A FEASIBILITY STUDY ON THE WEILAND FEEDER CANAL

Rehabilitate the Old Feeder Canal Association, Inc.

Box 54, Wainfleet, Ontario LOS IVO

September, 1979

The following report is a feasibility study concerning the rejuvenation of the Old Welland Feeder Canal System. The report has been written at the request of the 'Rehabilitate the Old Feeder Canal Committee' and with the assistance of a Young Canada Works Grant, 1979.

August 31, 1979

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GENERAL RECOMMENDATIONS

Historical sites and structures, related to the Feeder Canal, should be identified through the use of signs and plaques. Creation of Heritage Conservation Districts should be undertaken in the Village of Wainfleet and the hamlet of Stromness. Provisions for the preservation of historical resources should be clearly provided in the "Official Plan" for each community.

Construction of a trail suitable for bicycling, walking and cross-country skiing should be carried out between Wainfleet and the City of Welland.

The naturalness of the environment should be maintained by clearing only those areas designated for canal viewing and activities; unsightly vegetation should, however, be removed. Interpretive sites can be created for the naturalist and student. The effects of trail use on the environment should be checked periodically to avoid vegetation and wildlife degradation.

The entire Feeder Canal system, running from Port Maitland and Dunnville to the Welland River should be excavated as detailed in the engineer drawings. Adequate culverts should be installed wherever a crossing would inhibit water flow. A series of gates can be installed to provide water control up and down the canal. The drainage and irrigation potential of the canal should be developed. Reconstruction of the entire canal will require financing of approximately two million dollars.

HISTORY

Introduction

The completion of the Feeder Canal in 1829 encouraged settlement along its banks. Today, 150 years later, the canal continues to exist in an altered state. Its survival, despite many adversities, provides the region with an opportunity to preserve a very significant historical feature. Along the canal banks related buildings have also struggled to survive. Immediate and careful planning is required to ensure that these remaining resources are conserved.

The objectives of the historical analysis are:

- to identify existing structures and features in order to assist the process of -

    a) educating the population (local and visiting) regarding the role of the Feeder Canal in local, regional and provincial history in an attempt to create an awareness of the local history

    b) developing the historical resources of the canal era to ensure their survival, to educate, and to attract visitors to the area

General History

The Feeder Canal has had a strong influence on the economic, physical and social-cultural landscape of the Niagara Peninsula. However, the historic significance of the canal has been virtually ignored. The "Feeder" has been called a "big overgrown ditch" by many area residents. The preparation of brief histories about the canal communities and the development of historical resources may enable the local population to understand and appreciate their heritage. Hence, it is important to study the Feeder Canal as it has acted to affect settlement patterns, transportation, industries and drainage along its route. This "general history" will examine the initial construction of the canal, its impact on bordering communities and some of the problems the Feeder presents today.

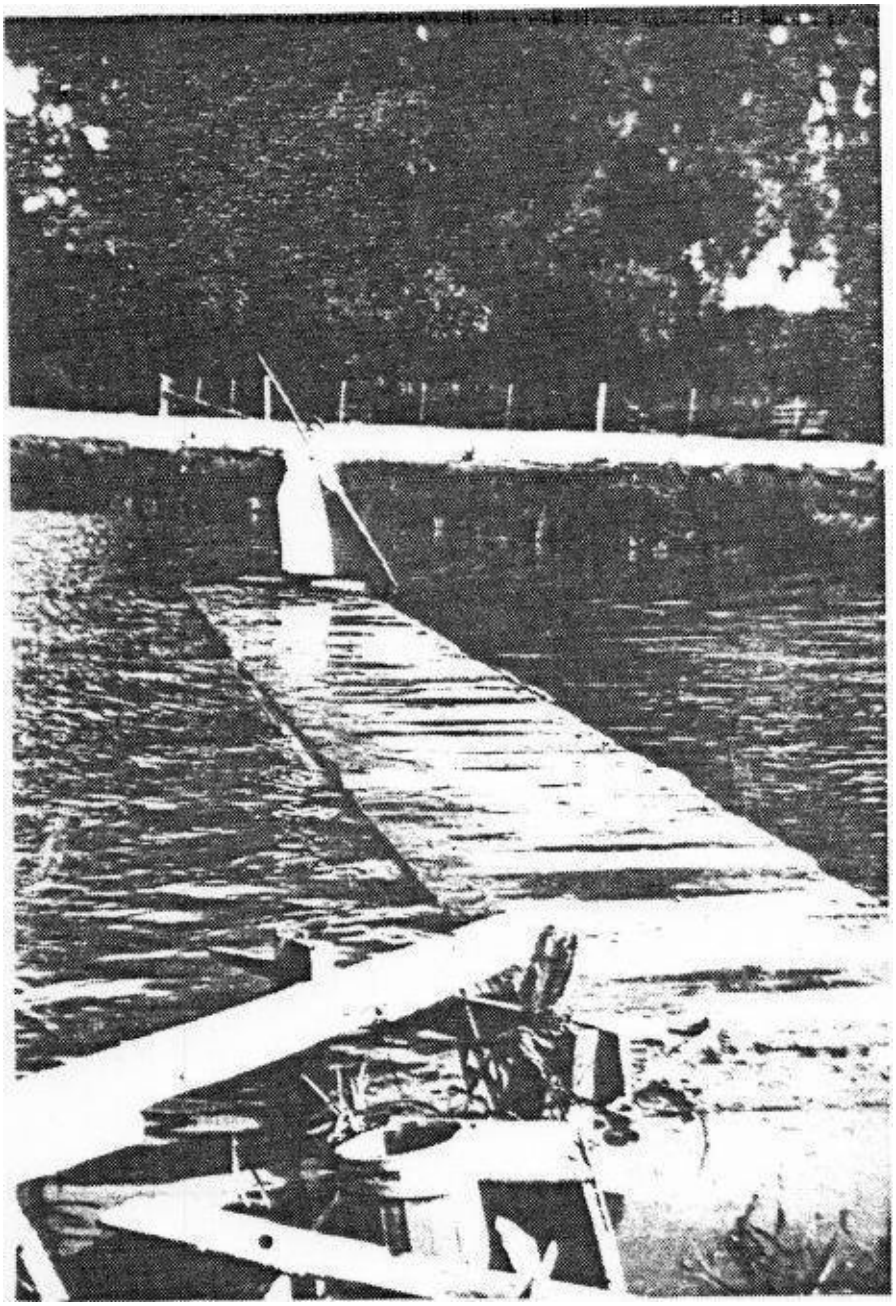
Construction of the Feeder Canal enabled the successful completion of the first Welland Canal. It also encouraged some of the early settlements of the land between Dunnville and Welland. **The canal provided** an additional transportation route for people and products in the area. It also encouraged the growth of industries along its **banks because of** the water it supplied. As a result of the canal's construction the communities of Welland, Marshville (Wainfleet), Stromness, Port Maitland and Dunnville experienced a period of relatively rapid growth. Equally **as important, the Feeder Canal altered the drainage patterns of the region.** Agricultural practices continue to be *affected* by the canal.

