8096
	Length:	754.1689	Course: N 45-07-27.00 W			
PI	30+003.5310				4812249.5152	253326.3772
	Length:	975.7233	Course: S 88-04-01.20 W			
	Delta:	46-48-31.80				
		Tangent Data				
	29+249.3621				4811717.3942	253860.8096
	29+759.3920				4812077.2574	253499.3833
	Length:	510.0299	Course: N 45-07-27.00 W			
		Spiral Curve Data: CLOTHOID				
TS	29+759.3920				4812077.2574	253499.3833
SPI					4812123.3835	253453.0568
SC	29+857.3920				4812143.8031	253427.5114
	Length:	98.0000	L Tan:	65.3740		
	Radius:	-450.0000	S Tan:	32.7036		
	Theta:	6-14-19.95	P:	0.8889		
	X:	97.8839	K:	48.9806		
	Y:	3.5540	A:	210.0000		
	Chord:	97.9484	Course: N 47-12-12.90 W			
		Circular Curve Data C 20				
SC	29+857.3920				4812143.8031	253427.5114
RP					4811792.3001	253146.5388
CS	30+127.0278				4812241.0299	253180.3253
	Delta:	34-19-51.90	Type:	LEFT		
	Radius:	450.0000	DOC:	12-43-56.62		
	Length:	269.6357	Tangent:	139.0018		
	Mid-Ord:	20.0448	External:	20.9793		
	Chord:	265.6201	Course: N 68-31-42.90 W			
		Spiral Curve Data: CLOTHOID				
SC	30+127.0278				4812241.0299	253180.3253
SPI					4812243.4853	253147.7140
ST	30+225.0278				4812241.2802	253082.3772
	Length:	98.0000	L Tan:	65.3740		
	Radius:	450.0000	S Tan:	32.7036		
	Theta:	6-14-19.95	P:	0.8889		
	X:	97.8839	K:	48.9806		
	Y:	3.5540	A:	210.0000		
	Chord:	97.9484	Course: N 89-51-12.90 W			
PI	30+956.6121				4812216.6033	252351.2092
	Length:	980.2194	Course: N 87-59-05.05 W			
	Delta:	3-56-53.75				
		Tangent Data				
	30+225.0278				4812241.2802	253082.3772
	30+818.7372				4812221.2539	252489.0056

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	Length:	593.7094	Course: S 88-04-01.20 W			
		Circular Curve Data C 21				
PC	30+818.7372				4812221.2539	252489.0056
RP					4816218.9778	252354.0825
PT	31+094.3779				4812221.4518	252213.4195
	Delta:	03-56-53.75	Type:	RIGHT		
	Radius:	4000.0000	DOC:	01-25-56.62		
	Length:	275.6407	Tangent:	137.8749		
	Mid-Ord:	2.3741	External:	2.3755		
	Chord:	275.5862	Course: N 89-57-31.92 W			
PI	31+936.7223				4812251.0734	251371.5961
	Length:	393.9275	Course: N 87-59-05.05 W			
	Delta:	0-00-00.00				
		Tangent Data				
	31+094.3779				4812221.4518	252213.4195
	31+936.7223				4812251.0734	251371.5961
	Length:	842.3444	Course: N 87-59-05.05 W			
PI	32+330.6499				4812264.9262	250977.9122
	Length:	284.8700	Course: S 79-24-37.01 W			
	Delta:	12-36-17.94				
		Tangent Data				
	31+936.7223				4812251.0734	251371.5961
	32+070.2018				4812255.7673	251238.1991
	Length:	133.4795	Course: N 87-59-05.05 W			
		Spiral Curve Data: CLOTHOID				
TS	32+070.2018				4812255.7673	251238.1991
SPI					4812257.6430	251184.8933
SC	32+150.2084				4812258.0477	251158.2265
	Length:	80.0065	L Tan:	53.3388		
	Radius:	-2000.0000	S Tan:	26.6699		
	Theta:	1-08-45.63	P:	0.1334		
	X:	80.0033	K:	40.0027		
	Y:	0.5334	A:	400.0163		
	Chord:	80.0051	Course: N 88-22-00.26 W			
		Circular Curve Data C 22				
SC	32+150.2084				4812258.0477	251158.2265
RP					4810258.2778	251127.8850
CS	32+525.9264				4812228.5308	250784.2237
	Delta:	10-45-48.70	Type:	LEFT		
	Radius:	2000.0000	DOC:	02-51-53.24		
	Length:	375.7180	Tangent:	188.4134		
	Mid-Ord:	8.8163	External:	8.8553		
	Chord:	375.1658	Course: S 85-29-14.97 W			
		Compound Spiral Curve Data				
CS	32+525.9264				4812228.5308	250784.2237

SPI			481222. 9769	250769.5819
ST	32+560.6059		4812222.3351	250750.1024

PI	32+613.7188		4812212.5742	250697.8940
	Length:	53.1129	Course: S 78-11-35.04 W	
	Delta:	1-13-01.97		

Circular Curve Data C 23

PC	32+560.6059		4812222.3351	250750.1024
RP			4807307.4934	251668.9773
PT	32+666.8278		4812201.7065	250645.9048
	Delta:	01-13-01.97	Type:	LEFT
	Radius:	5000.0000	DOC:	01-08-45.30
	Length:	106.2219	Tangent:	53.1129
	Mid-Ord:	0.2821	External:	0.2821
	Chord:	106.2199	Course:	S 78-48-06.02 W

PI	32+666.8278		4812201.7065	250645.9048
	Length:	153.4366	Course: S 78-11-35.24 W	
	Delta:	0-00-00.20		

PI	32+820.2644		4812170.3113	250495.7145
	Length:	43.9319	Course: S 78-11-35.37 W	
	Delta:	0-00-00.12		

Tangent Data

	32+666.8278		4812201.7065	250645.9048
	32+820.2644		4812170.3113	250495.7145
	Length:	153.4366	Course: S 78-11-35.24 W	

PI	32+864.1963		4812161.3223	250452.7120
	Length:	87.7715	Course: S 87-09-42.71 W	
	Delta:	8-58-07.34		

Spiral Curve Data: CLOTHOID

SC	32+820.2644		4812170.3113	250495.7145
SPI			4812161.3223	250452.7120
ST	32+951.7525		4812156.9763	250365.0482
	Length:	131.4881	L Tan:	87.7715
	Radius:	-420.0000	S Tan:	43.9319
	Theta:	8-58-07.34	P:	1.7137
	X:	131.1663	K:	65.6904
	Y:	6.8488	A:	235.0000
	Chord:	131.3450	Course:	S 84-10-22.50 W

PI	32+951.7525		4812156.9763	250365.0482
	Length:	261.7480	Course: S 87-09-42.30 W	
	Delta:	0-00-00.41		

PI	33+213.5005		4812144.0155	250103.6212
	Length:	290.1830	Course: N 29-09-12.36 W	
	Delta:	63-41-05.34		

Circular Curve Data C 24

PC	32+951.7525		4812156.9763	250365.0482
RP			4812576.4611	250344.2512
CS	33+369.2911		4812330.3139	250003.9403
	Delta:	56-57-36.00	Type:	RIGHT
	Radius:	420.0000	DOC:	13-38-30.67
	Length:	417.5386	Tangent:	227.8516
	Mid-Ord:	50.8269	External:	57.8246
	Chord:	400.5557	Course:	N 64-21-29.70 W

Compound Spiral Curve Data

CS	33+369.2911		4812330.3139	250003.9403
SPI			4812355.9299	249985.4122
ST	33+448.3499		4812397.4376	249962.2586

PI	33+448.3499		4812397.4376	249962.2586
	Length:	196.4342	Course: N 29-09-12.70 W	
	Delta:	0-00-00.34		

PI	33+644.7841		4812568.9870	249866.5654
	Length:	231.3585	Course: N 16-00-29.57 W	
	Delta:	13-08-43.13		

Circular Curve Data C 25

PC	33+448.3499		4812397.4376	249962.2586
RP			4813225.5951	251446.8983
CS	33+802.3498		4812722.2529	249823.1229
	Delta:	11-55-51.60	Type:	RIGHT
	Radius:	1700.0000	DOC:	03-22-13.22
	Length:	353.9999	Tangent:	177.6423
	Mid-Ord:	9.2061	External:	9.2562
	Chord:	353.3607	Course:	N 23-11-16.90 W

Spiral Curve Data: CLOTHOID

SC	33+802.3498		4812722.2529	249823.1229
SPI			481274. 1965	249816.0108
ST	33+874.4086		4812791.3739	249802.7625
	Length:	72.0588	L Tan:	48.0403
	Radius:	-1700.0000	S Tan:	24.0206
	Theta:	1-12-51.53	P:	0.1273
	X:	72.0556	K:	36.0289
	Y:	0.5090	A:	349.9999
	Chord:	72.0574	Course:	N 16-24-46.74 W

PI	33+874.4086		4812791.3739	249802.7625

HIGHWAY 6 (SOUTHBOUND) - PARALLEL TO HIGHWAY 401

Desc.	Station	Spiral/Curve Data			Northing	Easting
PI	49+249.3621				4811708.5363	253851.9899
	Length:	169.1310	Course: N 45-07-27.00 W			
PI	49+418.4931				4811827.8705	253732.1374
	Length:	458.1222	Course: N 50-32-38.66 W			
	Delta:	5-25-11.66				
		Tangent Data				
	49+249.3621				4811708.5363	253851.9899
	49+293.1988				4811739.4663	253820.9256
	Length:	43.8367	Course: N 45-07-27.00 W			
		Spiral Curve Data: CLOTHOID				
TS	49+293.1988				4811739.4663	253820.9256
SPI					4811768.2775	253791.9892
SC	49+354.4488				4811782.4600	253777.3020
	Length:	61.2500	L Tan:	40.8338		
	Radius:	-2000.0000	S Tan:	20.4171		
	Theta:	0-52-38.43	P:	0.0782		
	X:	61.2486	K:	30.6248		
	Y:	0.3126	A:	350.0000		
	Chord:	61.2494	Course: N 45-24-59.81 W			
		Circular Curve Data C 50				
SC	49+354.4488				4811782.4600	253777.3020
RP					4810343.7439	252388.0231
CS	49+482.3893				4811868.3292	253682.4881
	Delta:	03-39-54.80	Type:	LEFT		
	Radius:	2000.0000	DOC:	02-51-53.24		
	Length:	127.9404	Tangent:	63.9920		
	Mid-Ord:	1.0230	External:	1.0235		
	Chord:	127.9186	Course: N 47-50-02.83 W			
		Spiral Curve Data: CLOTHOID				
SC	49+482.3893				4811868.3292	253682.4881
SPI					4811881.5438	253666.9243
ST	49+543.6393				4811907.4930	253635.3959
	Length:	61.2500	L Tan:	40.8338		
	Radius:	2000.0000	S Tan:	20.4171		
	Theta:	0-52-38.43	P:	0.0782		
	X:	61.2486	K:	30.6248		
	Y:	0.3126	A:	350.0000		
	Chord:	61.2494	Course: N 50-15-05.86 W			
PI	49+876.4671				4812119.0000	253378.4150
	Length:	963.0832	Course: N 90-00-00.00 W			
	Delta:	39-27-21.34				
		Tangent Data				
	49+543.6393				4811907.4930	253635.3959
	49+665.7966				4811985.1221	253541.0766

	Length:	122.1573	Course: N 50-32-38.66 W			
		Spiral Curve Data: CLOTHOID				
TS	49+665.7966				4811985.1221	253541.0766
SPI					4812026.6663	253490.6005
SC	49+763.7966				4812044.5817	253463.2406
	Length:	98.0000	L Tan:	65.3740		
	Radius:	-450.0000	S Tan:	32.7036		
	Theta:	6-14-19.95	P:	0.8889		
	X:	97.8839	K:	48.9806		
	Y:	3.5540	A:	210.0000		
	Chord:	97.9484	Course: N 52-37-24.56 W			
		Circular Curve Data C 51				
SC	49+763.7966				4812044.5817	253463.2406
RP					4811668.1111	253216.7251
CS	49+975.6827				4812115.4460	253265.6283
	Delta:	26-58-41.44	Type:	LEFT		
	Radius:	450.0000	DOC:	12-43-56.62		
	Length:	211.8861	Tangent:	107.9448		
	Mid-Ord:	12.4135	External:	12.7657		
	Chord:	209.9342	Course: N 70-16-19.33 W			
		Spiral Curve Data: CLOTHOID				
SC	49+975.6827				4812115.4460	253265.6283
SPI					4812119.0000	253233.1184
ST	50+073.6827				4812119.0000	253167.7445
	Length:	98.0000	L Tan:	65.3740		
	Radius:	450.0000	S Tan:	32.7036		
	Theta:	6-14-19.95	P:	0.8889		
	X:	97.8839	K:	48.9806		
	Y:	3.5540	A:	210.0000		
	Chord:	97.9484	Course: N 87-55-14.10 W			
PI	50+826.0954				4812119.0000	252415.3318
	Length:	437.6019	Course: N 85-39-18.31 W			
	Delta:	4-20-41.69				
		Tangent Data				
	50+073.6827				4812119.0000	253167.7445
	50+693.3239				4812119.0000	252548.1033
	Length:	619.6412	Course: N 90-00-00.00 W			
		Circular Curve Data C 52				
PC	50+693.3239				4812119.0000	252548.1033
RP					4815619.0000	252548.1033
PT	50+958.7396				4812129.0588	252282.9419
	Delta:	04-20-41.69	Type:	RIGHT		
	Radius:	3500.0000	DOC:	01-38-13.28		
	Length:	265.4157	Tangent:	132.7715		
	Mid-Ord:	2.5156	External:	2.5174		
	Chord:	265.3521	Course: N 87-49-39.15 W			

PI	51+263.5700			481215 1529	251978.9875
	Length:	780.3473	Course:	N 87-59-05.05 W	
	Delta:	2-19-46.74			

Tangent Data

	50+958.7396			4812129.0588	252282.9419
	51+121.2402			4812141.3699	252120.9083
	Length:	162.5006	Course:	N 85-39-18.31 W	

Circular Curve Data C 53

PC	51+121.2402			4812141.3699	252120.9083
RP				4805161.4876	251590.5856
PT	51+405.8607			4812157.1580	251836.7457
	Delta:	02-19-46.74	Type:	LEFT	
	Radius:	7000.0000	DOC:	00-49-06.64	
	Length:	284.6205	Tangent:	142.3298	
	Mid-Ord:	1.4465	External:	1.4468	
	Chord:	284.6009	Course:	N 86-49-11.68 W	

PI	52+043.8781			4812179.5944	251199.1229
	Length:	316.5243	Course:	S 88-25-40.55 W	
	Delta:	3-35-14.39			

Tangent Data

	51+405.8607			4812157.1580	251836.7457
	51+887.3001			4812174.0882	251355.6041
	Length:	481.4394	Course:	N 87-59-05.05 W	

Circular Curve Data C 54

PC	51+887.3001			4812174.0882	251355.6041
RP				4807177.1807	251179.7754
PT	52+200.3538			4812175.2988	251042.6038
	Delta:	03-35-14.39	Type:	LEFT	
	Radius:	5000.0000	DOC:	01-08-45.30	
	Length:	313.0538	Tangent:	156.5780	
	Mid-Ord:	2.4499	External:	2.4511	
	Chord:	313.0026	Course:	N 89-46-42.25 W	

PI	52+360.3001			4812170.9108	250882.7177
	Length:	171.2640	Course:	S 68-48-40.04 W	
	Delta:	19-37-00.51			

Compound Spiral Curve Data

TS	52+200.3538			4812175.2988	251042.6038
SPI				4812174.0875	250998.4700
SC	52+271.1869			4812171.9076	250971.8610

Circular Curve Data C 55

SC	52+271.1869			4812171.9076	250971.8610
RP				4811424.4119	251033.1001
CS	52+445.5746			4812137.6809	250801.2654

	Delta:	13-19-20.08	Type:	LEFT	
	Radius:	750.0000	DOC:	07-38-21.97	
	Length:	174.3878	Tangent:	87.5889	
	Mid-Ord:	5.0628	External:	5.0972	
	Chord:	173.9952	Course:	S 78-39-19.24 W	

Spiral Curve Data: CLOTHOID

SC	52+445.5746			4812137.6809	250801.2654
SPI				4812129.0919	250774.8403
ST	52+528.9080			4812109.0085	250723.0322
	Length:	83.3333	L Tan:	55.5645	
	Radius:	750.0000	S Tan:	27.7859	
	Theta:	3-10-59.16	P:	0.3858	
	X:	83.3076	K:	41.6624	
	Y:	1.5429	A:	250.0000	
	Chord:	83.3219	Course:	S 69-52-19.66 W	

PI	52+528.9080			4812109.0085	250723.0322
	Length:	725.5792	Course:	S 68-48-40.00 W	
	Delta:	0-00-00.04			

PI	53+254.4872			4811846.7524	250046.5065
	Length:	1011.2412	Course:	N 16-00-30.00 W	
	Delta:	95-10-50.00			

Tangent Data

	52+528.9080			4812109.0085	250723.0322
	52+544.7323			4812103.2889	250708.2777
	Length:	15.8243	Course:	S 68-48-40.00 W	

Spiral Curve Data: CLOTHOID

TS	52+544.7323			4812103.2889	250708.2777
SPI				4812078.1787	250643.5026
SC	52+648.8989			4812068.4756	250610.1377
	Length:	104.1667	L Tan:	69.4719	
	Radius:	600.0000	S Tan:	34.7472	
	Theta:	4-58-24.93	P:	0.7533	
	X:	104.0882	K:	52.0703	
	Y:	3.0125	A:	250.0000	
	Chord:	104.1318	Course:	S 70-28-07.93 W	

Circular Curve Data C 56

SC	52+648.8989			4812068.4756	250610.1377
RP				4812644.6071	250442.5892
CS	53+541.4607			4812429.7631	249882.3731
	Delta:	85-14-00.14	Type:	RIGHT	
	Radius:	600.0000	DOC:	09-32-57.47	
	Length:	892.5618	Tangent:	552.0509	
	Mid-Ord:	158.4600	External:	215.3282	
	Chord:	812.5084	Course:	N 63-35-55.00 W	

Spiral Curve Data: CLOTHOID

SC	53+541.4607			4812429.7631	249882.3731

SPI				481246 2063	249869.9311
ST	53+645.6274			4812528.9842	249850.7723
	Length:	104.1667	L Tan:	69.4719	
	Radius:	-600.0000	S Tan:	34.7472	
	Theta:	4-58-24.93	P:	0.7533	
	X:	104.0882	K:	52.0703	
	Y:	3.0125	A:	250.0000	
	Chord:	104.1318	Course:	N 17-39-57.93 W	

PI	53+947.1136			4812818.7792	249767.6293

Tangent Data

	53+645.6274			4812528.9842	249850.7723
	53+947.1136			4812818.7792	249767.6293
	Length:	301.4862	Course:	N 16-00-30.00 W	

HIGHWAY 401 TO HIGHWAY 6 (HANLON) W-N RAMP

Desc.	Station	Spiral/Curve Data			Northing	Easting
PI	10+000				4811990.9128	250009.0217
	Length:	118.6715	Course: N 15-30-33.60 W			
PI	10+118.6715				4812105.2632	249977.2895
	Length:	258.6993	Course: N 06-20-52.99 W			
	Delta:	9-09-40.62				
		Tangent Data				
	10+000				4811990.9128	250009.0217
	10+026.4820				4812016.4306	250001.9405
	Length:	26.4820	Course: N 15-30-33.60 W			
		Spiral Curve Data: CLOTHOID				
TS	10+026.4820				4812016.4306	250001.9405
SPI					4812073.0841	249986.2192
SC	10+114.6487				4812101.9182	249980.4577
	Length:	88.1667	L Tan:	58.7944		
	Radius:	600.0000	S Tan:	29.4040		
	Theta:	4-12-34.74	P:	0.5397		
	X:	88.1191	K:	44.0754		
	Y:	2.1584	A:	230.0000		
	Chord:	88.1455	Course: N 14-06-22.26 W			
		Circular Curve Data C 30				
SC	10+114.6487				4812101.9182	249980.4577
RP					4812219.4826	250568.8272
CS	10+122.4187				4812109.5472	249978.9846
	Delta:	00-44-31.14	Type:	RIGHT		
	Radius:	600.0000	DOC:	09-32-57.47		
	Length:	7.7700	Tangent:	3.8851		
	Mid-Ord:	0.0126	External:	0.0126		
	Chord:	7.7700	Course: N 10-55-43.30 W			
		Spiral Curve Data: CLOTHOID				
SC	10+122.4187				4812109.5472	249978.9846
SPI					4812138.4535	249973.5971
ST	10+210.5854				4812196.8874	249967.0963
	Length:	88.1667	L Tan:	58.7944		
	Radius:	-600.0000	S Tan:	29.4040		
	Theta:	4-12-34.74	P:	0.5397		
	X:	88.1191	K:	44.0754		
	Y:	2.1584	A:	230.0000		
	Chord:	88.1455	Course: N 07-45-04.34 W			
PI	10+377.0952				4812362.3762	249948.6856
	Length:	358.2862	Course: N 20-06-28.84 W			

	Delta:	1 45-35.85				
		Tangent Data				
	10+210.5854				4812196.8874	249967.0963
	10+268.2868				4812254.2349	249960.7164
	Length:	57.7013	Course: N 06-20-52.99 W			
		Spiral Curve Data: CLOTHOID				
TS	10+268.2868				4812254.2349	249960.7164
SPI					4812318.4041	249953.5775
SC	10+365.0868				4812350.0062	249946.9212
	Length:	96.8000	L Tan:	64.5650		
	Radius:	-500.0000	S Tan:	32.2955		
	Theta:	5-32-46.43	P:	0.7806		
	X:	96.7093	K:	48.3849		
	Y:	3.1213	A:	220.0000		
	Chord:	96.7597	Course: N 08-11-47.94 W			
		Circular Curve Data C 31				
SC	10+365.0868				4812350.0062	249946.9212
RP					4812246.9529	249457.6565
CS	10+388.3651				4812372.6648	249941.5950
	Delta:	02-40-02.98	Type:	LEFT		
	Radius:	500.0000	DOC:	11-27-32.96		
	Length:	23.2783	Tangent:	11.6412		
	Mid-Ord:	0.1355	External:	0.1355		
	Chord:	23.2762	Course: N 13-13-40.91 W			
		Spiral Curve Data: CLOTHOID				
SC	10+388.3651				4812372.6648	249941.5950
SPI					4812403.9229	249933.4752
ST	10+485.1651				4812464.5524	249911.2783
	Length:	96.8000	L Tan:	64.5650		
	Radius:	500.0000	S Tan:	32.2955		
	Theta:	5-32-46.43	P:	0.7806		
	X:	96.7093	K:	48.3849		
	Y:	3.1213	A:	220.0000		
	Chord:	96.7597	Course: N 18-15-33.89 W			
PI	10+734.6428				4812698.8235	249825.5101
	Length:	95.2592	Course: N 16-00-30.00 W			
	Delta:	4-05-58.84				
		Tangent Data				
	10+485.1651				4812464.5524	249911.2783
	10+671.8870				4812639.8929	249847.0850
	Length:	186.7219	Course: N 20-06-28.84 W			
		Circular Curve Data C 32				
PC	10+671.8870				4812639.8929	249847.0850
RP					4813225.5950	251446.8983
CS	10+757.7311				4812721.2137	249819.6155
	Delta:	02-53-13.30	Type:	RIGHT		
	Radius:	1703.6577	DOC:	03-21-47.17		
	Length:	85.8441	Tangent:	42.9311		
	Mid-Ord:	0.5407	External:	0.5408		
	Chord:	85.8350	Course: N 18-39-52.19 W			

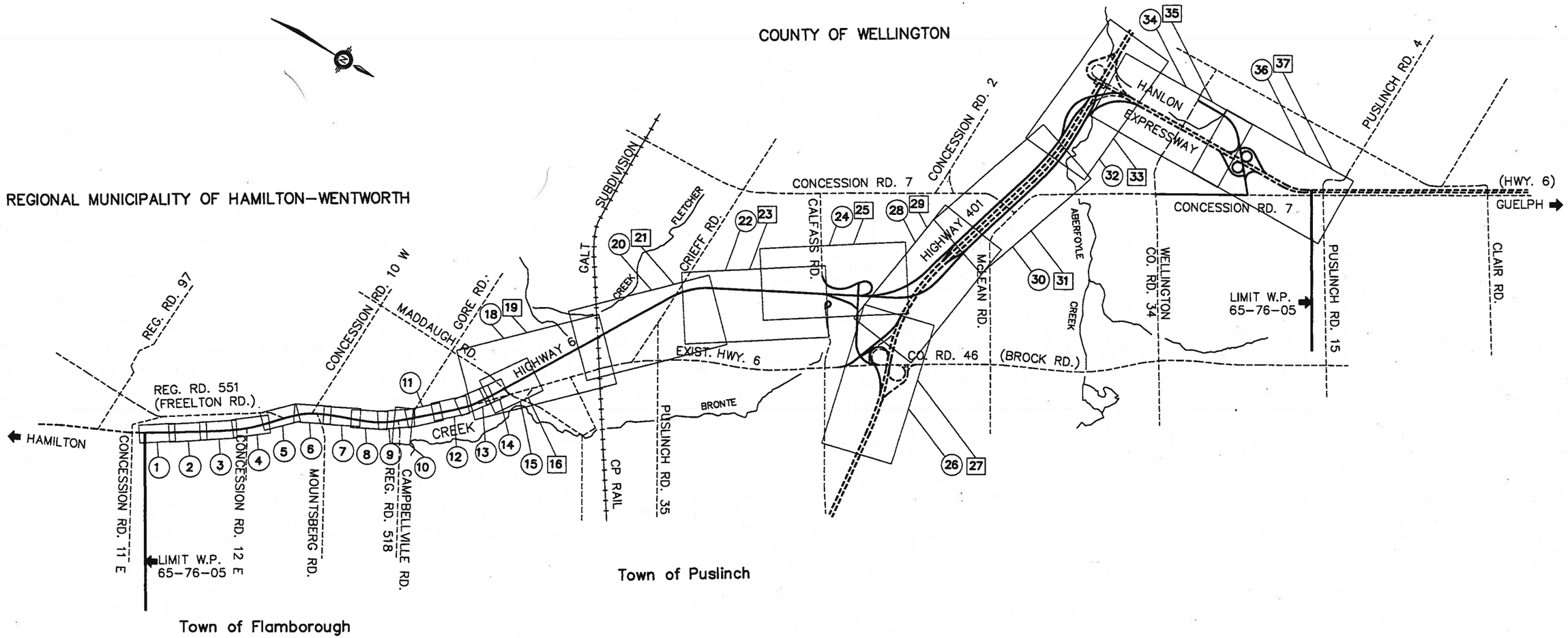
Spiral Curve Data: CLOTHOID

SC	10+757.7311			4812721.37	249819.6155
SPI				4812744.1754	249812.4985
ST	10+829.8460			4812790.3888	249799.2398
	Length:	72.1150	L Tan:	48.0778	
	Radius:	-1703.6577	S Tan:	24.0393	
	Theta:	1-12-45.54	P:	0.1272	
	X:	72.1117	K:	36.0569	
	Y:	0.5087	A:	350.5128	
	Chord:	72.1135	Course:	N 16-24-45.17 W	

PI	10+829.8460	4812790.3888	249799.2398

APPENDIX O

DESIGN PLATES



HIGHWAY 6

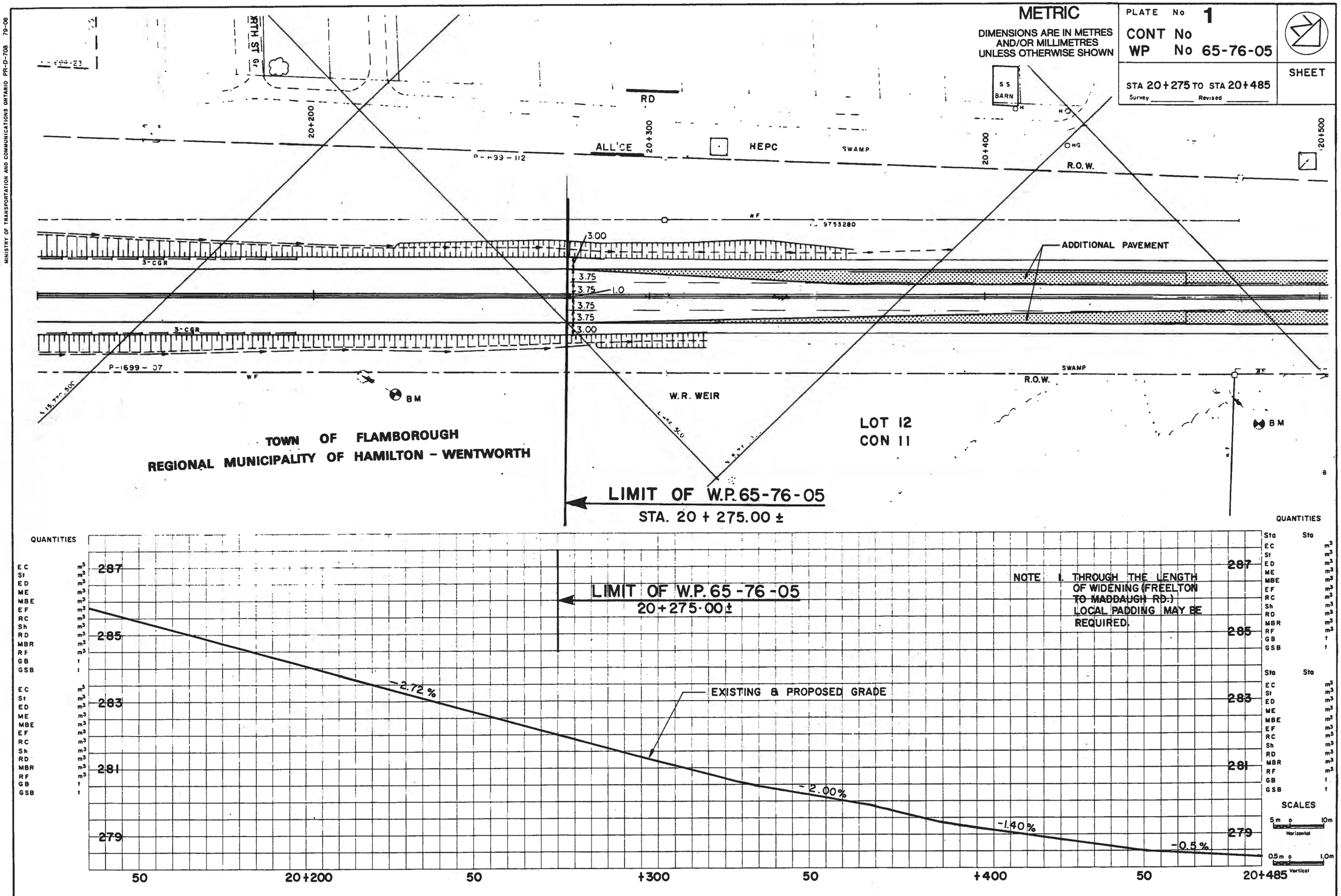
FREELTON TO GUELPH
Environmental Assessment
& Preliminary Design Report

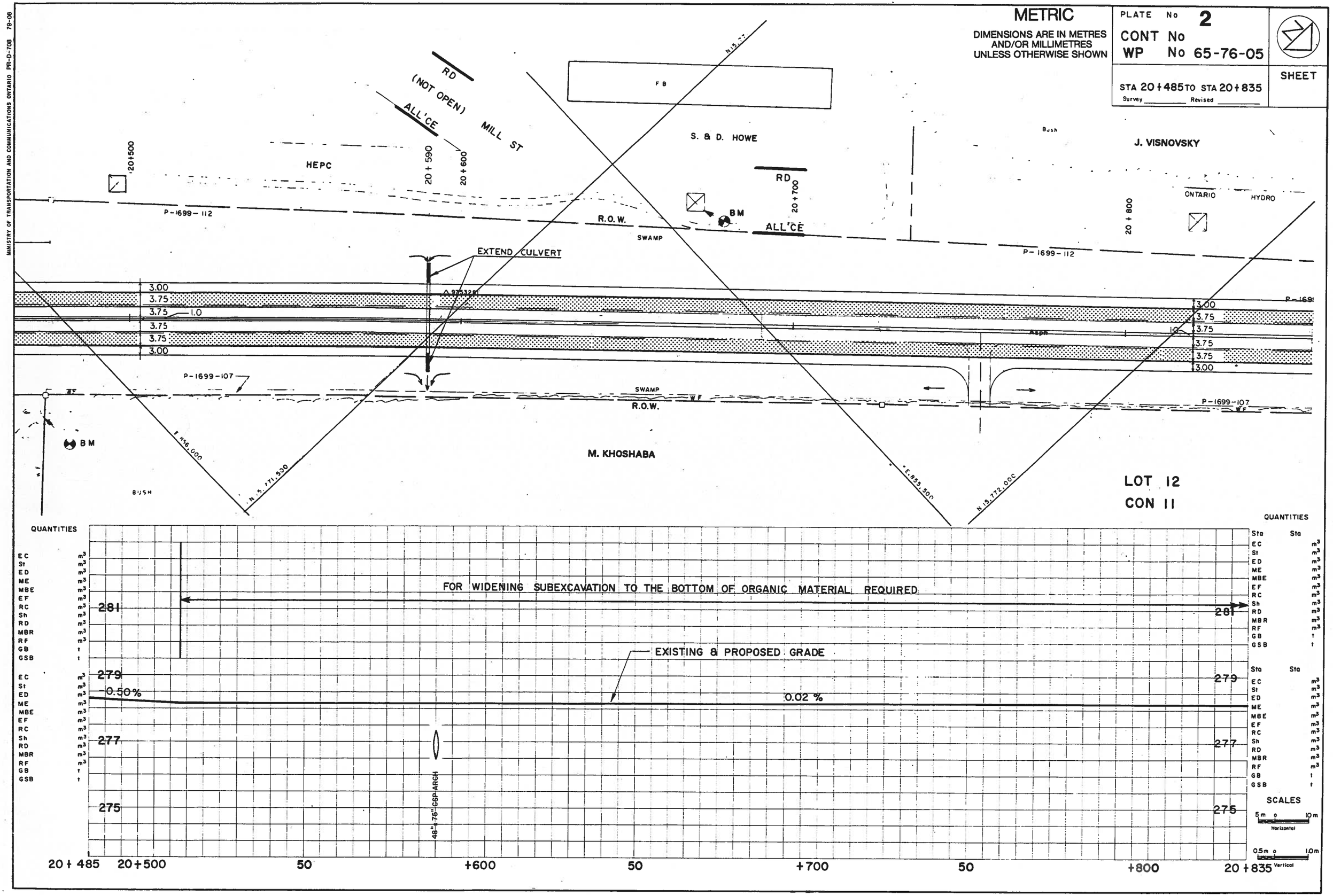
LEGEND:

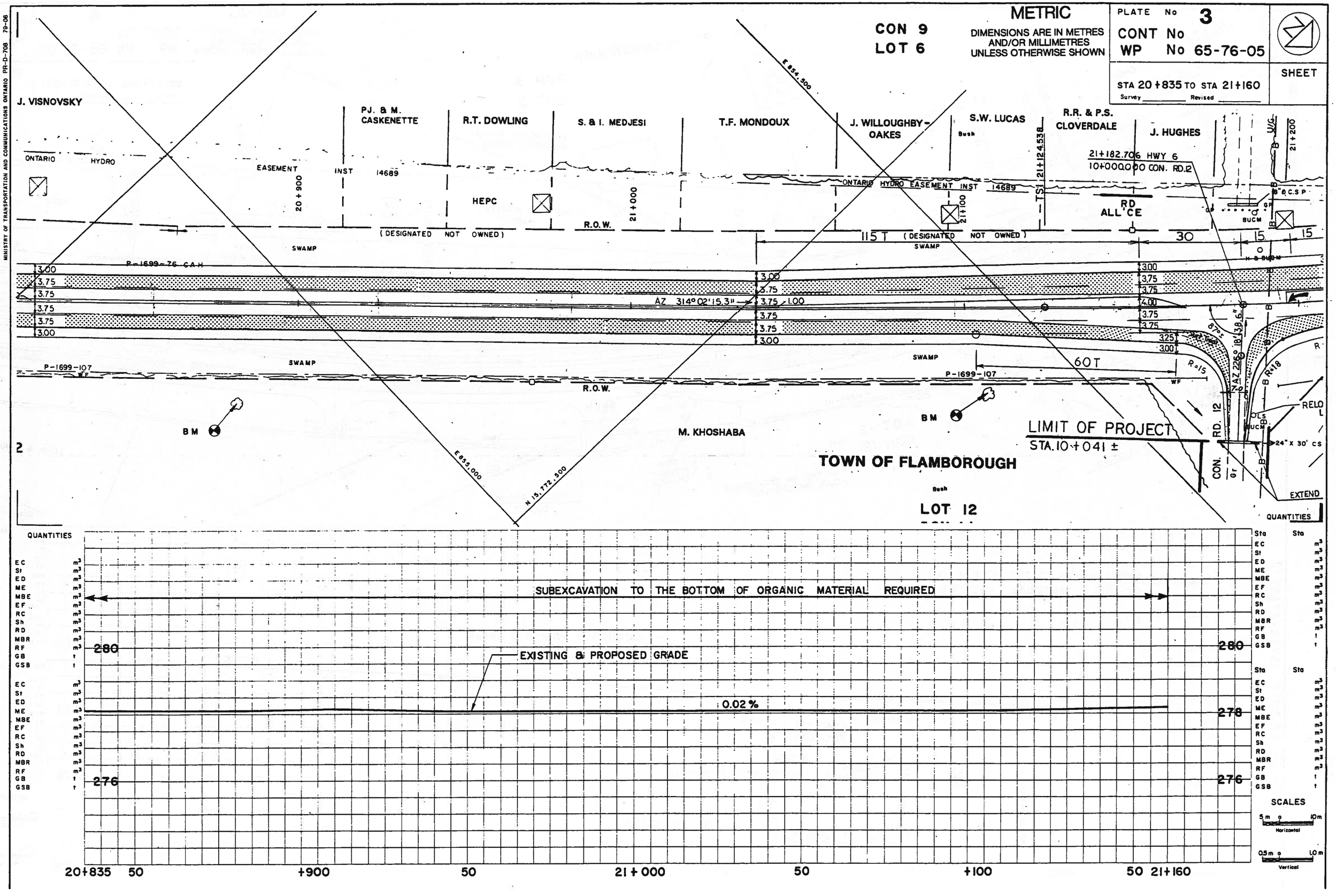
(18) PLAN PLATE LOCATION

[19] PROFILE PLATE LOCATION

KEY PLAN


METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
PLATE No 1
CONT No
WP No 65-76-05
SHEET
STA 20+275 TO STA 20+485
Survey
Revised
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO PR-D-708 79-06
RD
ALL'CE
HEPC
SWAMP
R.O.W.
20+200
20+300
20+400
20+500
3.00
3.75
3.75
1.0
3.75
3.75
3.00
3-CGR
ADDITIONAL PAVEMENT
P-1699-07
BM
W.R. WEIR
LOT 12
CON 11
TOWN OF FLAMBOROUGH
REGIONAL MUNICIPALITY OF HAMILTON - WENTWORTH
LIMIT OF W.P. 65-76-05
STA. 20 + 275.00 ±
QUANTITIES
EC
St
ED
ME
MBE
EF
RC
Sh
RD
MBR
RF
GB
GSB
287
285
283
281
279
LIMIT OF W.P. 65-76-05
20+275.00±
NOTE 1. THROUGH THE LENGTH OF WIDENING (FREELTON TO MADDAUGH RD.) LOCAL PADDING MAY BE REQUIRED.
-2.72 %
EXISTING & PROPOSED GRADE
-2.00%
-1.40%
-0.5%
50
20+200
50
+300
50
+400
50
20+485
SCALES
5m 0 10m
Horizontal
0.5m 0 1.0m
Vertical


METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
PLATE No 2
CONT No
WP No 65-76-05
SHEET
STA 20+485 TO STA 20+835
Survey
Revised
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO PR-D-708 79-08
RD (NOT OPEN)
ALL'CE
MILL ST
HEPC
S. & D. HOWE
J. VISNOVSKY
ONTARIO HYDRO
RD
ALL'CE
BM
R.O.W.
SWAMP
P-1699-112
P-1699-107
EXTEND CULVERT
3.00
3.75
1.0
Asph
M. KHOSHABA
BUSH
LOT 12
CON 11
QUANTITIES
FOR WIDENING SUBEXCAVATION TO THE BOTTOM OF ORGANIC MATERIAL REQUIRED
EXISTING & PROPOSED GRADE
-0.50%
0.02 %
281
279
277
275
48" x 76" CSP ARCH
20+485
20+500
50
+600
50
+700
50
+800
20+835
SCALES
Horizontal
Vertical


METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
PLATE No 3
CONT No
WP No 65-76-05
SHEET
STA 20+835 TO STA 21+160
Survey
Revised
CON 9
LOT 6
J. VISNOVSKY
PJ. & M. CASKENETTE
R.T. DOWLING
S. & I. MEDJESI
T.F. MONDOUX
J. WILLOUGHBY-OAKES
S.W. LUCAS
R.R. & P.S. CLOVERDALE
J. HUGHES
ONTARIO HYDRO EASEMENT INST 14689
HEPC
R.O.W.
(DESIGNATED NOT OWNED)
SWAMP
21+182.706 HWY 6
10+000.000 CON. RD.12
RD ALL'CE
115 T
30
15
P-1699-76 C.A.H.
AZ 314°02'15.3"
60 T
P-1699-107
BM
M. KHOSHABA
LIMIT OF PROJECT
STA.10+041 ±
TOWN OF FLAMBOROUGH
LOT 12
CON. RD. 12
EXTEND
QUANTITIES
SUBEXCAVATION TO THE BOTTOM OF ORGANIC MATERIAL REQUIRED
EXISTING & PROPOSED GRADE
0.02 %
280
278
276
20+835
50
+900
21+000
+100
21+160
SCALES
Horizontal
Vertical
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO PR-D-708 79-06

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO PR-D-708 79-06

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

PLATE No 4
CONT No
WP No 65-76-05
STA 21+160 TO STA 21+510
Survey ____ Revised ____
SHEET

TOWN OF FLAMBOROUGH
CON 9
LOT 5
LOT 12
CON 12

R.R. & P.S. CLOVERDALE
J. HUGHES
21+182.706 HWY 6
10+000.000 CON. RD.12
D.B. SUNSTRUM
WENTWORTH COUNTY EDUCATION BOARD
B SCHOOL
CURVE 1
A = 230
Ls = 92.0
S = 5.4%
N 13,773,000
ONTARIO HYDRO EASEMENT INST 14689
PROPERTY REQUIREMENTS
NEW R.O.W.
R.O.W.
HEPC
LIGHT STANI
TO BE RELO
CABLE GUIDE RAIL TO BE RELOCATED
J.E. & A.J. MUZAN
EXTEND CULVERT
RELOCATE LS
24" x 30' CSP
POND
WATERDOWN SPORTSMENS CLUB INCORPORATED
INSTALL 450 mm CULVERT
ALL'CE RD
CON. RD. 12
P-1699-115
P-1699-110
P-1699-78 CAK
BM 9753283
PI STA. 21+310.6
N 4,807,651.1
E 260,311.2
AZ 226° 18' 38.6"
AZ 286° 40' 40.1"
R=575
R=52
R=18
R=15
WF
R.O.W
Bush
SCI 21+216.538
21+200
21+300
21+400
CS2 21+399.111
ST2 21+491.111
21+500
3.0
30
15
0
15

QUANTITIES

SUBEXCAVATION TO THE BOTTOM OF ORGANIC MATERIAL REQUIRED

℄ CONC. RD. 12

EXISTING & PROPOSED GRADE

+0.25%

+0.47%

℄ HWY 6

LIMIT OF PROJECT

10+041

-4.00% -2.00%

5.00%

K=4

K=4

PROPOSED PROFILE

EXISTING GROUND LINE

PROFILE OF CONC. RD.12

30" x 83' C.S.P.