peat was too soft for horses and cattle to be used. Construction of the Feeder began in earnest in early 1829. By the beginning of October, 1829 the Feeder was completed, stretching twenty-one miles from the Welland Junction to the Grand River at Dunnville. In less than 214 days the canal was prepared for its official opening at Dunnville, November 14, 1829.[4] However, at some points the Feeder was only two feet deep and four feet wide.[5]

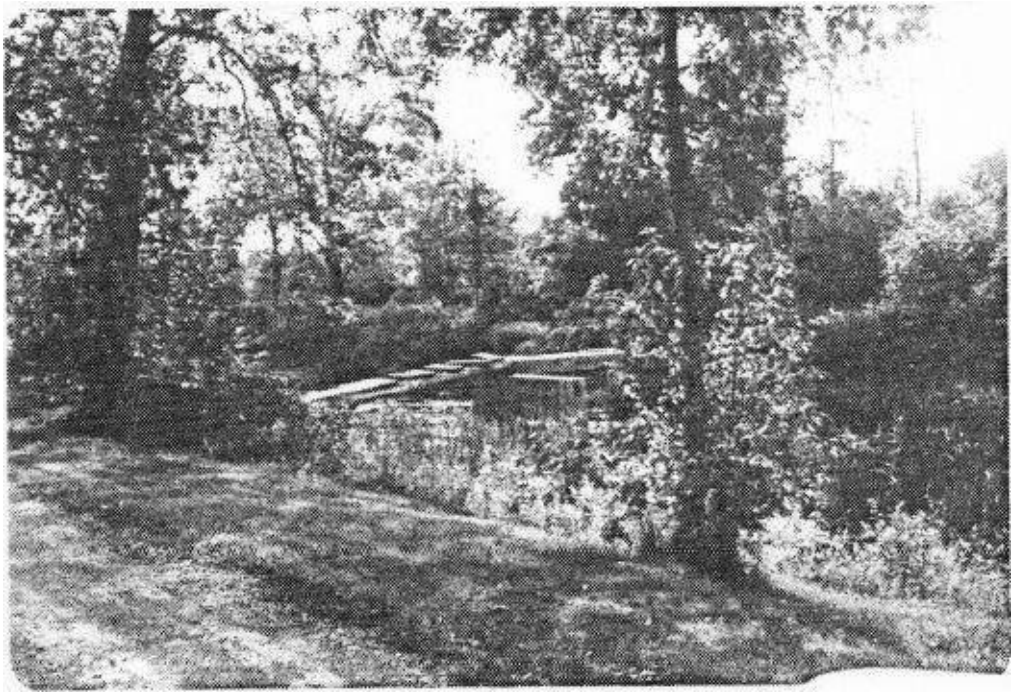
Following its hasty construction the Feeder was plagued with problems. The dam at Dunnville caused flooding of hundreds of acres of land near the Grand River. In 1831, a leak at the dam delayed canal navigation in the spring. The 1832 Welland Canal navigation season was interrupted for about a month because grass was obstructing the water flow resulting in an insufficient depth in the main canal. Subsequently, numerous small modifications were made to the Feeder channel. By 1837 Merritt began to doubt the capacity of the Feeder as a water supplier.[6]