280
279
278
277
276

10+000

21+160 +200 50 +300 50 +400 50 21+500

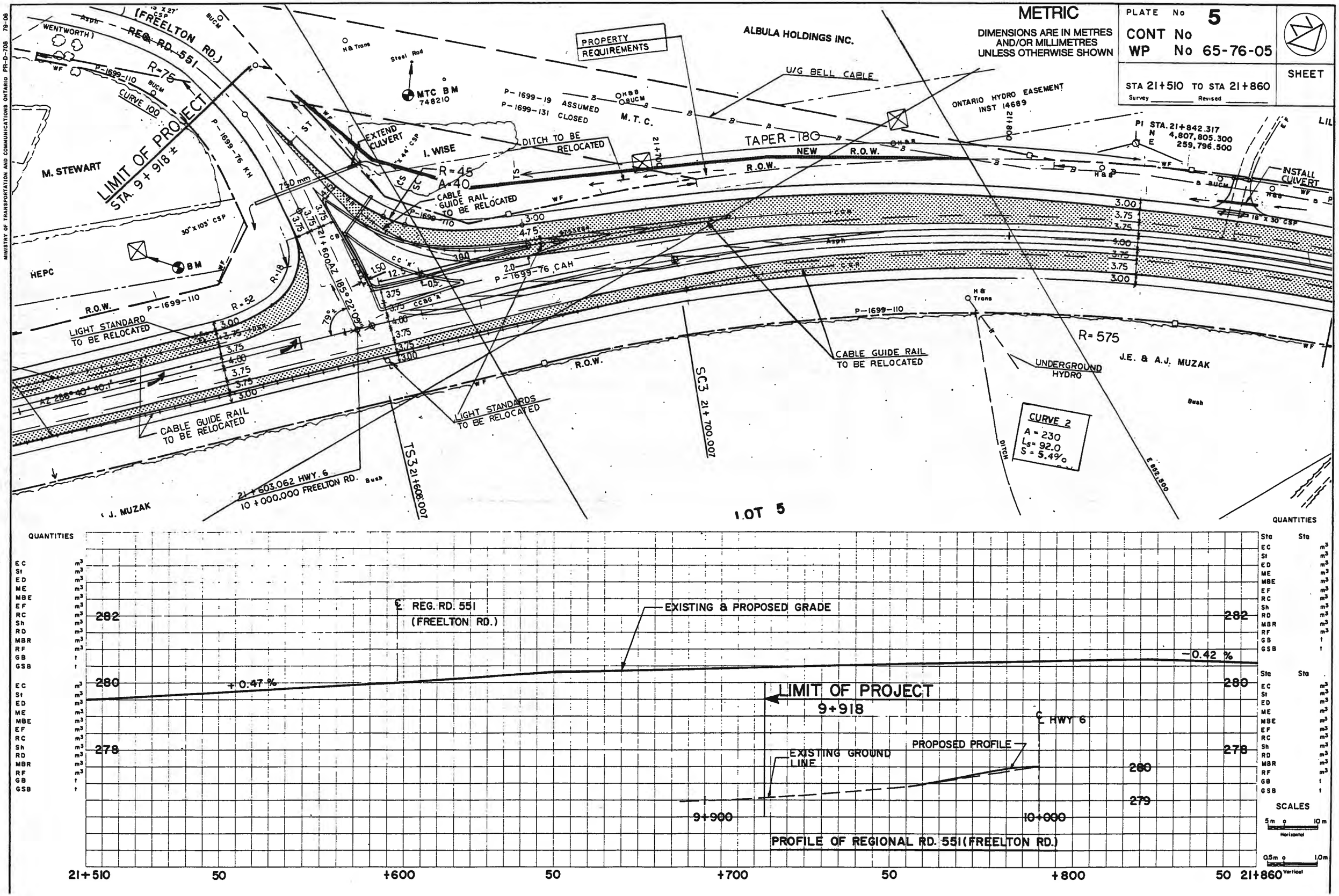
QUANTITIES

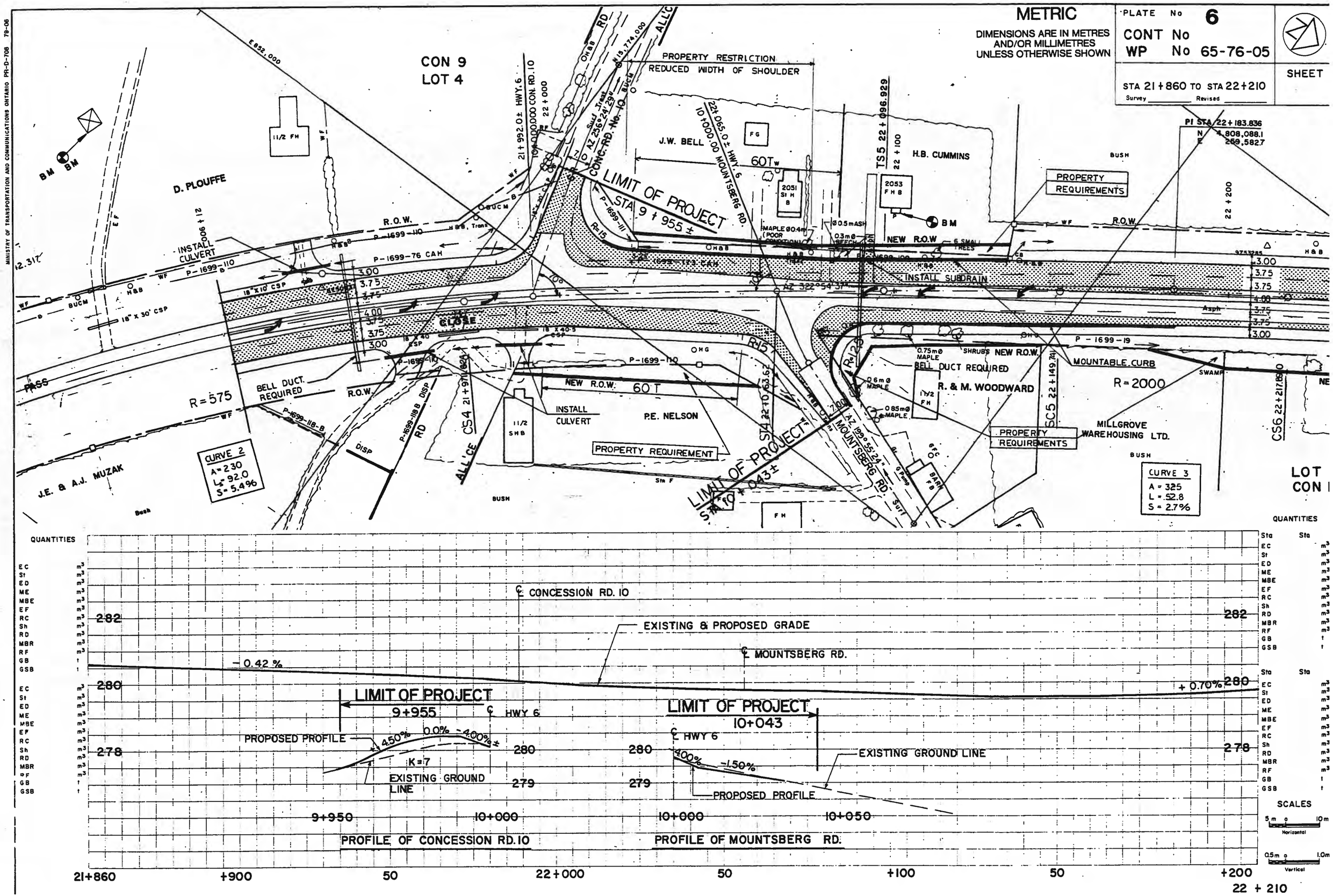
Sta Sta
EC
St
ED
ME
MBE
EF
RC
Sh
RD
MBR
RF
GB
GSB

SCALES

5m 0 10m Horizontal

0.5m 0 1.0 Vertical


METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
PLATE No 5
CONT No
WP No 65-76-05
STA 21+510 TO STA 21+860
SHEET
Survey
Revised
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO PR-D-708 79-06
(FREELTON RD.)
REG. RD. 551
WENTWORTH
R=75
CURVE 100
LIMIT OF PROJECT
STA. 9+918 ±
M. STEWART
HEPC
BM
R.O.W.
P-1699-110
R=52
R=18
LIGHT STANDARD TO BE RELOCATED
CABLE GUIDE RAIL TO BE RELOCATED
AZ 266° 40' 40.1"
21+600 AZ 185° 22' 09"
750 mm
EXTEND CULVERT
I. WISE
MTC BM 748210
Steel Rod
PROPERTY REQUIREMENTS
ALBULA HOLDINGS INC.
U/G BELL CABLE
P-1699-19 ASSUMED
P-1699-131 CLOSED
M.T.C.
DITCH TO BE RELOCATED
R=45
A=40
CABLE GUIDE RAIL TO BE RELOCATED
P-1699-76 CAH
TAPER-180
NEW R.O.W.
ONTARIO HYDRO EASEMENT INST 14689
PI STA. 21+842.317
N 4,807,805.300
E 259,796.500
INSTALL CULVERT
18 x 30 CSP
R=575
J.E. & A.J. MUZAK
UNDERGROUND HYDRO
CABLE GUIDE RAIL TO BE RELOCATED
LIGHT STANDARDS TO BE RELOCATED
SC3 21+700.007
TS3 21+608.007
21+603.062 HWY. 6
10+000.000 FREELTON RD.
J. MUZAK
CURVE 2
A = 230
Ls = 92.0
S = 5.4%
LOT 5
QUANTITIES
EC
St
ED
ME
MBE
EF
RC
Sh
RD
MBR
RF
GB
GSB
℄ REG. RD. 551 (FREELTON RD.)
EXISTING & PROPOSED GRADE
+0.47 %
-0.42 %
LIMIT OF PROJECT
9+918
℄ HWY 6
PROPOSED PROFILE
EXISTING GROUND LINE
282
280
278
279
9+900
10+000
PROFILE OF REGIONAL RD. 551 (FREELTON RD.)
SCALES
Horizontal
Vertical
21+510
50
+600
50
+700
50
+800
50
21+860


METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
PLATE No 6
CONT No
WP No 65-76-05
STA 21+860 TO STA 22+210
SHEET
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO PR-D-708 79-06
CON 9
LOT 4
PROPERTY RESTRICTION
REDUCED WIDTH OF SHOULDER
D. PLOUFFE
J.W. BELL
H.B. CUMMINS
LIMIT OF PROJECT
STA 9+955±
LIMIT OF PROJECT
STA 10+043±
CONC. RD. No. 10
MOUNTSBERG RD.
PROPERTY REQUIREMENTS
INSTALL SUBDRAIN
INSTALL CULVERT
BELL DUCT REQUIRED
R. & M. WOODWARD
MOUNTABLE CURB
MILLGROVE WAREHOUSING LTD.
P.E. NELSON
J.E. & A.J. MUZAK
CURVE 2
A=230
L=92.0
S=5.4%
CURVE 3
A=325
L=52.8
S=2.7%
R=575
R=2000
NEW R.O.W.
60T
PI STA 22+183.836
N 4,808,088.1
E 269,582.7
LOT
CON
QUANTITIES
℄ CONCESSION RD. 10
EXISTING & PROPOSED GRADE
℄ MOUNTSBERG RD.
-0.42 %
+0.70%
LIMIT OF PROJECT
9+955
℄ HWY 6
PROPOSED PROFILE
4.50%
0.0%
-4.00%±
K=7
EXISTING GROUND LINE
LIMIT OF PROJECT
10+043
℄ HWY 6
4.00%
-1.50%
EXISTING GROUND LINE
PROPOSED PROFILE
9+950
10+000
10+000
10+050
PROFILE OF CONCESSION RD.10
PROFILE OF MOUNTSBERG RD.
SCALES
Horizontal
Vertical
21+860
+900
50
22+000
50
+100
50
+200
22 + 210

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO PR-D-708 79-08

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

PLATE No 7
CONT No
WP No 65-76-05

STA 22+210 TO STA 22+560
Survey _____ Revised _____

SHEET

CON 10
LOT 4

N 15,774,500

STA 22+183.836
N 4,808,088.1
E 259,582.7

D.J. MEHLENBACHER

BUSH

22+200 | 22+268 | 22+300 | 22+400 | 22+500

BM

R.O.W.

INSTALL CULVERT

P-1699-II

EXTEND CULVERT

H&B

9753285

3.00
3.75
3.75
4.00
Asph
3.75
3.75
3.00

AZ 326° 29' 32"

SWAMP

NEW R.O.W.

PROPERTY REQUIREMENTS

CS6 22+217.890

ST6 22+270.703

R.E. & N.L. McCARTHY

BUSH

LOT 4
CON 10

E 851.5

18" CSP

18"x40" CSP

P-1699-50

P-1699-III

INSTALL CULVERT

9753286

R.O.W.

HG

D.J. KIRKPATRICK

CON 10
LOT 4

11/2 CSMB FV

D. HOSKINS

MOUNTABLE CURB

P-1699-III

P-1699-18

SWALE

PARKING

SUBDRAIN

AZ 329° 29' 44"

70°

W.T. MONTEITH

11/2 CSBF H&SS 2099

INSTALL CULVERT

Asph

Cls

CC&G

9.0

3.75
3.75
4.00
3.75
3.75
3.00

PI STA. 22+474.182
N 4,808,329.9
E 259,921.9

BUSH

SWAMP

QUANTITIES

EC
St
ED
ME
MBE
EF
RC
Sh
RD
MBR
RF
GB
GSB

EXISTING & PROPOSED GRADE

282

278

+0.70%

-0.50%

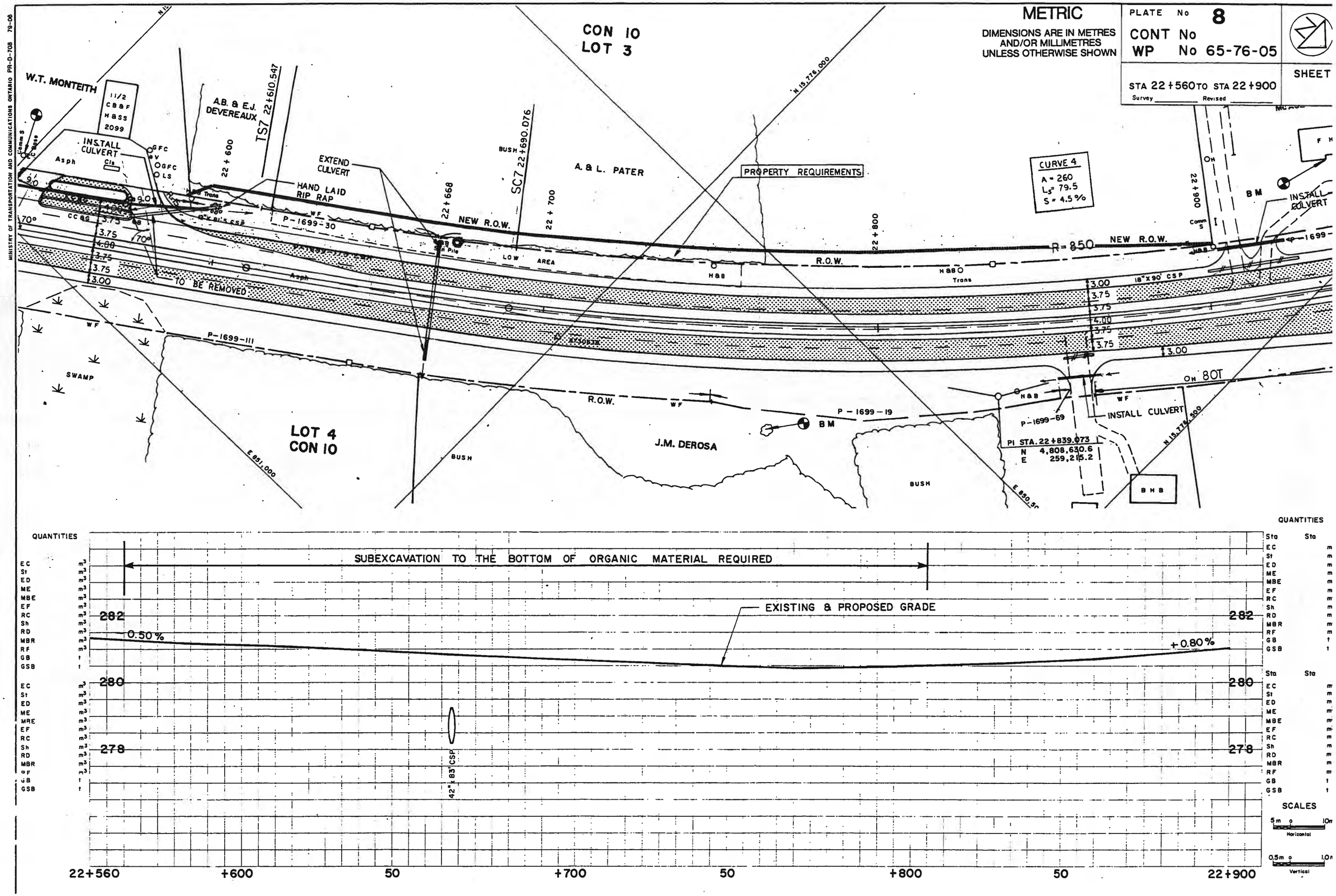
30" ø 81.5' CSP

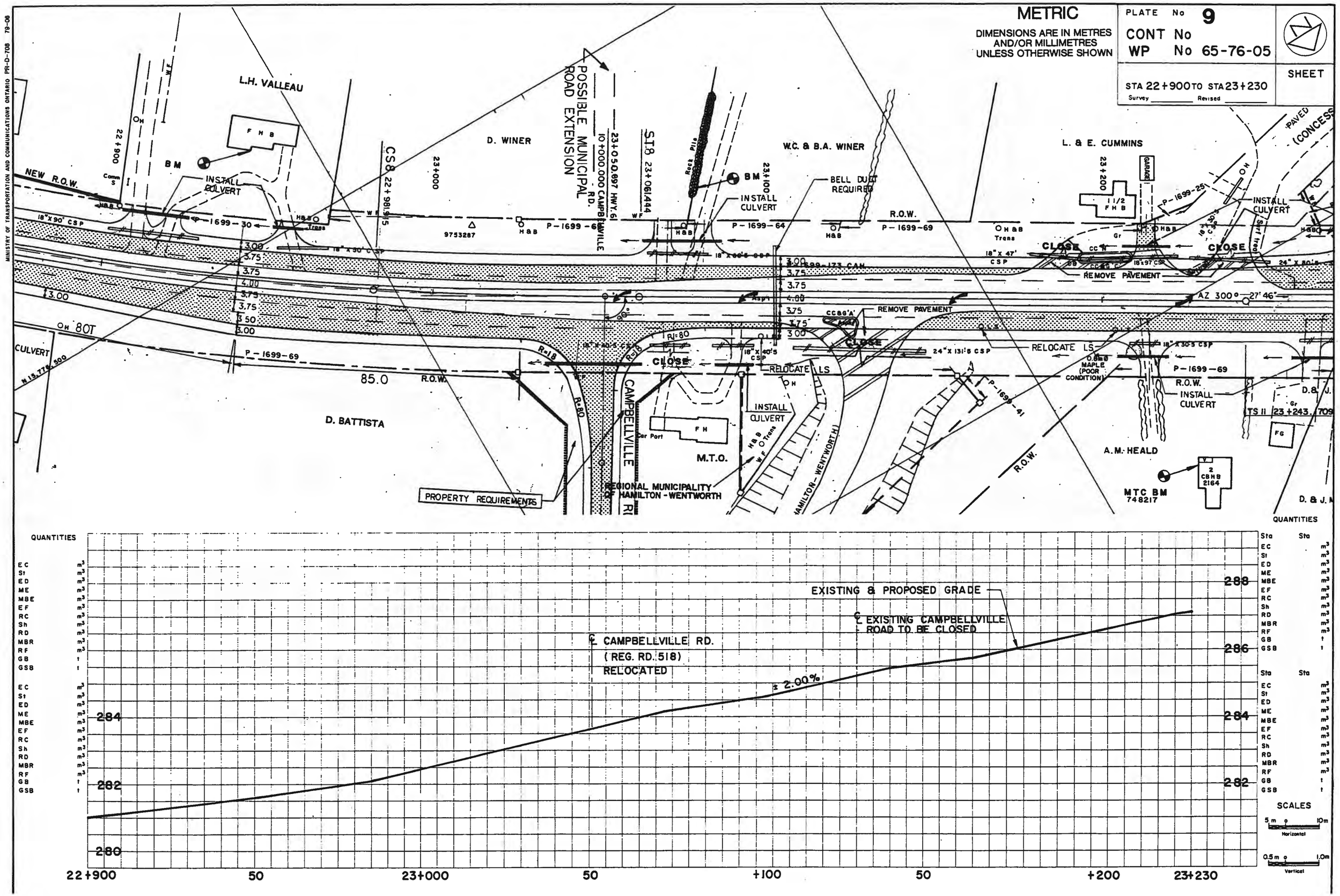
22+210 | 50 | +300 | 50 | +400 | 50 | 22+500 | 50 | 22+560