The Feeder Canal was not abandoned. As part of a project designed to deepen and widen the entire Welland Canal system, the Canal Company advertised October 8, 1841 to receive tenders for the widening and deepening of the Feeder.[?] In 1842, the canal ***was*** converted to function as a regular branch of the Welland Canal. The Port Maitland branch of the Feeder was constructed to provide an additional Lake Erie harbour because the Port Colborne route was going to be closed for reconstruction.

Canal Crossings



Floating Bridge
- Stromness



Private Crossing
- Wainfleet

Shortly after the completion of the improved Port Colborne to Welland Junction section of the main canal, the Feeder declined in regional significance. By 1881 the canal ceased to operate as a commercial waterway. Railroads offered an alternate transport mechanism for heavy and bulky articles. The Feeder was left to decline. In 1890 a small schooner, "The Rapid City", was towed through the canal to Dunnville. It was forced to cope with collapsed canal banks, a washed out towpath, and badly rusted bridges. Local people used the canal for pleasure trips but no one planned major industrial activities around the canal. In 1908 a load of wood was sent down the Feeder to serve as trolley line ties. That was the last major commercial activity on the Feeder.

While the canal was operative it played a large role in the growth of several communities. Now, because the canal has declined significantly, it is important to consider the impact the Feeder had on each of these centres. Space limits this overview from adequately describing the total impact of the *Feeder* Canal on the local communities. Further information may be gained by examining selected references at the end of this section.

The wooden aqueduct which was constructed to allow the Feeder to cross the Welland River initiated settlement in the community of "Aqueduct." The centre was renamed Merritsville in 1842 and, finally, changed to Welland in 1858. The Feeder ***was*** the first engineering project to encourage growth at this site.

One of three bridges at Stromness (nearly 190(Ps)

Marsftville - Saw and Roller Mill at left (early MO's)

The original aqueduct was only five or six feet deep.[13] A space was left between the bottom of the structure and the river water enabling barges to travel up the Chippawa (or Welland) River. A wooden lock was built immediately east of the aqueduct and another was constructed at Port Robinson to carry the Feeder into the main canal. In 1842 the aqueduct and canal locks in the region were rebuilt with stone. In 1846 the settlement contained 100 inhabitants, five stores, three taverns, two tailors and two shoemakersJA Welland grew as a transportation centre and industries followed, primarily along the main canal. The Feeder was the initial spur to settlement. It has been virtually forgotten by the community as related features have been torn down, the canal partially filled in, and the remainder of the Feeder re-routed and allowed to fill in with weeds and litter.

The few early residents in Wainfleet Township eagerly awaited construction of the Feeder Canal. They hoped the canal would help the drainage situation and also longed for an adequate road through the Township centre. During the canal's construction, Marshville was the site for the headquarters of the chief engineer on the Feeder. That early period was a difficult time. Local tales tell of tempers flaring along the canal route leading to fights and occasionally deaths.