SCALES

5m 0 10m
Horizontal

0.5m 0 1.0m
Vertical


METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
PLATE No 8
CONT No
WP No 65-76-05
SHEET
STA 22+560 TO STA 22+900
Survey
Revised
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO PR-D-708 79-06
CON 10
LOT 3
W.T. MONTEITH
A.B. & E.J. DEVEREAUX
TS7 22+610.547
SC7 22+690.076
A. & L. PATER
PROPERTY REQUIREMENTS
CURVE 4
A = 260
Ls = 79.5
S = 4.5%
INSTALL CULVERT
EXTEND CULVERT
HAND LAID RIP RAP
NEW R.O.W.
R.O.W.
R=850
TO BE REMOVED
P-1699-30
P-1699-111
P-1699-19
P-1699-69
18"x90' CSP
LOW AREA
SWAMP
LOT 4
CON 10
J.M. DEROSA
BUSH
BM
BHB
PI STA. 22+839.073
N 4,808,630.6
E 259,215.2
N 15,776,000
N 15,776,500
E 851,000
E 850,500
QUANTITIES
SUBEXCAVATION TO THE BOTTOM OF ORGANIC MATERIAL REQUIRED
EXISTING & PROPOSED GRADE
-0.50%
+0.80%
282
280
278
42" x 83' CSP
22+560
+600
50
+700
50
+800
50
22+900
SCALES
Horizontal
Vertical


METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
PLATE No 9
CONT No
WP No 65-76-05
SHEET
STA 22+900 TO STA 23+230
Survey
Revised
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO PR-D-708 79-06
L.H. VALLEAU
D. WINER
W.C. & B.A. WINER
L. & E. CUMMINS
POSSIBLE MUNICIPAL ROAD EXTENSION
10+000.000 CAMPBELLVILLE RD.
23+050.697 HWY. 61
ST8 23+061.444
CS8 22+981.915
NEW R.O.W.
INSTALL CULVERT
BELL DUCT REQUIRED
REMOVE PAVEMENT
RELOCATE LS
CLOSE
CAMPBELLVILLE
D. BATTISTA
M.T.O.
A.M. HEALD
MTC BM 748217
REGIONAL MUNICIPALITY OF HAMILTON - WENTWORTH
PROPERTY REQUIREMENTS
HAMILTON - WENTWORTH
85.0
R.O.W.
QUANTITIES
EXISTING & PROPOSED GRADE
℄ EXISTING CAMPBELLVILLE ROAD TO BE CLOSED
℄ CAMPBELLVILLE RD. (REG. RD. 518) RELOCATED
± 2.00%
288
286
284
282
280
22+900
50
23+000
50
+100
50
+200
23+230
SCALES
Horizontal
Vertical

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO PR-D-708 78-08

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

PLATE No **10**
CONT No
WP No 65-76-05
STA 10+000 TO STA 10+250
Survey _____ Revised _____

SHEET

BELL DUCT REQUIRED
INSTALL CULVERT 23+100
8M
ST 8 STA. 23+061.444
POSSIBLE MUNICIPAL ROAD EXTENSION
HWY 6 STA. 23+050.897
CAMPBELLVILLE RD. STA. 10+000.000
23+000
CS 8 STA. 22+981.915
HIGHWAY 6
CLOSE
RELOCATE LS
INSTALL CULVERT
REGIONAL MUNICIPALITY OF HAMILTON - WENTWORTH
M.T.O.
PROPOSED R.O.W.
RELOCATED CAMPBELLVILLE RD. (REG. RD. 18)
PROPERTY REQUIREMENTS
D. BATTISTA
A. M. HEALD
A. & C. TURNER
E. & B. BROWN
REMOVE PAVEMENT
ACCESS FOR HYDRO MAINTENANCE TRUCKS IF HYDRO POLES NOT RELOCATED.
PI STA. 10+190.500
N 4,808,905.3
E 259,123.9
LIMIT OF PROJECT 10+250
TS 53 STA. 10+131.273
SC 53 STA. 10+181.690
CS 54 STA. 10+198.756
ST 54 STA. 10+249.173
R = 240
A = 110
M. ISHOY
LOT 12
CON 12

QUANTITIES

EC	m³
St	m³
ED	m³
ME	m³
MBE	m³
EF	m³
RC	m³
Sh	m³
RD	m³
MBR	m³
RF	m³
GB	t
GSB	t

℄ HWY 6
286
284
282
280
PROFILE OF POSSIBLE MUNICIPAL ROAD EXTENSION
ORIGINAL GROUND LINE (APPROX)
- 0.40 %
PROPOSED PROFILE
PROPOSED 500 mm CSP
10+000 +50 +100 +150 +200 +250
LIMIT OF PROJECT 10+250
ALONG EXISTING CAMPBELLVILLE ROAD
PROFILE OF RELOCATED CAMPBELLVILLE ROAD

QUANTITIES

	Sta	Sta
EC		m³
St		m³
ED		m³
ME		m³
MBE		m³
EF		m³
RC		m³
Sh		m³
RD		m³
MBR		m³
RF		m³
GB		t
GSB		t

SCALES
5m 0 10m Horizontal
0.5m 0 1.0m Vertical

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO PR-D-709 79-06

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

PLATE No 11
CONT No
WP No 65-76-05
STA 23+230 TO STA 23+580
Survey _____ Revised _____
SHEET

PI STA. 9+927.564
N 4,808,798.1
E 258,787.9

PI STA. 23+360.553
N 4,808,898.1
E 258,760.4

LIMIT OF PROJECT STA 9+886±

BENSON CHEMICALS
S & C B'ldg
F Bldg
Conc Base
Storage Tanks
Gr
Cls

RD No 11
GORE RD.
R=100
CURVE 1
Δ=45.000
NEW R.O.W.
"PAVED AREA" (CONCESSION RD. 11)
R=8
R=15
INSTALL CULVERT
CLOSE
PAVEMENT
AZ 300°-27'-46"
AZ 21°-11'-38"
AZ 310°40'33" Asph
N 15.77

CON II LOT 3
A.E. WRIGHT
T.L. WRIGHT
B.A. REA
A.E. WRIGHT-SHEPHERD

APPROX
PROPERTY REQUIRMENTS
NEW R.O.W.
R.O.W.
Comm S
23+400
23+500
23+266
60T
P-1699-61
P-1699-25
P-1699-69
HBB Trans
10' Cut
3.00
3.75
3.75
4.00
3.75
3.75
3.00
3.25
18"x30' CSP
18"x41' CSP
18"x40' CSP
18"x80.5 CSP
18"x97 CSP
18"x71 CSP
18"x30.5 CSP
24"x80.5 CSP
18"x30' CSP
18"x30 CSP
WF
OH
HBB
BM
RIB
D.B. J. McEDWARD
2170 FNB
2172
23+289.219 HWY 6
10+000.000 GORE RD.
A. MEDEIROS
SC 11 23+320.966
INSTALL CULVERT
R=8.75
11/2 CBHB
CURVE 5
A=260
Ls=77.257
CS 12 23+399.681
R. McEDWARD (ESTATE)
ST 12 23+476.938
F. RUDZICK
E 848,500
LOT 3
CON II LOT 2
ST 15 23+547.828
A.E. WRIGHT
T.L. WRIGHT
B.A. REA
A.E. WRIGHT-SHEPHERD
23+600

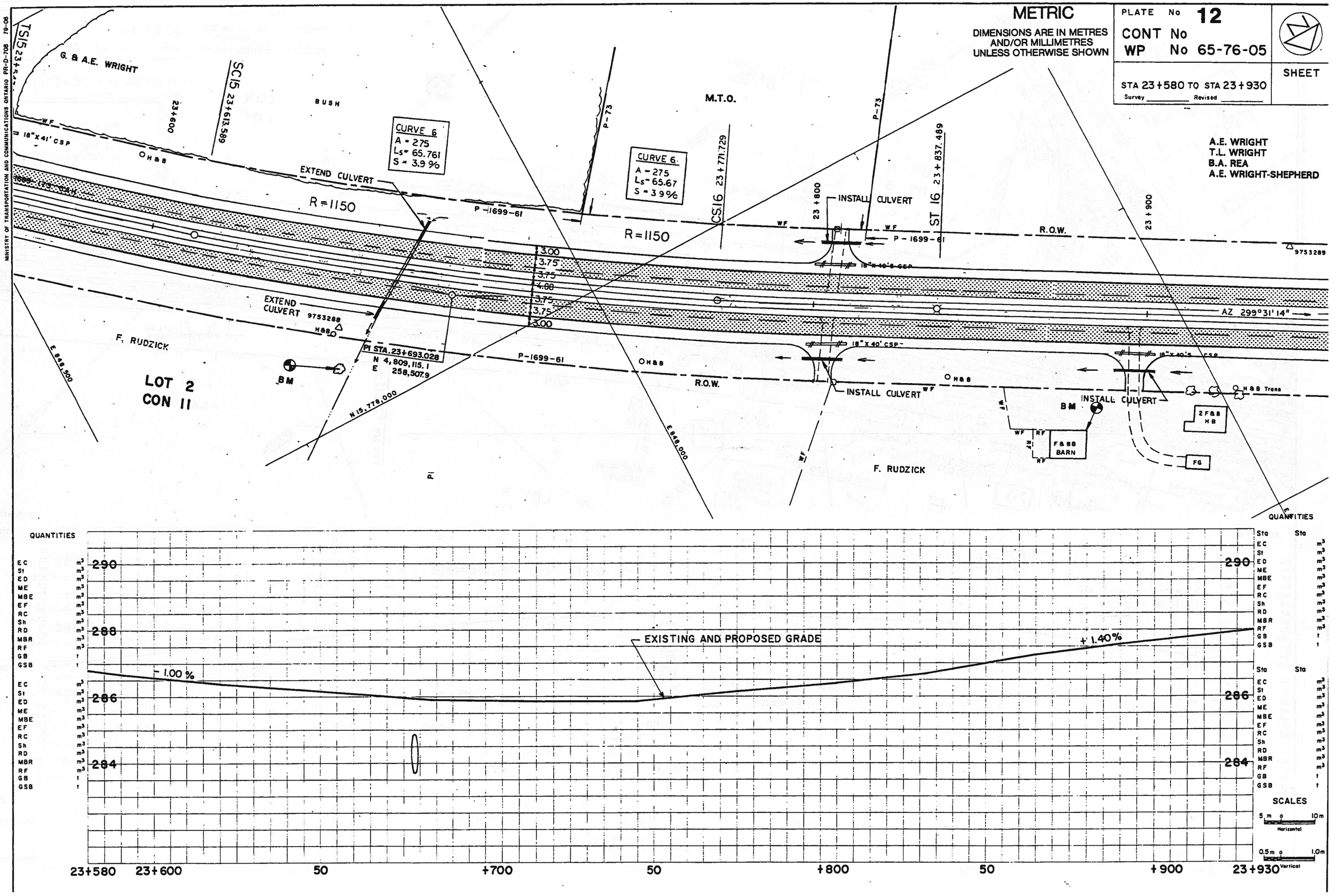
QUANTITIES

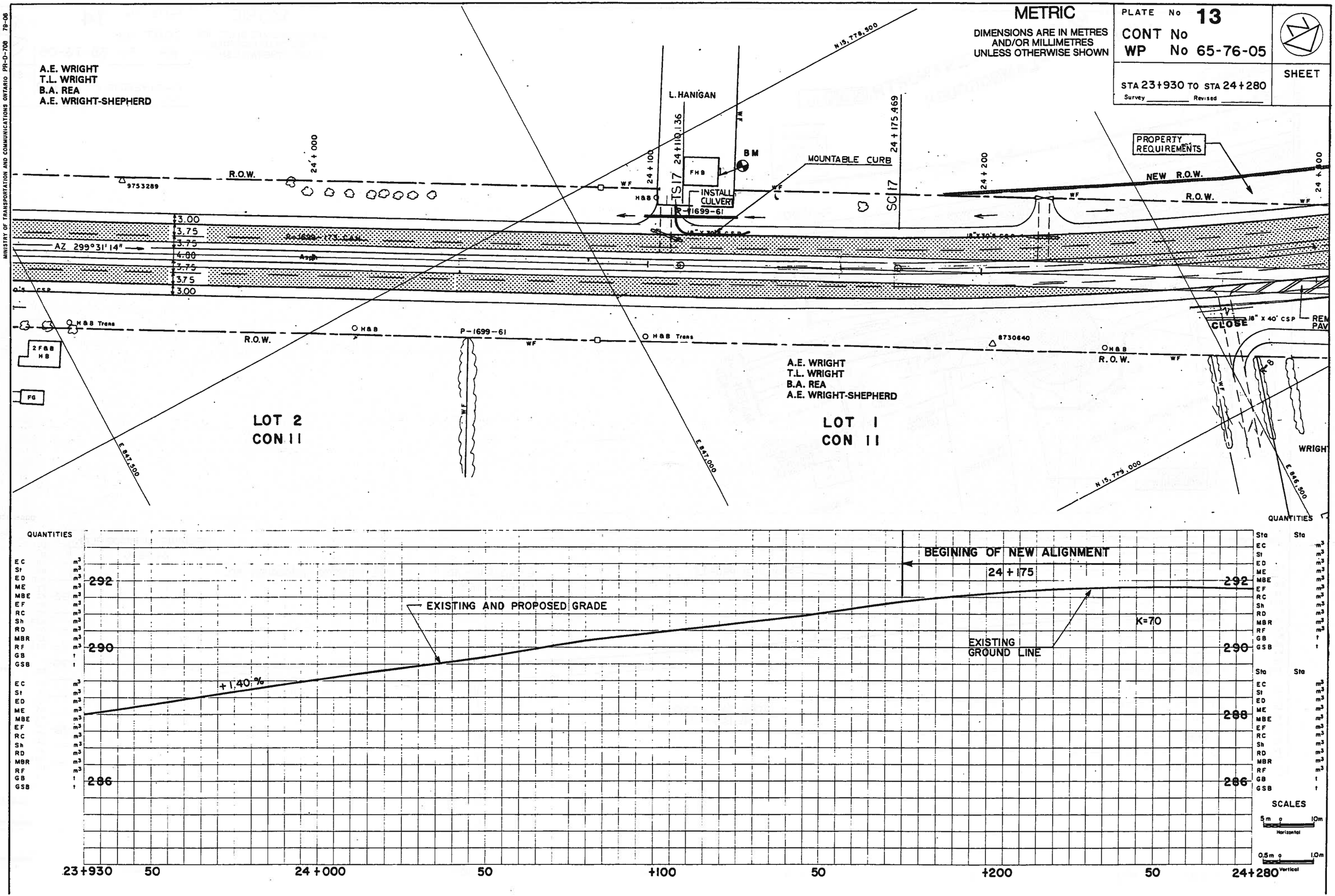
EC
St
ED
ME
MBE
EF
RC
Sh
RD
MBR
RF
GB
GSB

PROFILE OF RELOCATED GORE RD.

℄ GORE RD. (CONCESSION RD. 11) RELOCATED
℄ EXISTING GORE RD. (TO BE CLOSED)
EXISTING AND PROPOSED GRADE
EXISTING GROUND LINE
+2.00%
±1.00%
-0.56%
-2.25%
K=12
PROPOSED PROFILE
ACCESS TO BENSON CHEMICALS
LIMIT OF PROJECT 9+886±
℄ HWY 6
290
288
286
284
291
289
287
9+900
+950
10+000
23+230
50
+300
50
+400
50
23+500
50
23+580

SCALES
5 m 0 10m Horizontal
0.5 m 0 1.0m Vertical


METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
PLATE No 12
CONT No
WP No 65-76-05
STA 23+580 TO STA 23+930
Survey
Revised
SHEET
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO PR-D-708 79-06
G. & A.E. WRIGHT
BUSH
M.T.O.
CURVE 6
A = 275
Ls = 65.761
S = 3.9 %
CURVE 6
A = 275
Ls = 65.67
S = 3.9 %
EXTEND CULVERT
R = 1150
INSTALL CULVERT
R.O.W.
A.E. WRIGHT
T.L. WRIGHT
B.A. REA
A.E. WRIGHT-SHEPHERD
EXTEND CULVERT 9753288
PI STA. 23+693.028
N 4,809,115.1
E 258,507.9
F. RUDZICK
LOT 2
CON 11
BM
AZ 299°31'14"
F&BB BARN
2 F&B HB
FG
H&B Trans
QUANTITIES
EXISTING AND PROPOSED GRADE
- 1.00 %
+ 1.40%
290
288
286
284
23+580
23+600
50
+700
50
+800
50
+900
23+930
SCALES
Horizontal
Vertical


METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
PLATE No 13
CONT No
WP No 65-76-05
STA 23+930 TO STA 24+280
Survey
Revised
SHEET
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO PR-D-708 79-08
A.E. WRIGHT
T.L. WRIGHT
B.A. REA
A.E. WRIGHT-SHEPHERD
L. HANIGAN
R.O.W.
24+000
24+100
24+110.136
24+175.469
24+200
24+300
TS17
SC17
FHB
BM
MOUNTABLE CURB
INSTALL CULVERT
P-1699-61
PROPERTY REQUIREMENTS
NEW R.O.W.
R.O.W.
9753289
AZ 299°31'14"
3.00
3.75
3.75
4.00
3.75
3.75
3.00
H&B Trans
H&B
P-1699-61
H&B Trans
8730640
H&B
R.O.W.
CLOSE
18" X 40' CSP
REM PAV
2F&B HB
FG
LOT 2
CON 11
LOT 1
CON 11
E 847,500
E 847,000
N 15,778,500
N 15,779,000
E 846,500
WRIGHT
QUANTITIES
EC
St
ED
ME
MBE
EF
RC
Sh
RD
MBR
RF
GB
GSB
BEGINING OF NEW ALIGNMENT
24+175
EXISTING AND PROPOSED GRADE
EXISTING GROUND LINE
K=70
+1.40 %
292
290
288
286
Sta
SCALES
5m 0 10m
Horizontal
0.5m 0 1.0m
Vertical
23+930
50
24+000
50
+100
50
+200
50
24+280

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO PR-D-708 79-06

HAMILTON – WENTWORTH
TOWN OF FLAMBOROUGH

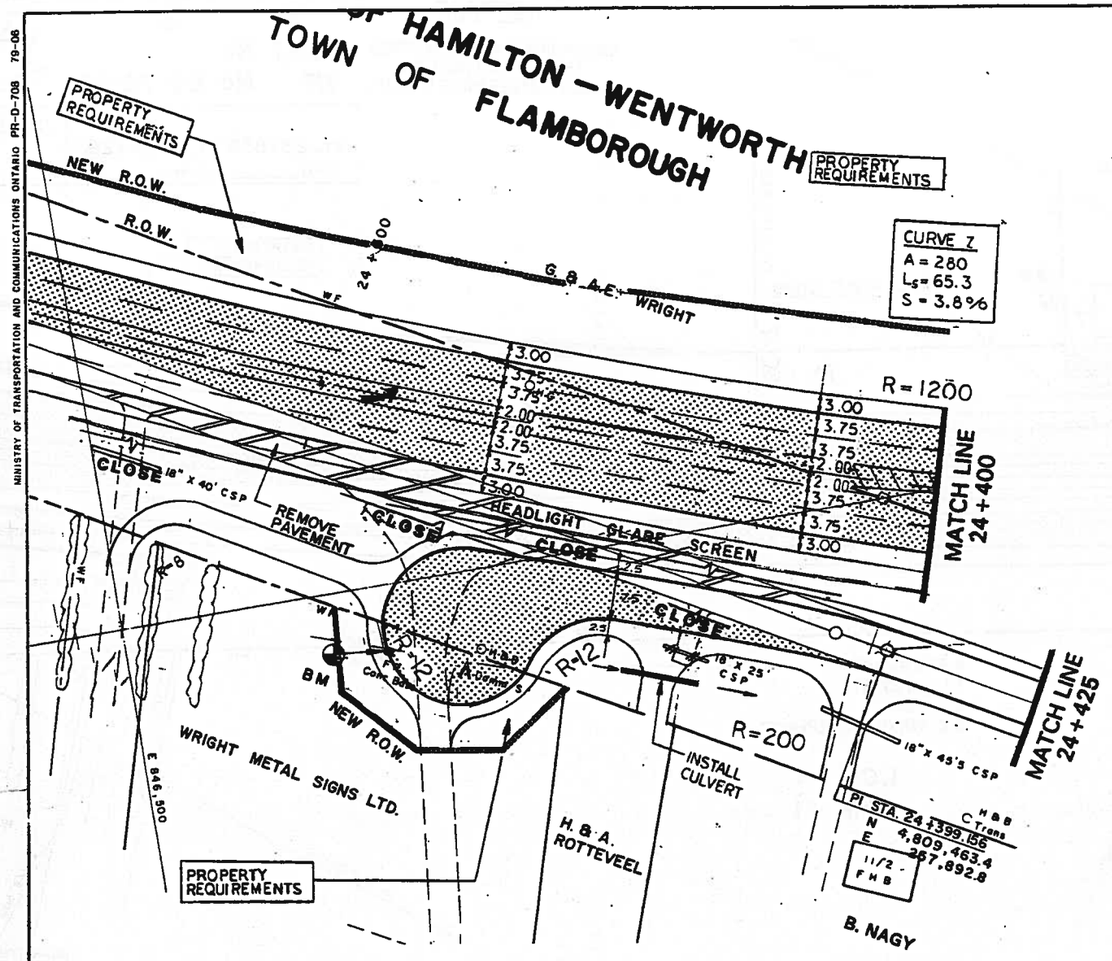
METRIC

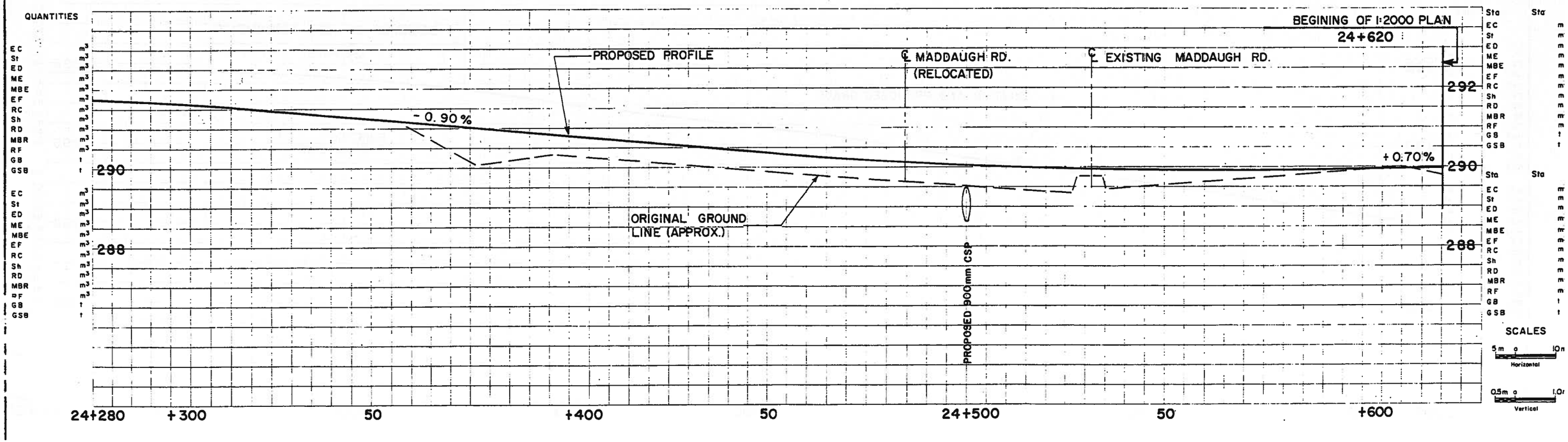
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

PLATE No 14
CONT No
WP No 65-76-05

STA 24+280 TO STA 24+620
Survey _____ Revised _____

SHEET





METRIC

PLATE No	15
CONT No	
WP No	65-76-05
STA 24+400 TO STA 24+620	SHEET
Fenco MacLaren Member of SNC-LAVALIN Group	

MINISTRY OF TRANSPORTATION, ONTARIO PR-D-706 65-05 AUTOCAD DWG.

BEGINING OF 1:2000 PLAN
24+620

24+500 HIGHWAY 6
10+000 MADDAUGH ROAD

MATCH TO EXISTING

CO OF WELLINGTON
TWP OF PUSLINCH

GORE CON
LOT 39

OF HAMILTON-WENTWORTH
WN OF FLAMBOROUGH
WP OF W. FLAMBOROUGH

CON 11
LOT 1
MATCH LINE
24+400

MADDAUGH ROAD

OLD HWY 6 (SOUTH LEG)

OLD HWY 6 (NORTH LEG)

R.O.W. AS PER W.P. 65-76-02

PREVIOUSLY REQUIRED PROPERTY

NEW PROPERTY

LOT 1
CON 11

LOT 39
GORE CON

10+140 MADDAUGH ROAD
=20+000 OLD HIGHWAY 6 (SOUTH LEG)
=24+622 OLD HIGHWAY 6 (NORTH LEG)

SCALES
0m 5m 10m

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO PR-D-709 79-06

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

PLATE No **16**

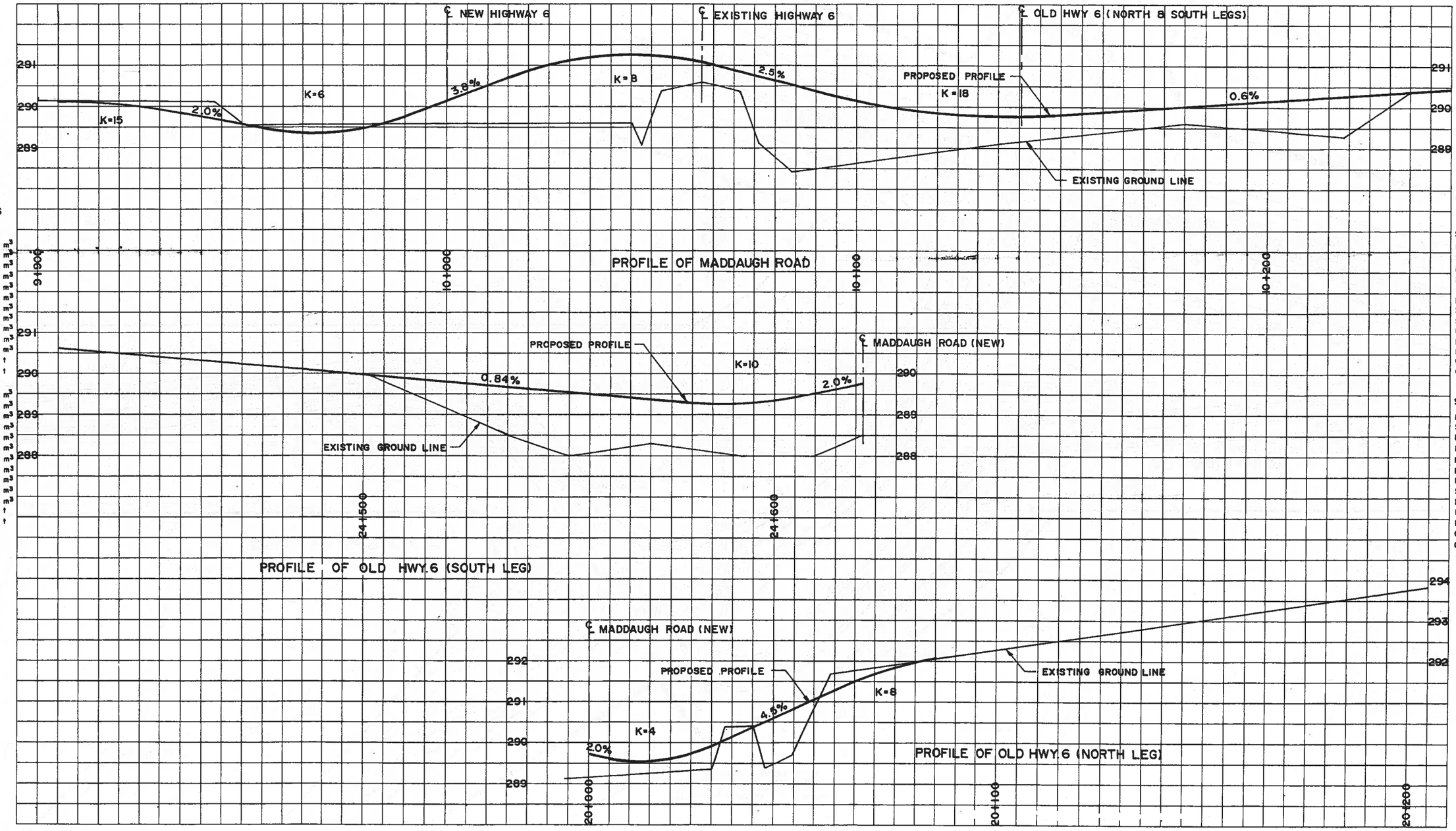
CONT No

WP No

STA TO STA

Survey _____ Revised _____

SHEET



MINISTRY OF TRANSPORTATION, ONTARIO PR-D-708 88-05 AUTOCAD DWG.

METRIC

PLATE No 17
CONT No
WP No 65-76-05

SHEET

Fenco MacLaren
Member of SNC•LAVALIN Group

THIS PLATE INTENTIONALLY LEFT BLANK

GORE CON.
LOT 38
LOT 37
LOT 36
LOT 39
P. & V. GODFREE
G. FIELDING
B. LILLYCROP
J.E. & L.E. BRADLEY
CP RAIL GALT SUBDIVISION
MADDAUGH ROAD
J. & M. SEGOTA
HIGHWAY 6
FIELDING LANE
PROPOSED R.O.W.
℄ HWY. 6
EXISTING GROUND LINE
CROSS SECTION HWY 6 & FIELDING FIELD ACCESS
1:200
UNDERPASS
R=2000 A=350
FLUSH MEDIAN
25+700
25+500
25+000
24+620
END OF PLANS 1:500
A.E. WRIGHT
T.L. WRIGHT
B.A. REA
A.E. WRIGHT - SHEPHERD
M. MARKOVINOVIC
M. & M. WATSON
J. SCHWEDEN
R. & E. KNAPTON
G. FIELDING
EXIST. HWY. 6
I. NICHOL
MARKS
C. BROWN
A.M. HUEEMON
F. LESLIE
M.T.O.
CPR
ASPHALT
N 4,809,000
N 4,809,200
N 4,809,400
N 4,809,600
N 4,809,800
N 4,810,000
E 257,000
E 257,200
E 257,400
E 257,600
E 257,800
E 258,000
E 256,800

SCALE:
0 50 100 150 200m

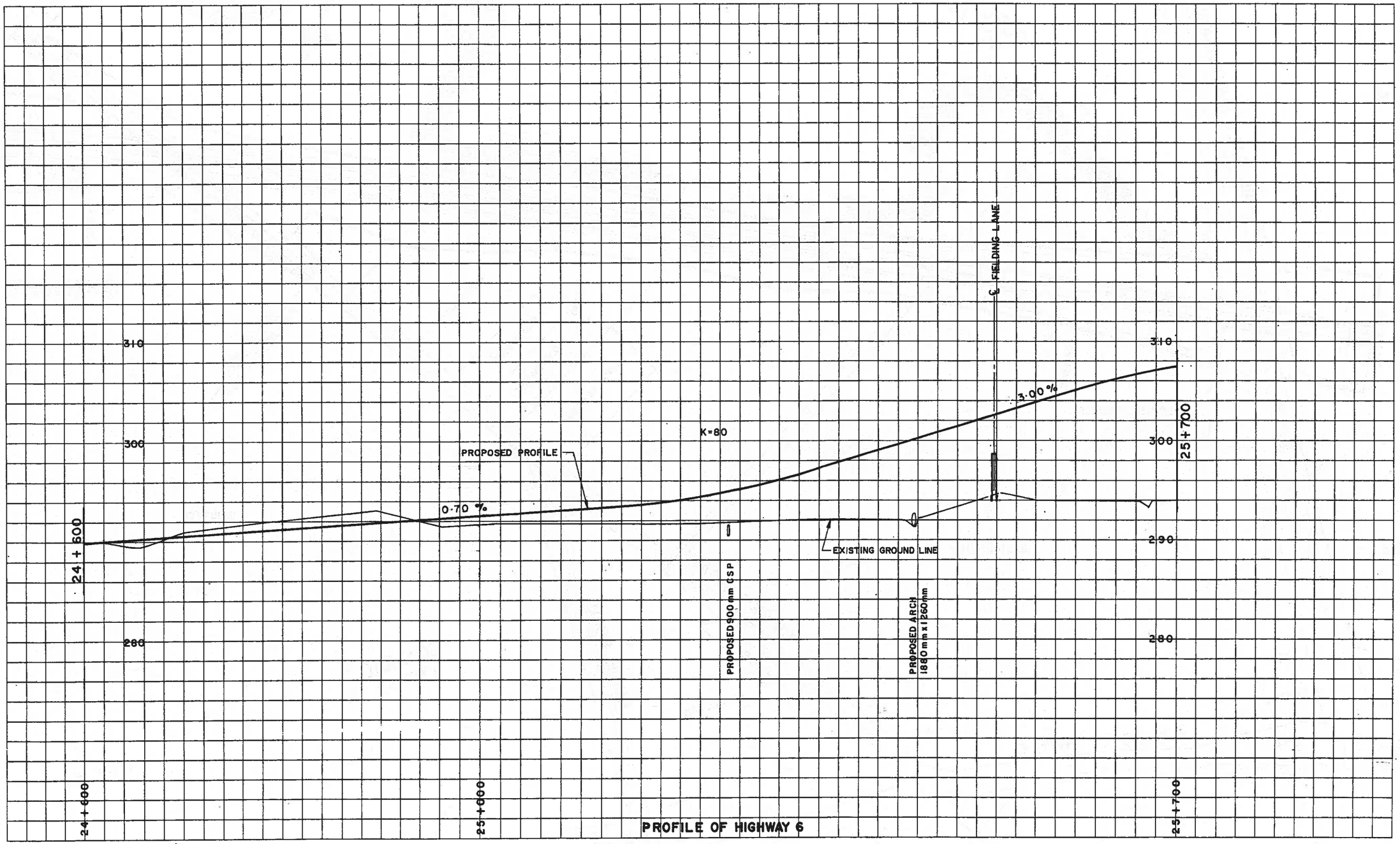
Req. Rd. 97
Con. Rd. 11E
Req. Rd. 551
Con. Rd. 10W
Con. Rd. 12E
Mountsberg Rd.
Campbellville Rd.
Middle Gore Rd.
Gore Rd.
HIGHWAY 6
EXIST. HWY. 6
CP Rail
Hunter St.
Guelph Rd.
Con. Rd. 7
Con. Rd. 2
Calfass Rd.
HIGHWAY 401
HANLON EXPRESSWAY
Sideroad 20
Puslinch Rd. 4
Con. Rd. 7
McLean Rd.
Brock Rd.
County Rd. 34
Puslinch Rd. 15
(HWY. 6)
Cpk. Rd.

HIGHWAY 6
FREELTON TO GUELPH
Environmental Assessment
& Preliminary Design Report

LEGEND:
EXISTING R.O.W.
PROPOSED R.O.W.

PLAN
W.P. 65-76-05

PLATE
18

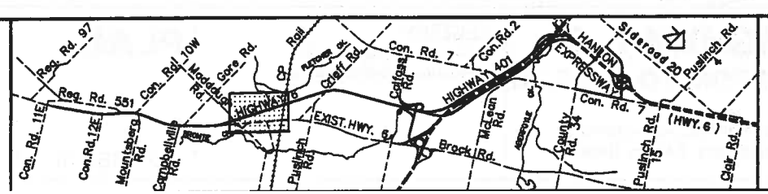


PROFILE OF HIGHWAY 6

SCALE:

HORIZ. 0 50 100 150 200m

VERT. 0 5 10 15 20m



HIGHWAY 6
FREELTON TO GUELPH

Environmental Assessment & Preliminary Design Report

LEGEND:
- ORIGINAL GROUND
- PROPOSED GRADE

PROFILE

W.P. 65-76-05

PLATE 19

B. LILLYCROP

GORE CON.
LOT 35

B. LILLYCROP

LOT 34

F. HOLLENBACH

STA. 9+800
PROJECT LIMIT

M.T.O.

LOT 36

CP RAIL GALT SUBDIVISION

HIGHWAY 6

6m RAISED MEDIAN

3.0
7.5
6.0
7.5
3.0

27+100

R = 1200
A = 280

27+000

26+929.350 HIGHWAY 6
= 10+000.000 CRIEFF RD.

1m FLUSH MEDIAN

3.0
7.5
7.5
1.0
3.0

N 4,809,600

25+700

26+000

26+500

H. STEWART

K.L. HILBORN

D. STEWART

L. PATTERSON

STA. 10+190
PROJECT LIMIT

25+819.440 HIGHWAY 6
= 10+000.000 CP RAIL

N 4,809,800

G. FIELDING

B. LILLYCROP

CRIEFF ROAD

G. SUTTON

CON. VII
LOT 35

A.M. HUFFMON

F. LESLIE

M.T.O.

EXIST. HWY. 6

R. TANNER

M. POLLARD

LESLIE ROAD

LOT 34

R. MAST

J. MAST

A. SUTTON

N 4,810,000

N 4,810,200

N 4,810,400

N 4,810,600

E 256,600

E 256,800

E 257,000

E 257,200

E 257,400

E 257,600

E 257,800

E 258,000

E 258,200

E 258,400

E 258,600

E 258,800

E 259,000

E 259,200

E 259,400

E 259,600

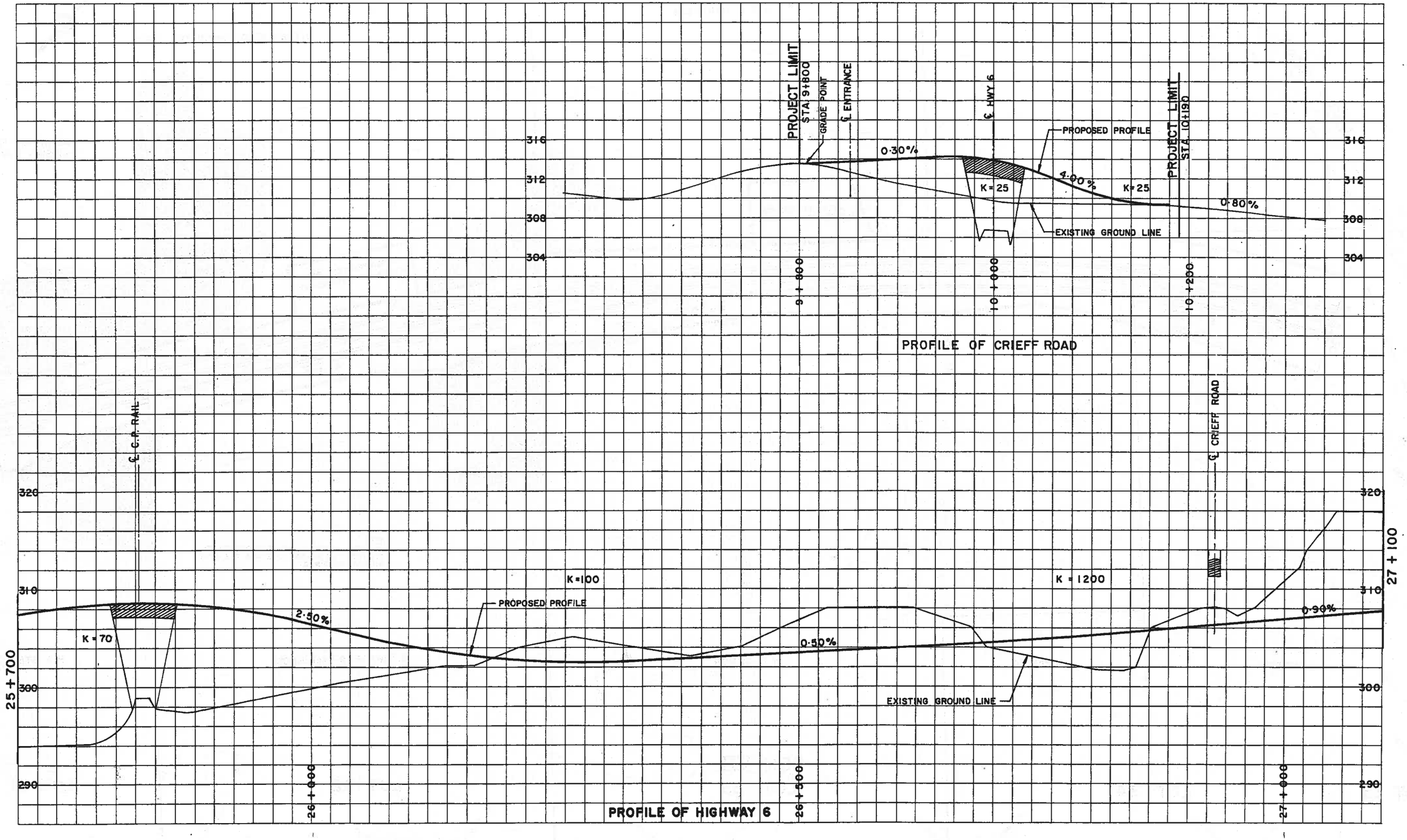
E 259,800

E 260,000

E 260,200

E 260,400

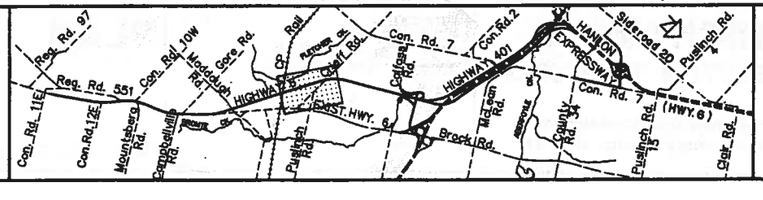
E



SCALE:

HORIZ. 0 50 100 150 200m

VERT. 0 5 10 15 20m



HIGHWAY 6
FREELTON TO GUELPH

Environmental Assessment & Preliminary Design Report

LEGEND:
- ORIGINAL GROUND
- PROPOSED GRADE

PROFILE

W.P. 65-76-05

PLATE
21

H.A. STEWART

D. & S. McKINNON

S. TOWNSEND – McKINNON

CRIEFF ROAD

MORRISTON PARK NURSING HOME INC.