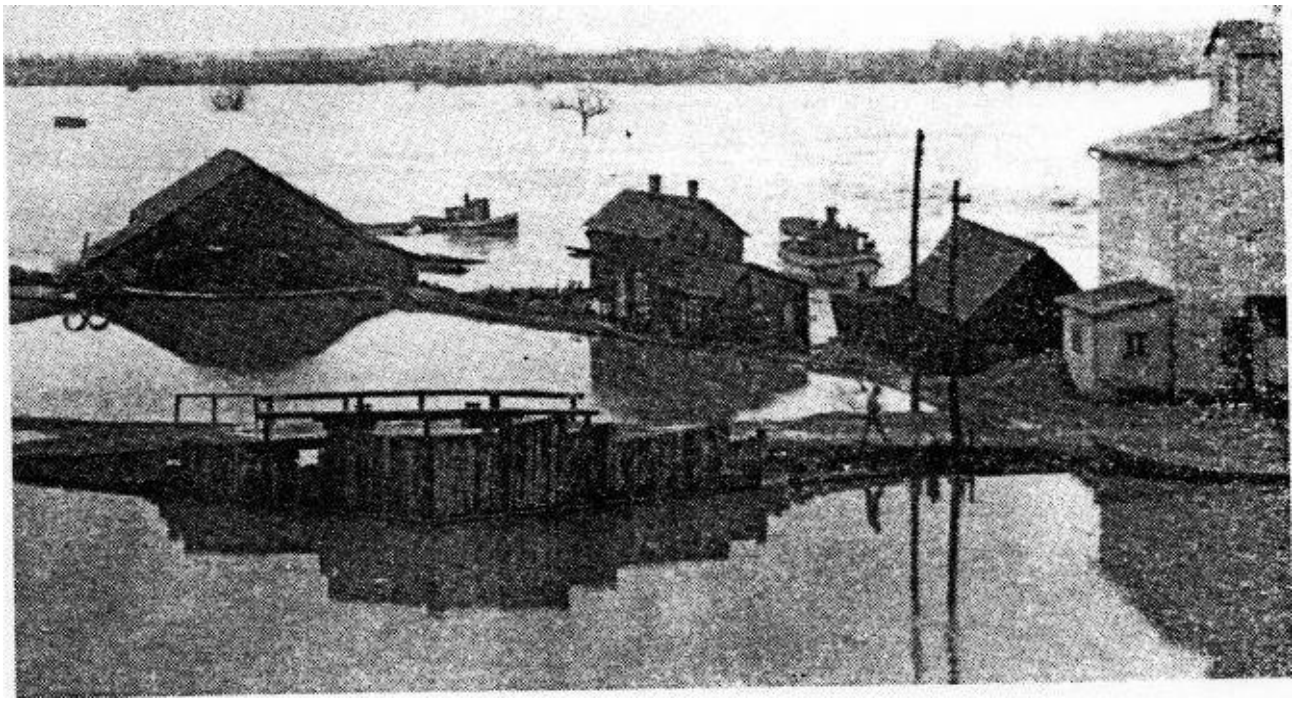
After completion of the Feeder Canal in 1829, the community of Marshville came to life. The centre acted as a distribution point for canal travellers, providing a change of horses, blacksmiths, a store and a post office. By 1846 Marshville had approximately sixty inhabitants15 The village was frequently busy with travellers. Numerous mills sprang up along the canal banks. In 1923, the community was renamed Wainfleet to the delight of many local residents.

The Feeder opened the marsh land to settlement but it did not solve all drainage problems. During the first spring flood after its construction the canal overflowed through existing ditches into the marsh. New drains were built and old drains reconstructed or destroyed where the Feeder crossed the marsh. In 1894 the Township applied to the Ministry of Railways and Canals for assistance so that the back ditches of the Feeder could be widened and deepened to carry water from lands adjacent to the canal to its natural watercourse 16

Stromness grew at a point where the Feeder Canal forked near the Grand River. Lachlan McCallum renamed the Broad Creek Community, Stromness. Senator McCallum began his stay in Canada by cutting cordwood for shipment along the canal. Eventually he owned timber limits, lumber mills, farms, stores and steamers which transported the goods along the Feeder.

Barges transported many materials including stone, wheat, lumber, tanbark, stave-bolts and shinglebolts through the waterway. Blacksmiths were kept busy because the horses used for towing often needed new shoes and the shipyards located at Stromness required related materials. Near the Stromness turning basin commercial fishing boats were built to sail the **Lake Erie waters. As** the canal's condition declined. the industrial activity moved away from this inland centre to other communities.

Port Maitland did not grow initially as a Feeder Canal community. The centre is located at the mouth of the Grand River in a natural harbour.



Dunnville - mills and industries

Dunnville - corner of Bridge & Canal Street

The "village built on sand" was reliant on the naval station found there. The original Grand River dam had been scheduled for construction at the Port but the military officials forbade it. When the Port Maitland extension of the Feeder was constructed in the early 1840's the community had fallen behind the growing centre of Dunnville. Stromness also had industries which might have been located nearer to the harbour community. The canal did encourage some activity at the Port but the boom period was short-lived.

Perhaps more than any other Feeder Canal community, Dunnville owes its existence to that engineering work. The Village, named after the President of the Welland Canal Company, J. H. Dunn, grew slowly initially. The construction of the dam attracted many labourers but they lived in boarding houses and shanties and after the work was completed moved away.[17] The dam provided an eight foot drop in the water level from the Grand River. Locks were installed to provide a water supply and flood gates were constructed in the centre of the dam.

To encourage some industrial activity along the entire canal system, the Canal Company offered exemption from rent for as "long as grass grows and water runs," to the first mill or factory in running order. Mr. Oliver Phelps, of Dunnville, successfully completed his mill and sent his ground wheat down the Feeder. Subsequently, numerous mills, blacksmith shops and supporting stores, homes and taverns came into existence. Many of the mills were located between the Feeder Canal and the Grand River. Dunnville became a busy shipping centre as improvements to the Feeder and the Grand River encouraged traffic between many centres including Brantford, St. Catharines and Port Colborne along the waterways.

The Grand River community diversified its commercial activity enough to survive the decline of the Feeder. In fact, Dunnville began to look at the Feeder as an obstacle to community growth. By 1890, the canal was closed to traffic and in the town centre the canal was completely filled in. All traces of the waterway were buried. In 1940, the Town council voted to change the name of Canal Street to Queen Street. At one time the Dunnville farmers complained that the canal interfered with the drainage of their lands. However, in the 1940's, area farmers requested a re—opening of the canal to a water level of two to three feet[8]

Since the Feeder declined as a commercial waterway the local communities have had to cope with an abandoned and overgrown channel. Beginning in the 1880's each township approached the Minister of Railways and Canals with Feeder related problems. The canal which acted to affect the settlement pattern of each community presented new problems for the residents. It became overgrown with weeds and filled in with sediment.

In 1947, the McGeorge Drainage Report, initiated by the Department of Transport, admitted that the canal created some drainage problems in Wainfleet Township. *As* a result, 1950 saw the establishment of the Consolidated South Wainfleet Drainage System supported by some government funding. Controversies continued as Welland re-routed its portion of the canal through the Brown Tap Drain and into the Welland River. In Dunnville, water leaving the Grand River flowed through a section of tile under the filled in Feeder. This lessened the water

flow through the Feeder and affected all of the communities along the route. Finally, Wainfleet took responsibility for its section of the canal in 1964, after numerous attempts by the Department of Transport and the St. Lawrence Seaway Authority to rid themselves of the problem. With the creation of the new Town of Dunnville, two Feeder Communities now have responsibility for the abandoned channel. Only in Welland does the Department of Public Works have control over that community's portion of the Feeder.

Unfortunately, there has been a tendency to overlook the Feeder Canal's proud history even while the drainage problems which it has contributed to have often drawn community attention. Each community's Feeder Canal heritage may be preserved if action is taken to recognize its remaining resources.

FOOTNOTES

[1]Harold V. Melick, "Two Craft of the Feeder Canal," Dunnville Chronicle, October 25, 1972.

[2]J. P. Merritt, Biography of the Hon. W. H. Merritt, (St. Catharines: F. S. Leavensworth).

[3]D. Michener, The Canals at Welland.

[4]Various sources give different data for the actual time taken to construct the canal.

[s]DeWitt Carter, The Welland Canal: A History, (Port Colborne), p.31.

[6]Merritt, op. cit., p. 168.

[7]J. Lawrence Runnalls, The Irish on the Welland Canal, (St. Catharines: Public Library), p. 18.

[8]Ibid.

[9]Carter, op. cit., p. 44.

[10]Report of the Chief Engineer of Public Works on the Enlargement of the Welland Canal, 1872.

[11]The Welland Ship Canal 1913-1933, reprint of Articles appearing in "Engineering" London, 1935, p. 7.

[12]The Niagara Chronicle, February 18, 1845.

[13]Michener, op. cit., p. 24.

[14]Wm. H. Smith, Smith's Canadian Cazeteer, 1846, (Toronto: fascimile edition, Coles), p. 113.

[15]Ibid., p. 112.

[16]Wainfleet Public Library'reporc.

[17]P. J. Donovan, "The Early Days in Dunnville and Its Vicinity," (St. Michael's Parish Almanac).

[18]Newspaper clippings from a black binder at Dunnville Public Library.

Historical Resources

The following structures and sites have been identified because of their historical significance. They may be significant because of their age, past owners, architecture, or significant contribution to the community. These features were identified through library research, old pictures and conversations with long—time community residents. By searching through Land Registry Titles and by examining the Provincial Archive records it may be possible to gain more insight into the early history of the canal communities. Although the roads along both sides of the ***canal*** are not always referred to as Feeder Roads in the municipalities, they have been assigned this name for simplification. The road running along the south bank of the canal marks the approximate location of the old Feeder towpath.

Welland

Much of the Feeder Canal route in this area has been severely altered or filled with land. The City could place a plaque (perhaps near the old junction lock) in a central ***area*** to ***acknowledge*** the impact the canal had on Welland's early growth. Further research into the history of all the canals at Welland will enhance the local understanding of the Feeder's role in the City's development. Unfortunately, most of the historical resources related to the Feeder have already been lost.

Hydraulic Raceway

Analysis

Location: A channel was built from the intersection of the Feeder and the Welland Canal at Broadway Avenue in Welland. It ran immediately west of the Welland Canal to the Lincoln Street area where it veered slightly west and continued along the route of Prince Charles Drive until it emptied into the Welland River.

Ownership: City of Welland

Condition: The channel is now filled in.

Significance: By 1881 the water from the Feeder Canal was no longer needed to maintain water levels in the main channel. At this time the channel known as the "Hydraulic Raceway" was constructed. The fall from the water level in this channel to the Welland River was used to generate power. The Clayton Page—Welland Electric Light Company generated power at this site until 1906 when the Ontario Hydro lines were moved into Welland. The Feeder continued to supply water for the Welland area after its usefulness as a transportation route was ended.

Planning Alternatives/Proposals

Use: A sign could be placed along Prince Charles Drive to indicate that it was once the route of the hydraulic raceway.

Legal: Contact must be made with the City of Welland regarding placement of a sign.

Costs: Construction and maintenance of a sign.

Effect: Education of public regarding the Feeder and the local industrial heritage.

Junction Lock at Welland

Analysis

Location: North of Broadway Avenue, east of Highway 58 and west of the Welland Canal.