AREA PROPOSED FOR STORMWATER MANAGEMENT

AREA PROPOSED FOR STORMWATER MANAGEMENT

6m RAISED MEDIAN

R = 1200
A = 280

R = 3000

A = 450

27+100

27+500

28+000

28+500

MTO

H. KRUSCH

NOTE:
IN DETAIL DESIGN PARTS OF THE WOODLOTS BETWEEN THE GRADING LINE AND THE R.O.W. WILL BE RETAINED

G. SUTTON

J. PELAIA

W. D. WINER

S. TOWNSEND – McKINNON

H.B. STEWART

CON. VII

LOT 35

LOT 34

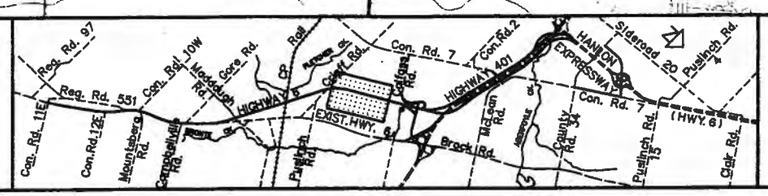
LOT 33

LOT 32

LOT 31

SCALE:

0 50 100 150 200m



HIGHWAY 6
FREELTON TO GUELPH

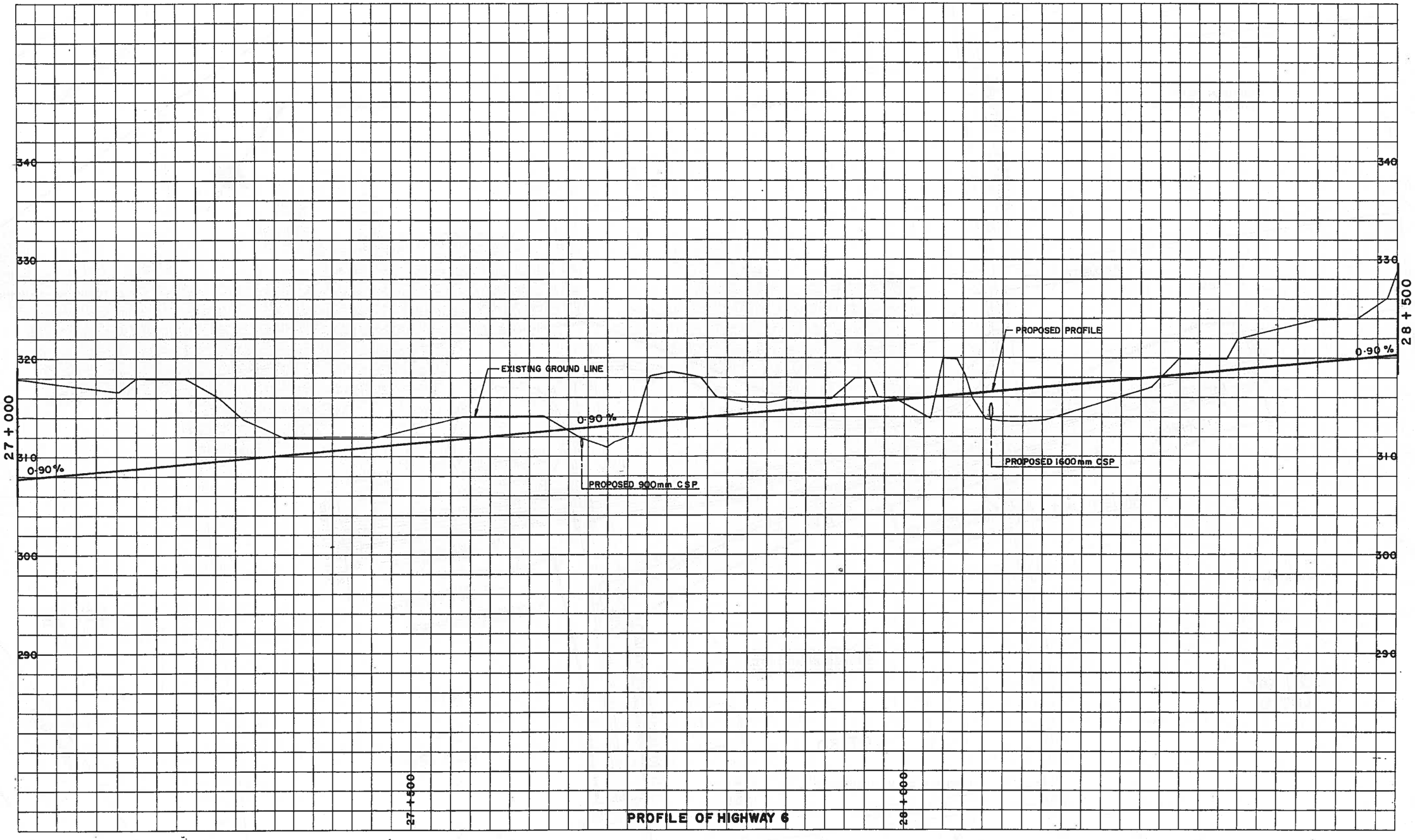
Environmental Assessment & Preliminary Design Report

LEGEND:
EXISTING R.O.W.
PROPOSED R.O.W.

PLAN

W.P. 65-76-05

PLATE
22

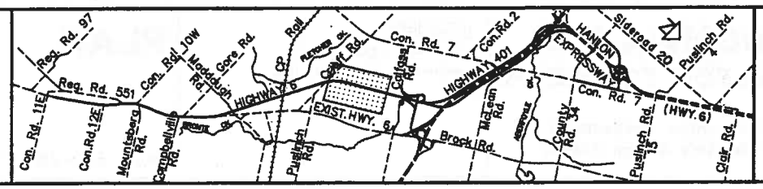


PROFILE OF HIGHWAY 6

SCALE:

HORIZ. 0 50 100 150 200m

VERT. 0 5 10 15 20m



HIGHWAY 6
FREELTON TO GUELPH

Environmental Assessment & Preliminary Design Report

LEGEND:

ORIGINAL GROUND

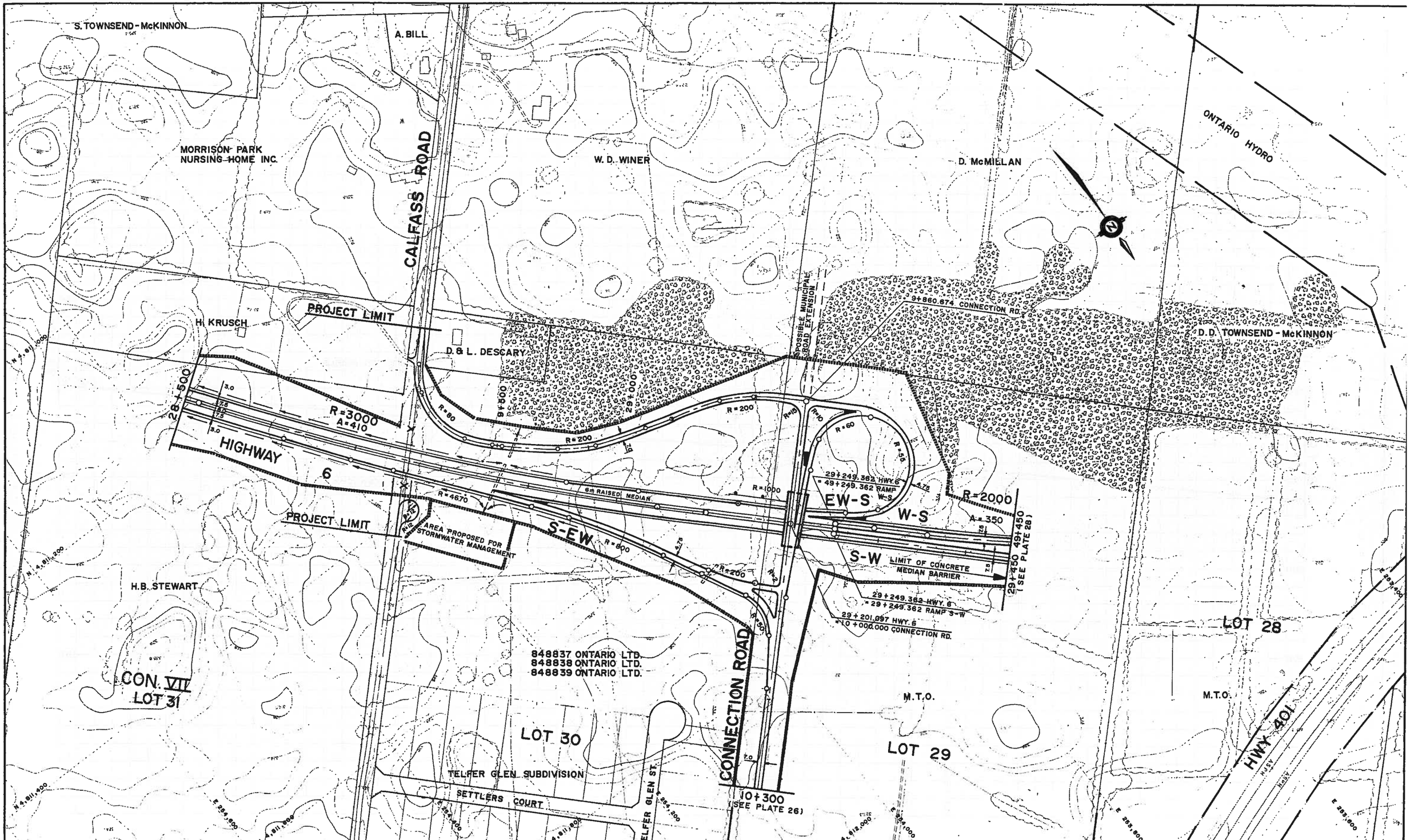
PROPOSED GRADE

PROFILE

W.P. 65-76-05

PLATE

23



SCALE:

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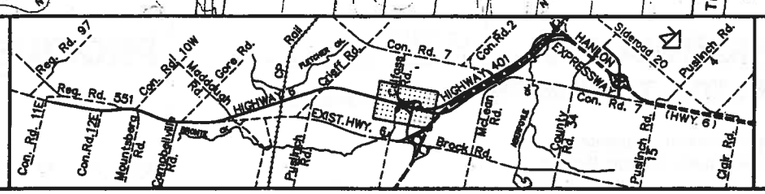


HIGHWAY 6
FREELTON TO GUELPH

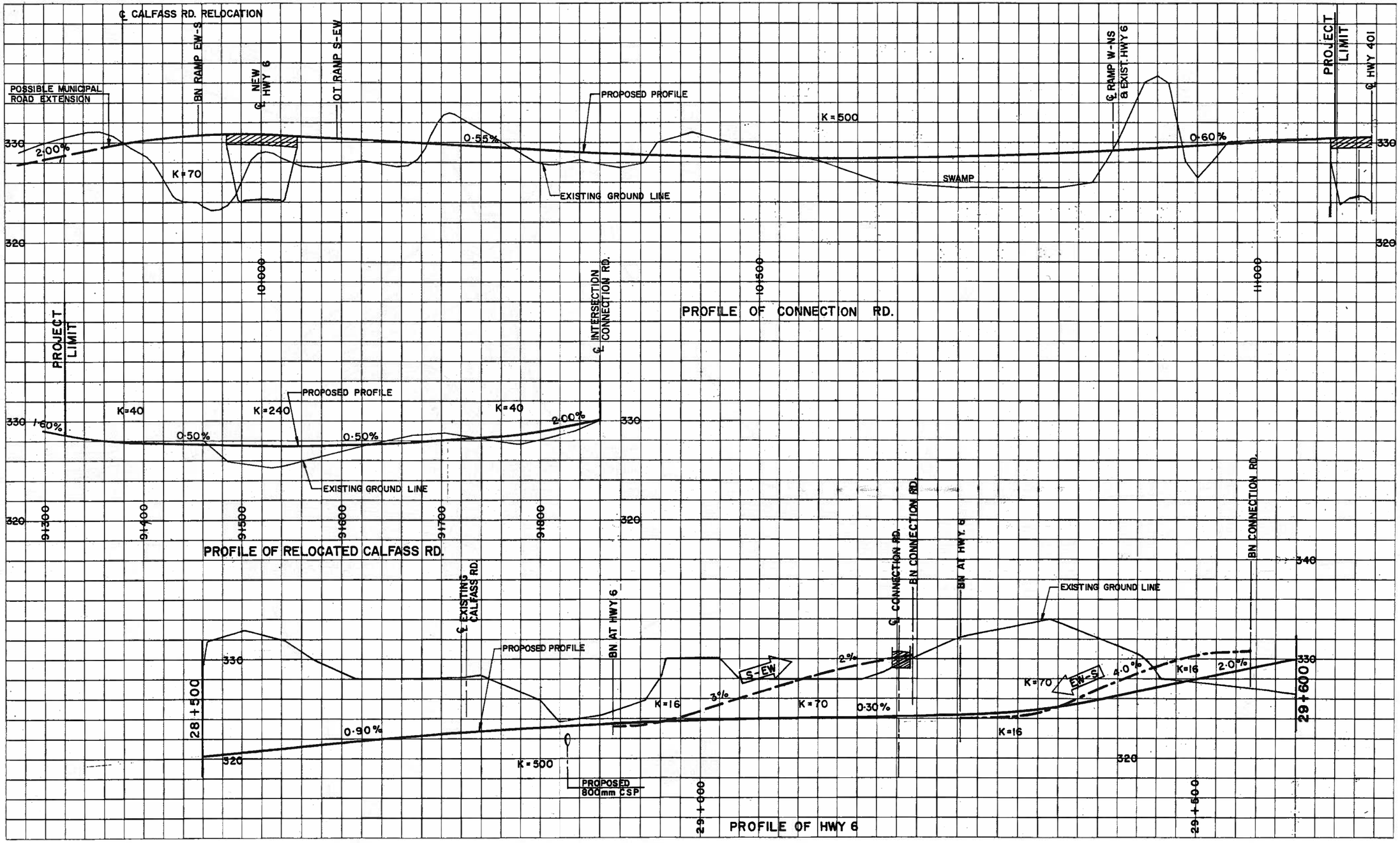
Environmental Assessment & Preliminary Design Report

LEGEND:
- EXISTING R.O.W.
- PROPOSED R.O.W.

PLAN

W.P. 65-76-05

PLATE 24



SCALE:

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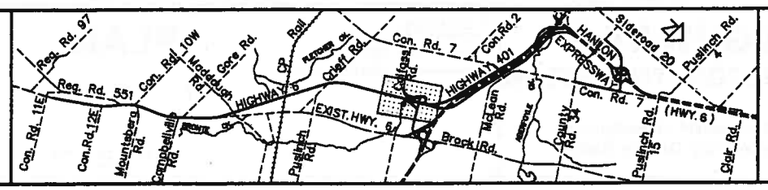
VERT. 0 5 10 15 20m



HIGHWAY 6
FREELTON TO GUELPH

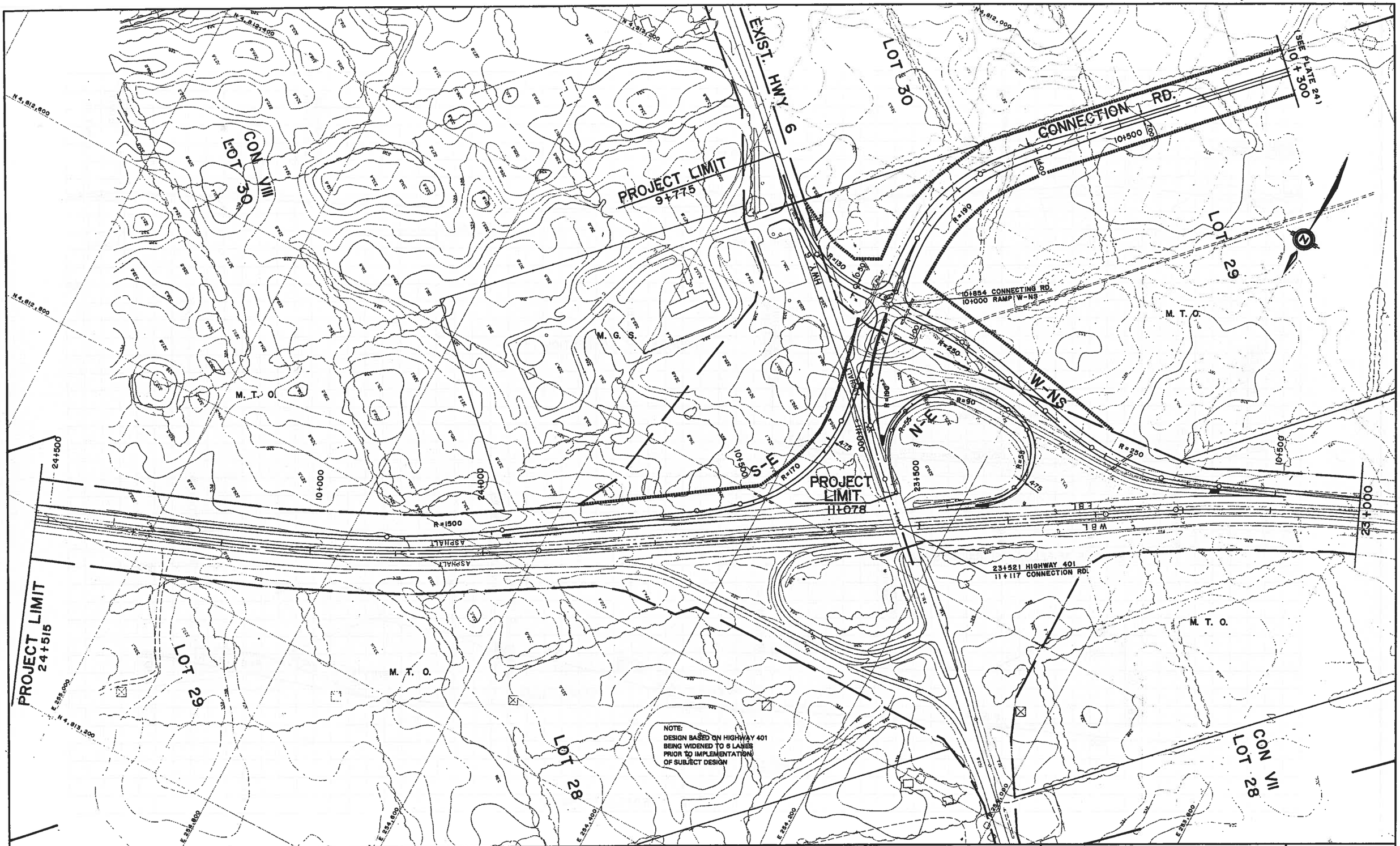
Environmental Assessment & Preliminary Design Report

LEGEND:
- ORIGINAL GROUND
- PROPOSED GRADE

PROFILE

W.P. 65-76-05

PLATE
25



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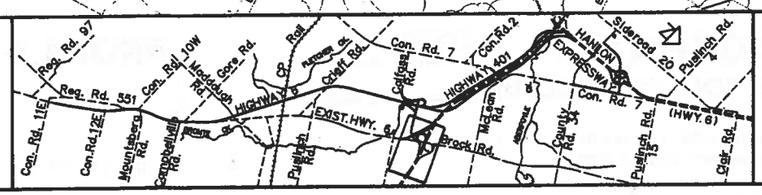


HIGHWAY 6
FREELTON TO GUELPH

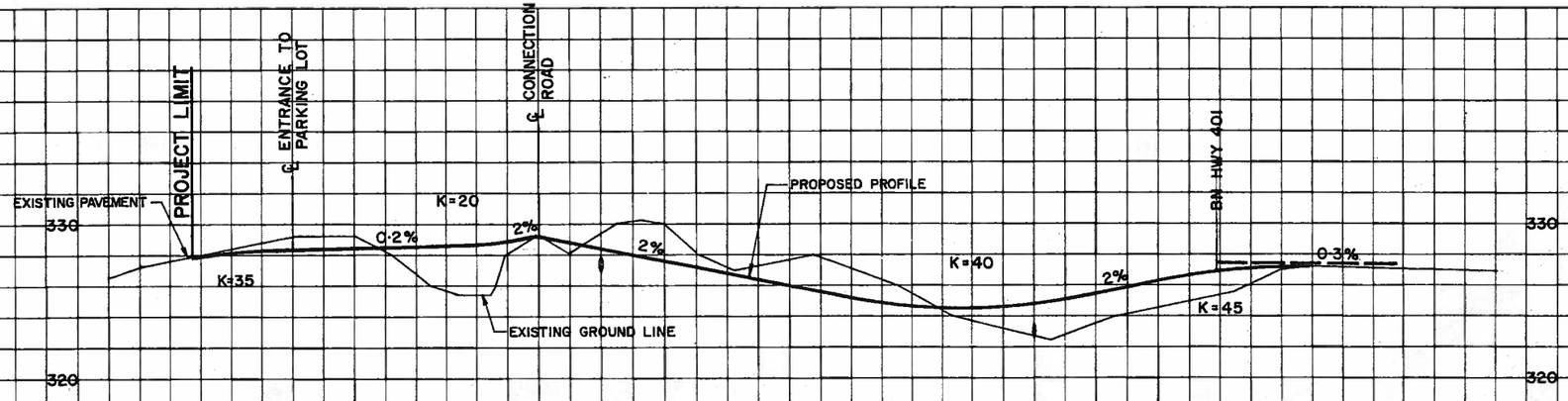
Environmental Assessment
& Preliminary Design Report

LEGEND:
EXISTING R.O.W.
PROPOSED R.O.W.