Ownership: The junction lock is located within the park land owned by the Federal Government under the jurisdiction of the Department of Public Works.

Present Use: In this landscaped area the traces of wall remain just visible **above the surface and are unmarked.**

Condition: Although much of the structure is buried, that portion above ground **may be easily recognized.**

Significance: This lock once connected the Feeder to the main canal at **Welland. It has been dated back to 1851. It is one** of the ***few*** remains of the Feeder Canal in Welland.

Analysis of Surrounding Landscape: Situated in a park like location this feature does not appear to be imminently doomed. It is located next to a **busy intersection and close to the old Welland Canal.**

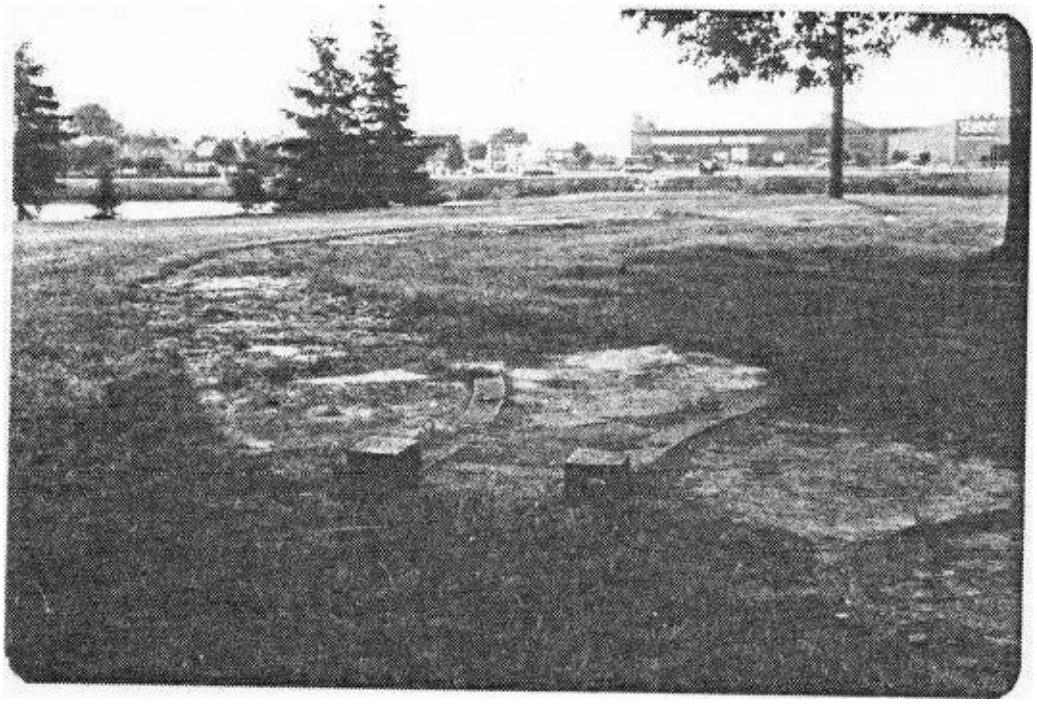
Planning Alternatives

Use: Situated in a park-like setting the remains could be easily identified by placing a sign **at this site.**

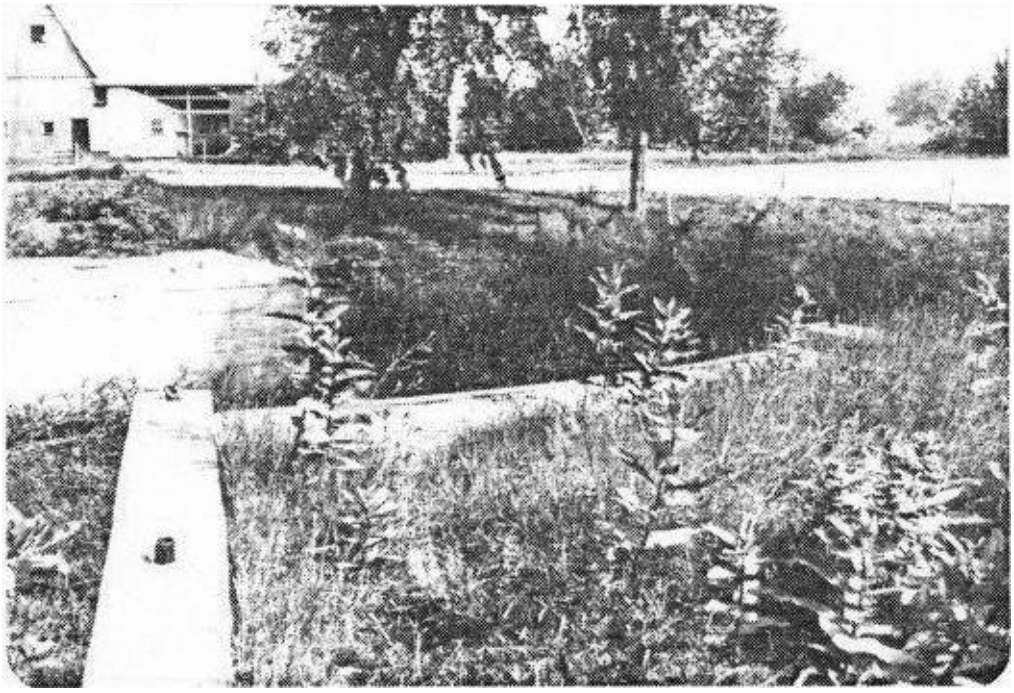
~~Legal~~: Consult the Department of Public Works about the possibility of posting a sign.

Costs: Construction of sign and maintenance.

Effect: Education of public regarding existence of **Feeder Canal.**



Welland Junction Lock



Forks Road Swing *Bridge* Remains

Wainfleet

The Wainfleet Community may consider itself rich in historical resources. Many features have been preserved along the canal bank. These structures have survived because they were modified to meet the agricultural community's needs. Unfortunately, many other canal related features were not protected in this way. It is strongly recommended that the Wainfleet Municipal Council act quickly to establish a Local Architectual Conservation Advisory Committee (LACAC) group to study the community's historical resources. Protection should be given to those sites identified in this report. One of the most effective means of protection would involve the creation of a Heritage Conservation District in the hamlet.

The local heritage would be enriched with further studies into many other features. Among these are: numerous homes, churches, an abandoned brickyard (near the Mill Race at Church Street), the site of an old cheese factory (across from Dayboll's), a feed shed which used to be an implement shed along the canal, and the site of the old livery stable (near the Township equipment storage shed). Most of the old core of Wainfleet owes its early growth to the Feeder Canal and the industries and people that it attracted. The Municipal Government's concern with heritage preservation must be clearly documented in its plans, to ensure the survival of Wainfleet as a canal community. Wainfleet could initiate its heritage awareness program by supporting the construction and placement of a sign along the canal, near Highway 3, identifying this historic waterway. See Map 5Ca).

Forkes Road Swing Bridge Remains

Analysis

Location: South of present day Forkes Road.

Ownership: Municipality of Wainfleet.

Condition: Only the two side supports of the bridge remain. There are also a few metal pieces of the bridge at the site.

Significance: This bridge was the most easterly canal crossing until Welland. Nearby there was a dock used in the grain shipping process.

Analysis of Surrounding Landscape: Forkes Road is located along the side of these remains. It is a well travelled regional road. There are several farms adjacent to the canal at this point.

Planning Alternatives

Use: A sign could be placed at this point to identify the bridge remains. This would also identify' the Feeder Canal for those travelling along Forkes Road. This point may also be worthy of consideration as a point for reconstruction of a swing bridge.

Legal: There appears to be no immediate threat to this site. It could be designated as a historical site by the Municipal Government. A sign may be the best way co ensure no action is taken to destroy the site without careful consideration.

Cost: Construction and maintenance of sign. The Restoration Services Division, Engineering and Architecture Branch of the Department of Indian and Northern Affairs will be forwarding approximate bridge reconstruction costs after the completion of this report.

Effect: This crossing will help to inform passers—by about the canal's existence. A swing bridge would be a tourist attraction.

Palcso Blacksmith Shop

Analysis

Location: South side of Canal, Feeder Road, Wainfleet, east of Highway 3

Ownership: Mrs. Palcso

Present Use: Family storage building. The building contains some old blacksmith and wagon maker equipment.

Condition: Although the building has not been used as a blacksmith shop since 1974 it is still in very good condition. The interior has been well preserved although the pine floor does show signs of wear.

Significance and Historical Sketch: Constructed in approximately 1860, this building's age and special function make it a significant historical structure. The building ***was*** originally located along the mill race approximately 100 yards from Highway 3. It was used for many years as a wagon maker's shop. Charles Fritz was a longtime occupant. Records show he operated the facility prior to 1881 until after 1910. When Mr. Palcso purchased the building in 1934 it had been sitting empty for a number of years. The structure was moved to its present site, August 6, 1934. At this site the blacksmith was kept busy, repairing farmers' tools and road construction equipment.

Analysis of Surrounding Landscape: Rural community setting. Nearby Highway 3 provides an excellent access route. The Feeder Road is also paved and in relatively good condition at this point.