PLAN

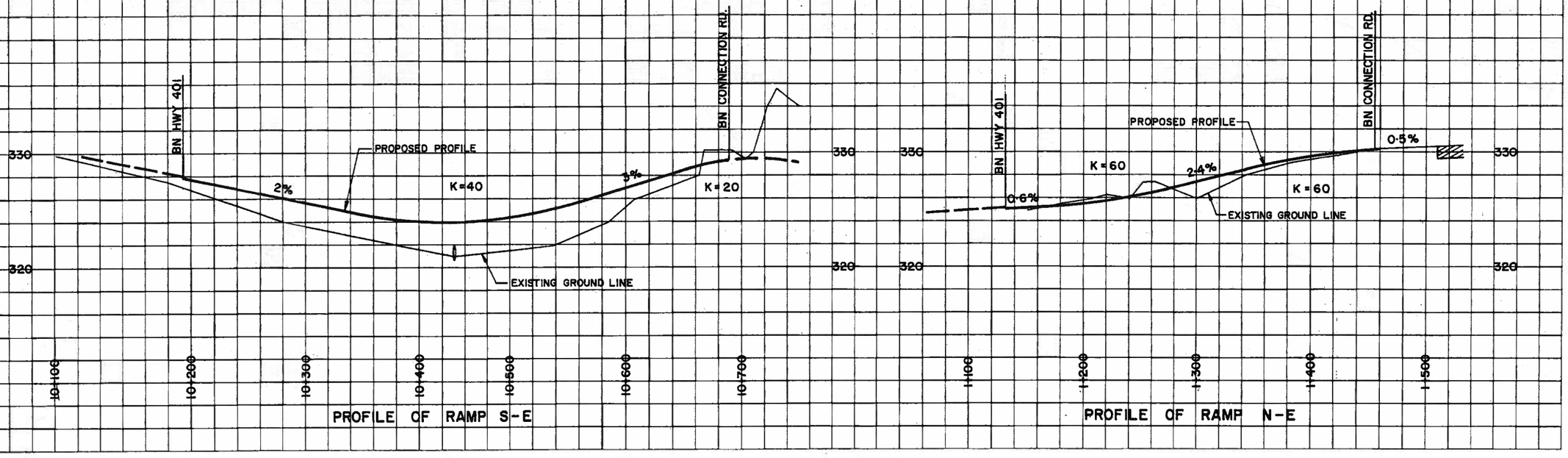
W.P. 65-76-05

PLATE
26



PROFILE OF CONNECTION TO EXISTING HIGHWAY 6

PROFILE OF RAMP W-N/S



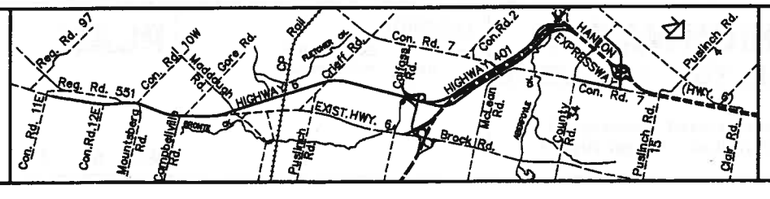
PROFILE OF RAMP S-E

PROFILE OF RAMP N-E

SCALE:

HORIZ. 0 50 100 150 200m

VERT. 0 5 10 15 20m



HIGHWAY 6
FREELTON TO GUELPH

Environmental Assessment & Preliminary Design Report

LEGEND:
- ORIGINAL GROUND
- EXISTING GRADE
- PROPOSED GRADE

PROFILE

W.P. 65-76-05

PLATE 27

LOT 29

LOT 28

CON. VIII
LOT 27

D.D. TOWNSEND - McKINNON

D.D. TOWNSEND - McKINNON

ONTARIO HYDRO

M.T.O.

M.T.O.

M.T.O.

L. FERRARO INC.

L. FERRARO INC.

CON-CAST PIPE LTD.

SEE PLATE 24
29+450

46+450

A=350
R=2000

49+500

29+600

A=210
R=450

50+000

50+800

HIGHWAY 6 SOUTHBOUND
(W-S)

HIGHWAY 401

R=3500

R=7090

R=5000

R=4000

R=4000

R=4000

50+928

21+500

30+990

*NOTE:
SHOULDER WIDENED TO 3.0m TO PROVIDE ADDITIONAL CLEARANCE FOR STOPPING SIGHT DISTANCE.

A=210
R=450

R=1746

23+000

22+568.72 HIGHWAY 401
29+912.97 RAMP S-W

30+000

22+500

HIGHWAY 6 NORTHBOUND
(S-W)

22+000

30+500

AREA PROPOSED FOR STORMWATER MANAGEMENT

NOTE:
DESIGN BASED ON HIGHWAY 401 BEING WIDENED TO 6 LANES PRIOR TO IMPLEMENTATION OF SUBJECT DESIGN

LOT 26

LOT 25

McLEAN ROAD

N 4,811,800

N 4,812,000

N 4,812,400

N 4,812,600

E 253,800

E 253,600

E 253,400

E 253,200

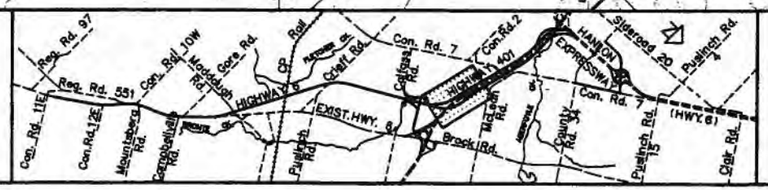
E 253,000

E 252,800

E 252,600

SCALE:

0 50 100 150 200m



HIGHWAY 6
FREELTON TO GUELPH

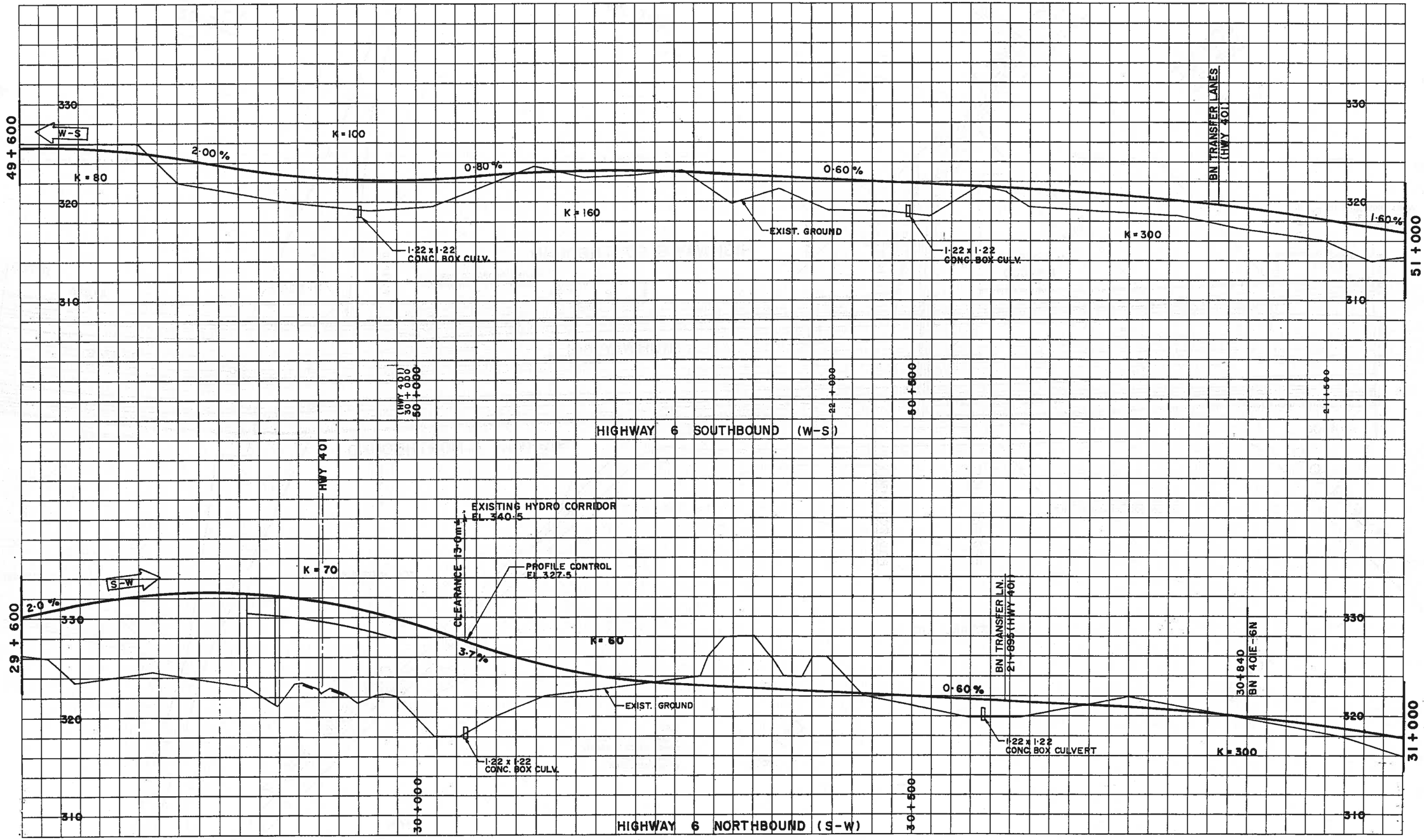
Environmental Assessment
& Preliminary Design Report

LEGEND:
EXISTING R.O.W.
PROPOSED R.O.W.

PLAN

W.P. 65-76-05

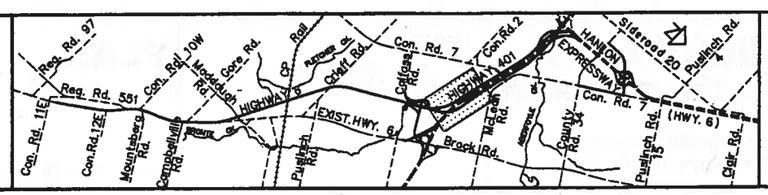
PLATE
28



SCALE:

HORIZ. 0 50 100 150 200m

VERT. 0 5 10 15 20m



HIGHWAY 6
FREELTON TO GUELPH

Environmental Assessment & Preliminary Design Report

LEGEND:
- ORIGINAL GROUND
- PROPOSED GRADE

PROFILE

W.P. 65-76-05

PLATE
29

CONCESSION ROAD 7

PROJECT LIMIT STA 10+280

CON. VII LOT 26

LOT 26

CON. II LOT 25

N 4,811,800

N 4,812,000

L. FERRARO INC.

S.J. ADDEO

TCG MATERIALS LTD.

S. McNALLY & SONS LTD.

AREA PROPOSED FOR STORMWATER MANAGEMENT

51+000

R=3500

50+928

M.E. OBBARD R=7000

TCG MATERIALS LTD.

21+000

51+500

HIGHWAY 6 SOUTHBOUND

AREA PROPOSED FOR STORMWATER MANAGEMENT

20+500

52+600

R=5000

R=750

52+320

A=230

21+500

16.25

12.50

14.75

11.0

HIGHWAY 401

R=1745

20+100

32+382

30+990

R=4000

A=400

R=2000

31+000

McLEAN ROAD

HIGHWAY 6 NORTHBOUND

32+000

21+043.580 HIGHWAY 401
10+000.000 CONCESSION RD.7

PROJECT LIMIT

PROJECT LIMIT

N 4,812,400

TCG MATERIAL LTD.

TCG MATERIAL LTD.

SLOVENSKI PARK LTD.

LOT 25

CONCESSION ROAD 7

N 4,812,600

LOT 24

NOTE:
DESIGN BASED ON HIGHWAY 401 BEING WIDENED TO 6 LANES PRIOR TO IMPLEMENTATION OF SUBJECT DESIGN

LOT 23

E 252,200

E 252,000

E 251,800

E 251,600

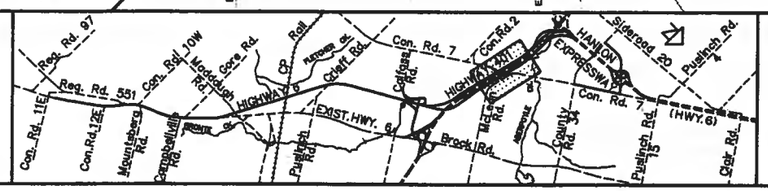
E 251,400

E 251,200

E 251,000

SCALE:

0 50 100 150 200m



HIGHWAY 6
FREELTON TO GUELPH

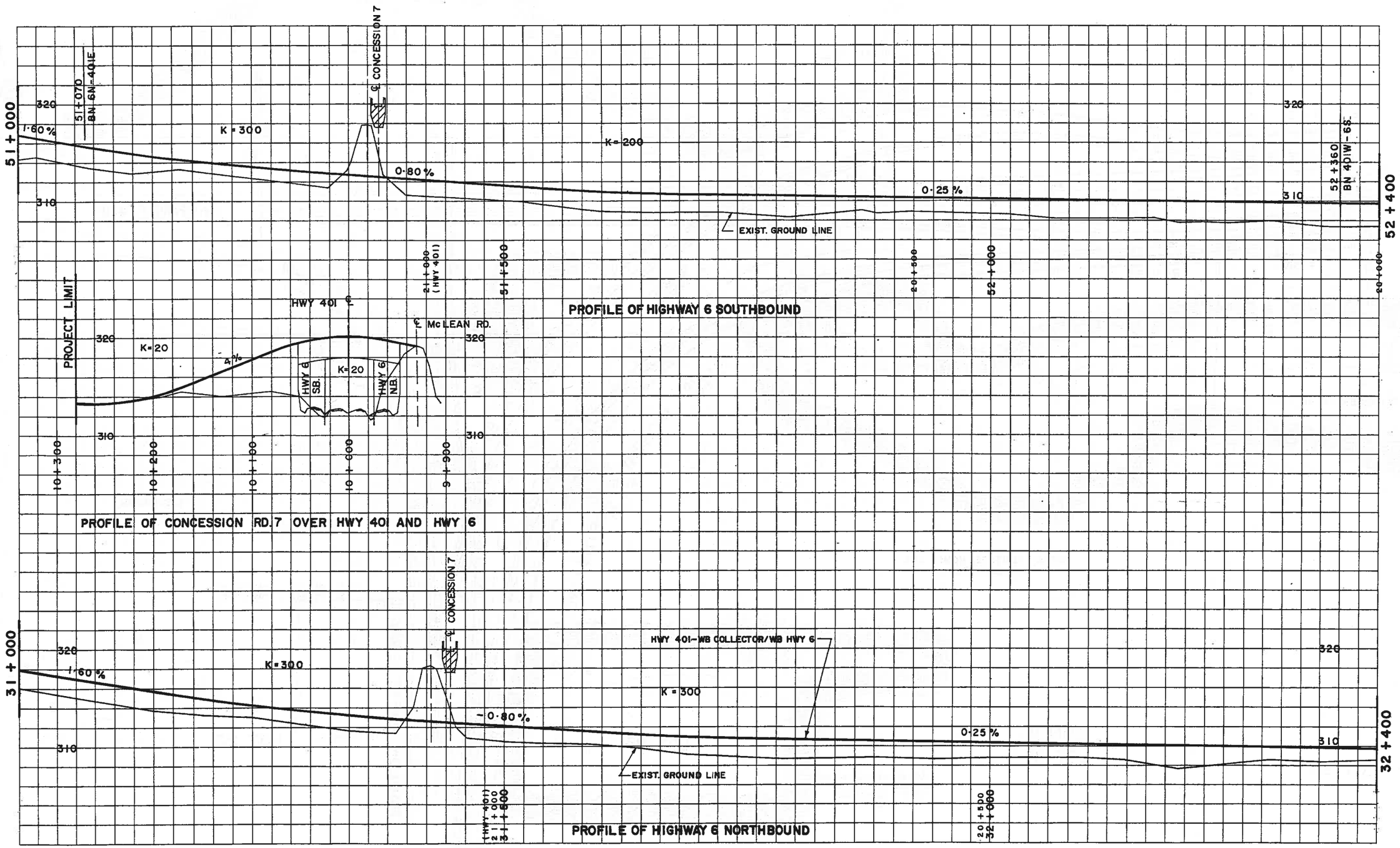
Environmental Assessment & Preliminary Design Report

LEGEND:
- EXISTING R.O.W.
- PROPOSED R.O.W.

PLAN

W.P. 65-76-05

PLATE
30



SCALE:

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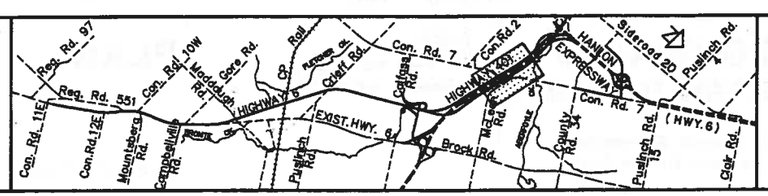
VERT. 0 5 10 15 20m



HIGHWAY 6
FREELTON TO GUELPH

Environmental Assessment & Preliminary Design Report

LEGEND:

ORIGINAL GROUND

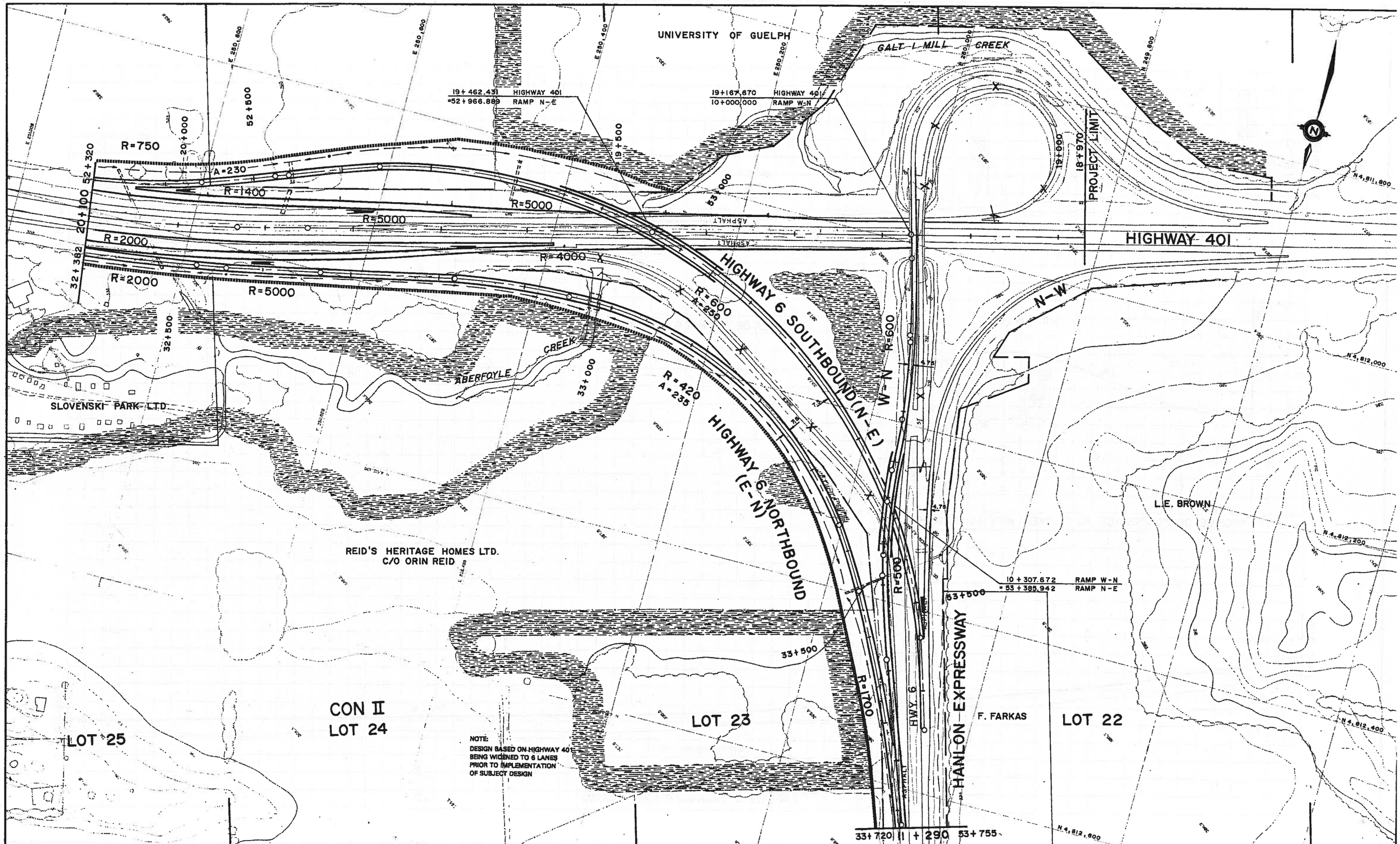
PROPOSED GRADE

PROFILE

W.P. 65-76-05

PLATE

31



SCALE:

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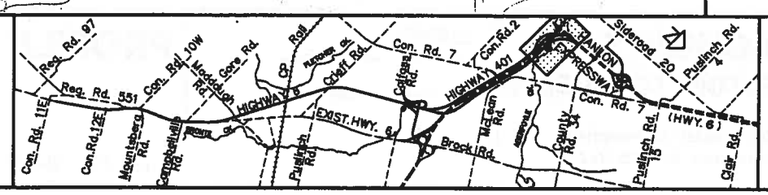


HIGHWAY 6
FREELTON TO GUELPH

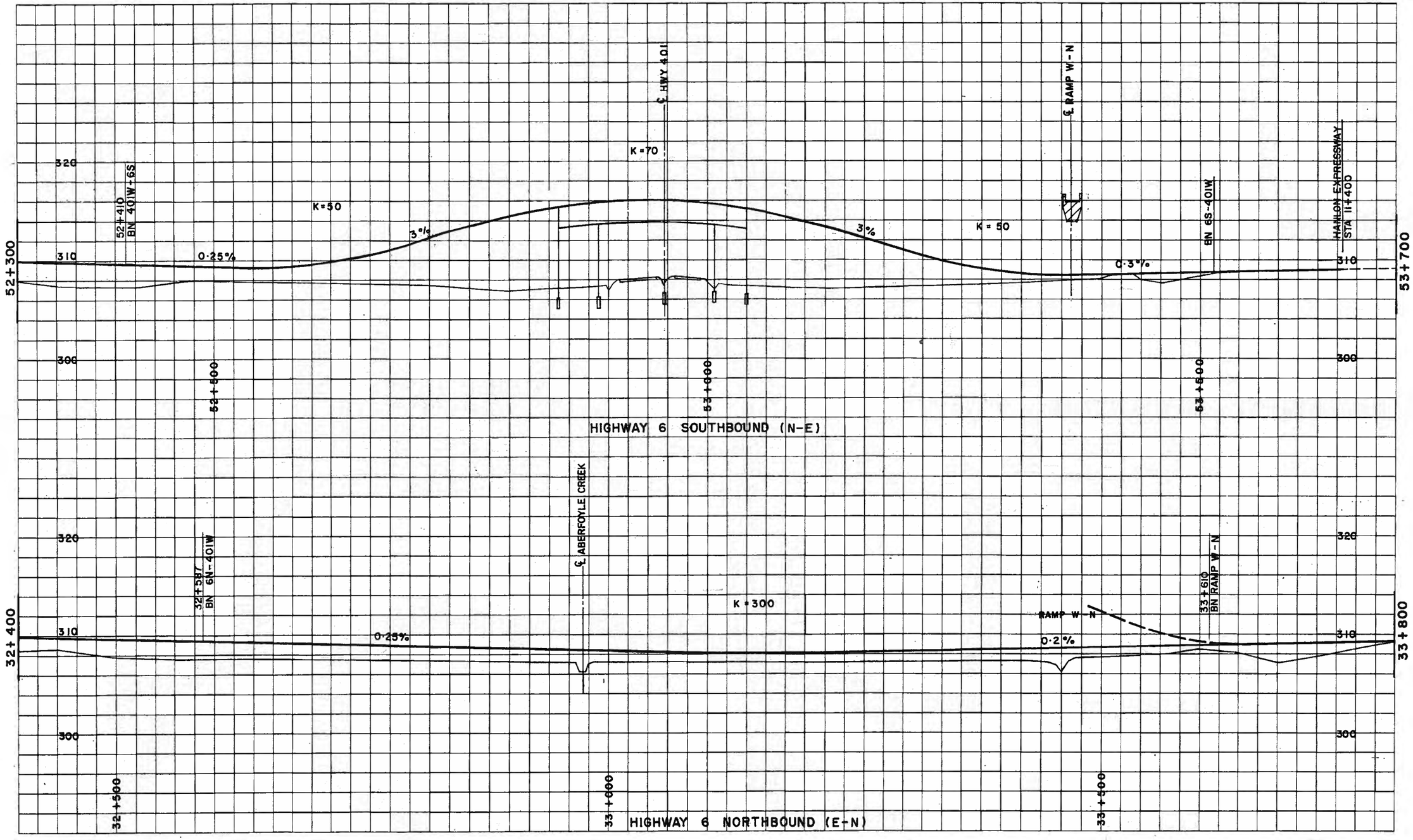
Environmental Assessment & Preliminary Design Report

LEGEND:
EXISTING R.O.W.
PROPOSED R.O.W.

PLAN

W.P. 65-76-05

PLATE 32



SCALE:

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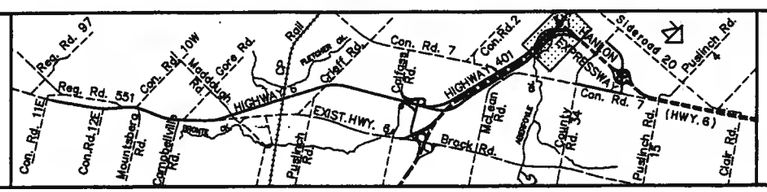
VERT. 0 5 10 15 20m



HIGHWAY 6
FREELTON TO GUELPH

Environmental Assessment & Preliminary Design Report

LEGEND:
- ORIGINAL GROUND
- PROPOSED GRADE

PROFILE

W.P. 65-76-05

PLATE
33

PROJECT LIMIT
9+500

LOT 21
G. & A. CROW

D.V. RAFUSE

M. PETRUSA

V. PETRUSA

COUNTY RD. 34 CONNECTION ROAD

9+570 COUNTY RD. 34
8+960 COUNTY RD. 34 CONNECTION RD.

CON III
LOT 22

L.E. BROWN

9+000

ACCESS TO BE REGRADED

R=250

9+500

POSSIBLE ACCESS POINT

E 249,200

9+700

ACCESS TO BE REGRADED

J. PETRUSA

EXACT ALIGNMENT TO BE COORDINATED WITH OWNER DURING NEXT DESIGN PHASE

F. FARKAS

10+865 HANLON EXPRESSWAY
= 10+000 COUNTY RD. 34

HANLON EXPRESSWAY (HIGHWAY 6)

R=4000

R=7000

11+290

10+400

ASPHALT

HWY 6

R=11700

R=5000

CULVERT EXTENSION

11+000

COUNTY ROAD 34

10+600

E 249,800

N 4,812,400

LOT 23

REID'S HERITAGE HOMES LTD.
C/O ORIN REID

E. WOZNIAK

ACCESS TO BE REGRADED

10+370
PROJECT LIMIT

LOT 24

N 4,812,800

E 250,200

N 4,813,000

N 4,813,200

N 4,813,400

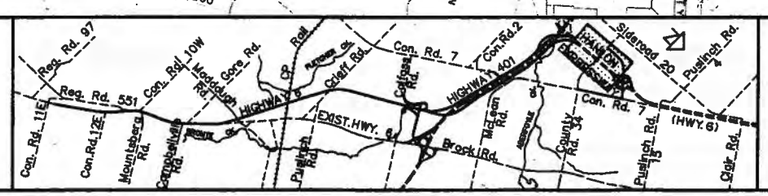
N 4,813,600

E 250,000

E 249,800

SCALE:

0 50 100 150 200m



HIGHWAY 6
FREELTON TO GUELPH

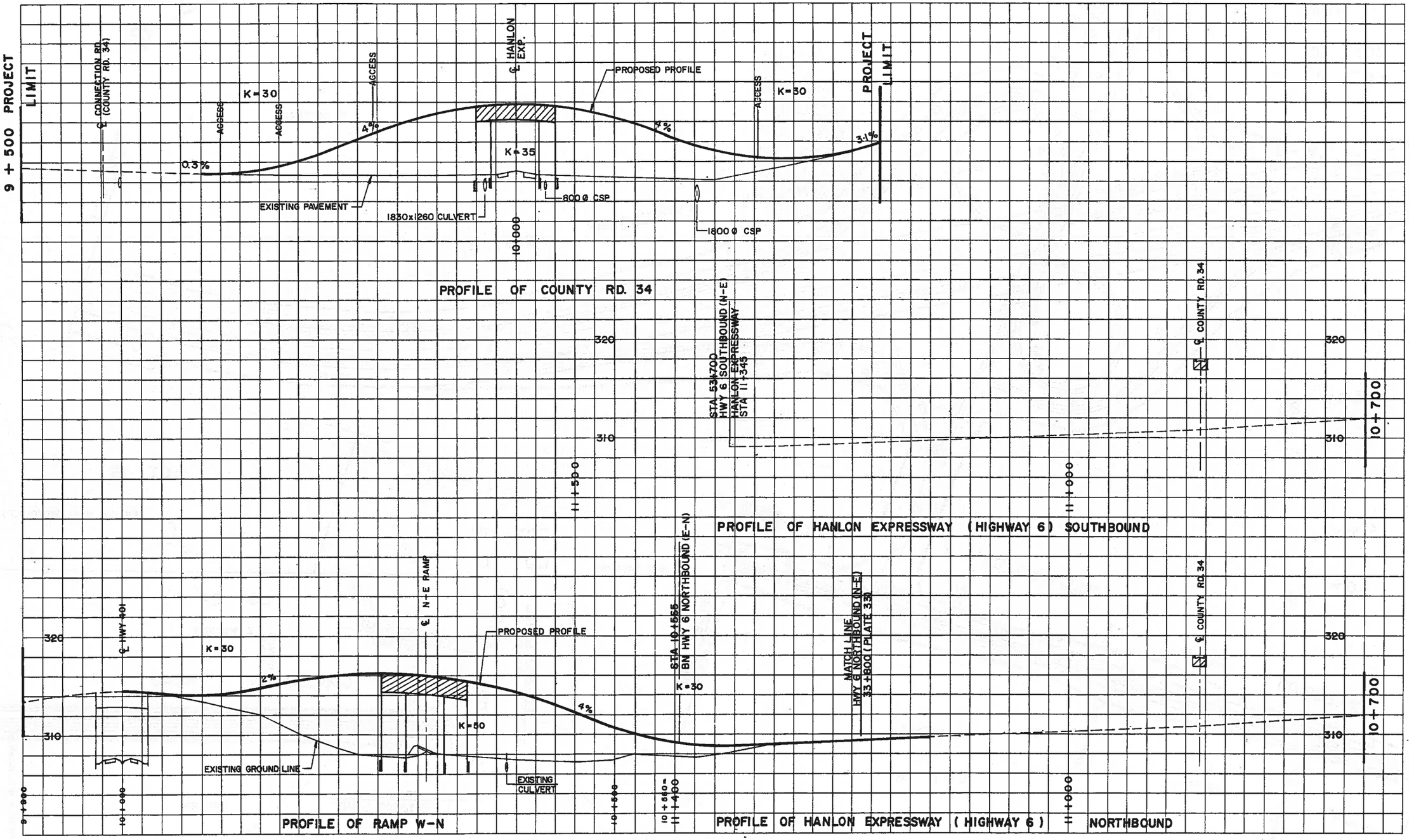
Environmental Assessment
& Preliminary Design Report

LEGEND:
EXISTING R.O.W.
PROPOSED R.O.W.

PLAN

W.P. 65-76-05

PLATE
34



SCALE:

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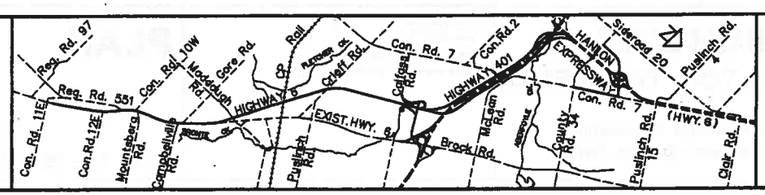
VERT. 0 5 10 15 20m



HIGHWAY 6
FREELTON TO GUELPH

Environmental Assessment & Preliminary Design Report

LEGEND:
- ORIGINAL GROUND
- EXISTING GRADE
- PROPOSED GRADE

PROFILE

W.P. 65-76-05

PLATE
35

NOTE:
NUMBER OF LANES AND EXIT LANE GEOMETRY ON BRIDGE TO BE DETERMINED IN NEXT DESIGN PHASE

J. PETRUSA

CON III
LOT 22

9+700

(COUNTY RD. 34) CONNECTION RD

W-S

N-EW

E-S

S-EW

W-N

E-N

10+000 CONNECTION ROAD
9+990 HANLON EXPRESSWAY

HANLON EXPRESSWAY (HWY 6)

9+400

9+500

9+000

PROJECT LIMIT

M. McDONALD

LOT 23

A. MOHENDER

LOT 16

PERSIAN INVESTMENTS LTD.

E. WOZNIAK

LOT 24

10+395 CONNECTION ROAD
11+087 CONCESSION RD. 7

FOUR TOWERS ALONG EXISTING 115kV LINE TO BE RELOCATED

G. & D. DAYMOND

CON VII
LOT 17

CONCESSION ROAD 7

PROJECT LIMIT
11+240

J. JOHNSON

LOT 18

10+500

BAUKHAM

GARDINER

ACCESS TO BE REGRADED

FIELD ENTRANCE

COUNTY RD. 34

PROJECT LIMIT
9+930

PROJECT LIMIT
10+800

10+600

10+950
PROJECT LIMIT

COBURN

SCALE:
0 50 100 150 200m



HIGHWAY 6
FREELTON TO GUELPH

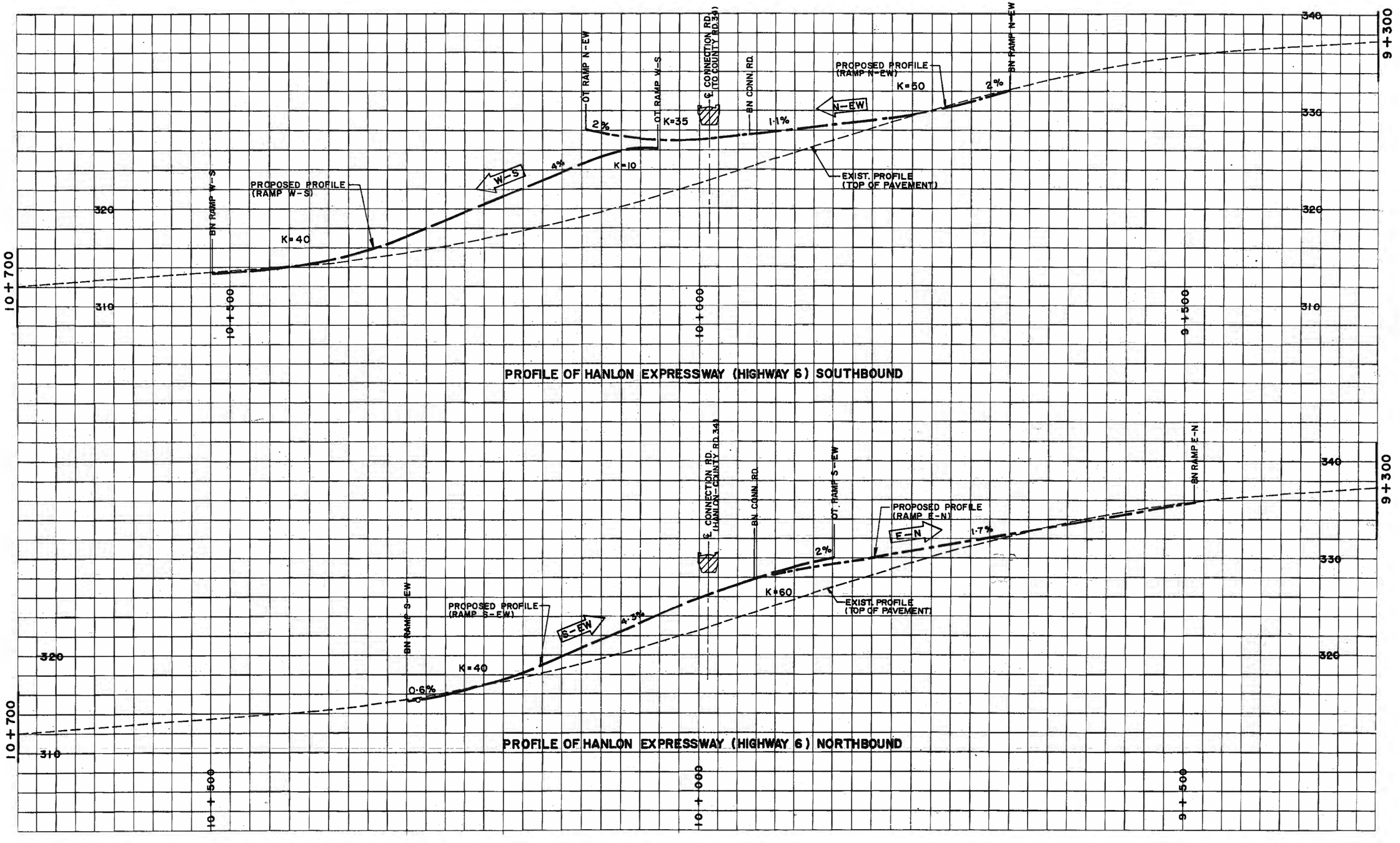
Environmental Assessment
& Preliminary Design Report

LEGEND:
EXISTING R.O.W.
PROPOSED R.O.W.

PLAN

W.P. 65-76-05

PLATE
36



SCALE:

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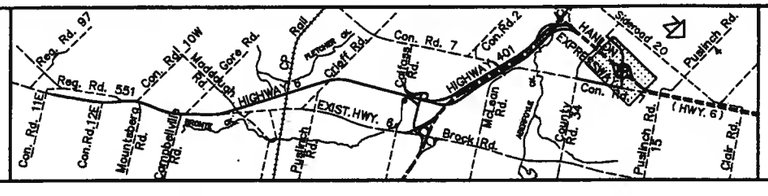
VERT. 0 5 10 15 20m



HIGHWAY 6
FREELTON TO GUELPH

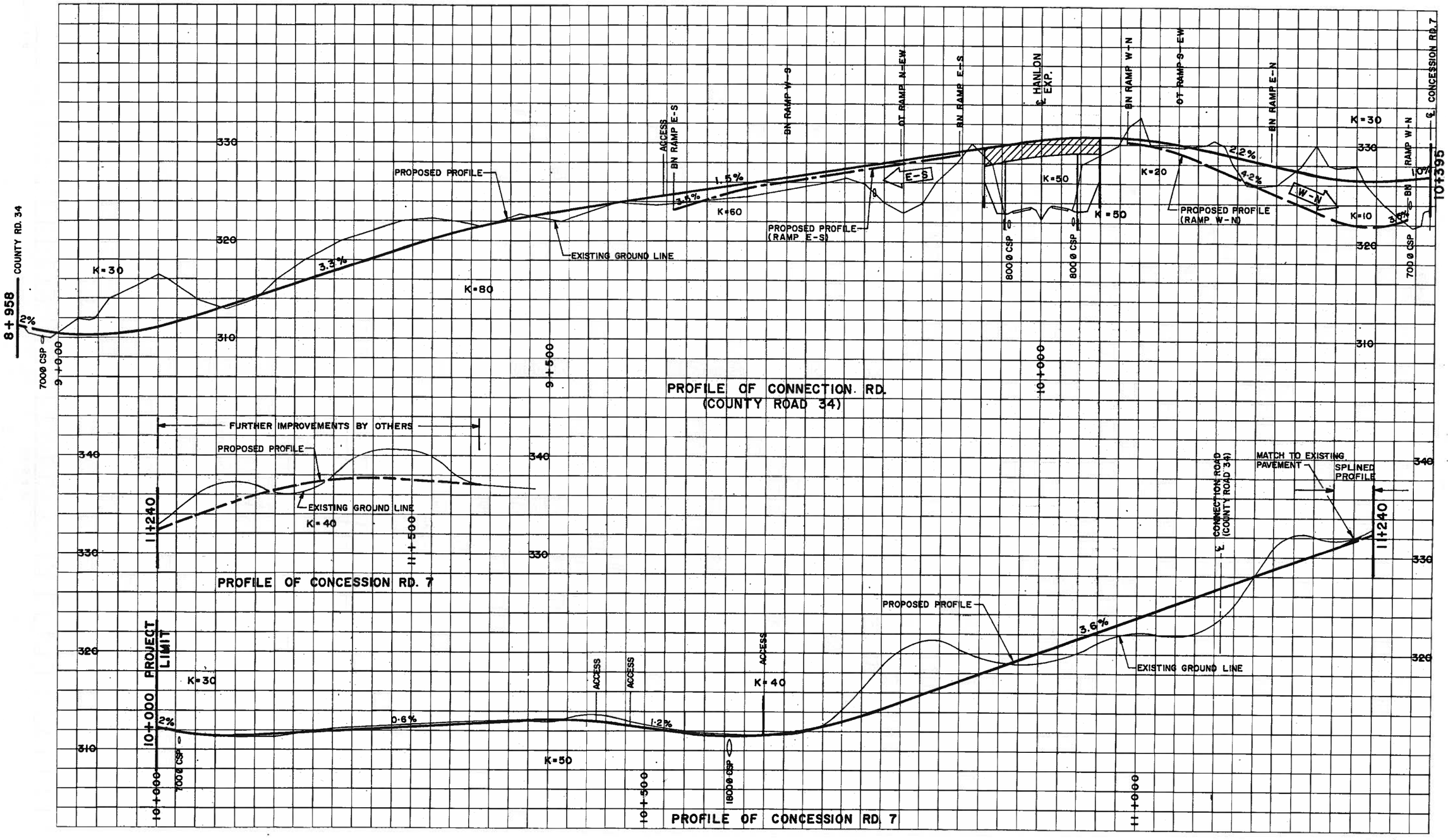
Environmental Assessment & Preliminary Design Report

LEGEND:
- ORIGINAL GROUND
- EXISTING GRADE
- PROPOSED GRADE

PROFILE

W.P. 65-76-05

PLATE
37



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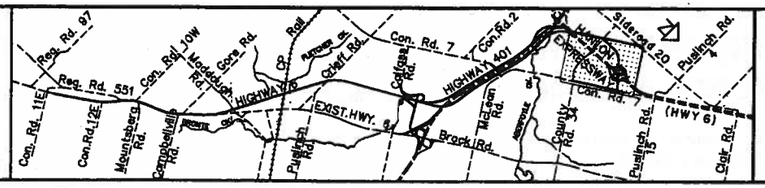
VERT. 0 5 10 15 20m



HIGHWAY 6
FREELTON TO GUELPH

Environmental Assessment & Preliminary Design Report

LEGEND:

ORIGINAL GROUND

PROPOSED GRADE

PROFILE

W.P. 65-76-05

PLATE

38