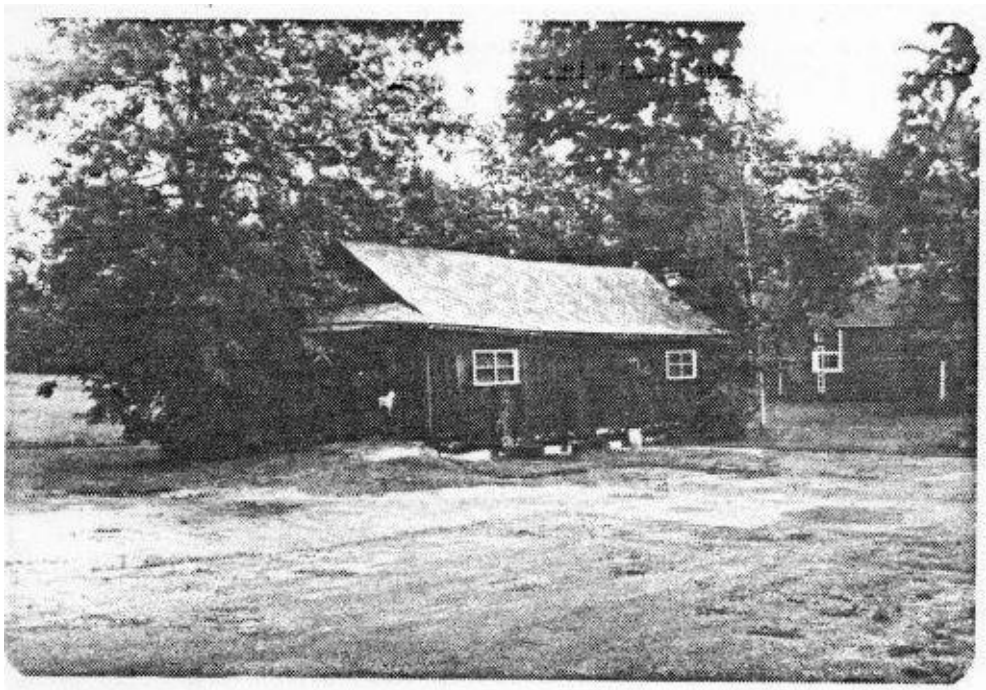
Use: A sign will be required to identify the building. This building could be conserved to provide an example of a blacksmith shop. It has, in its natural setting, been well preserved and would not require a great deal of investment to rehabilitate. Perhaps the building could be opened to the public for a limited number of hours each week. Displays of blacksmith tools could *be* set up. Feeder Canal memorabilia, primarily related to industrial activity,might also be kept at this location creating a miniature Wainfleet museum.

Legal: If the Wainfleet Municipal Council proceeds with the proposal to designate a Heritage Conservation District in Wainfleet, this building could be included in that area. However, because the building has been well protected inside, it might be designated individually. Alternately, because of the proposed plan to open the building to the public it may be necessary to adopt some form of easement or covenant with the present owners. This will ensure public access to the structure. Consultation with the Ontario Heritage Foundation will be necessary to ensure that the proper procedure is followed.

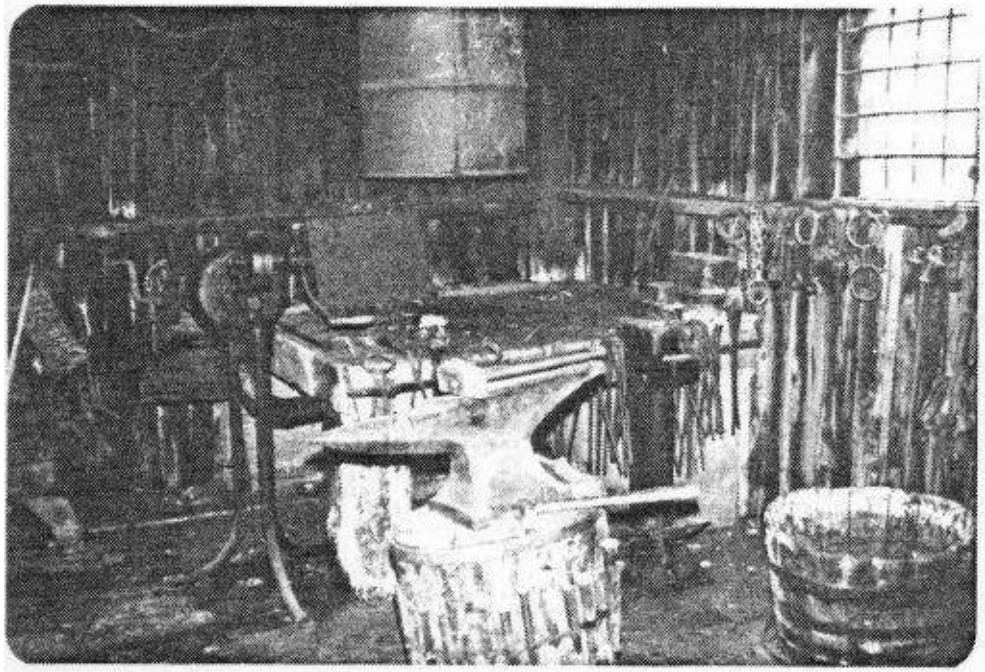
Costs: Construction and maintenance of sign. Rehabilitation of the structure. Preparation of additional information and displays for visitors.

Miscellaneous: Consultation with the present owner should begin as soon as development is initiated. Some of the historical resources, including some blacksmith equipment from this building, have already been donated to museums in nearby communities. Planning for parking facilities should also be considered.

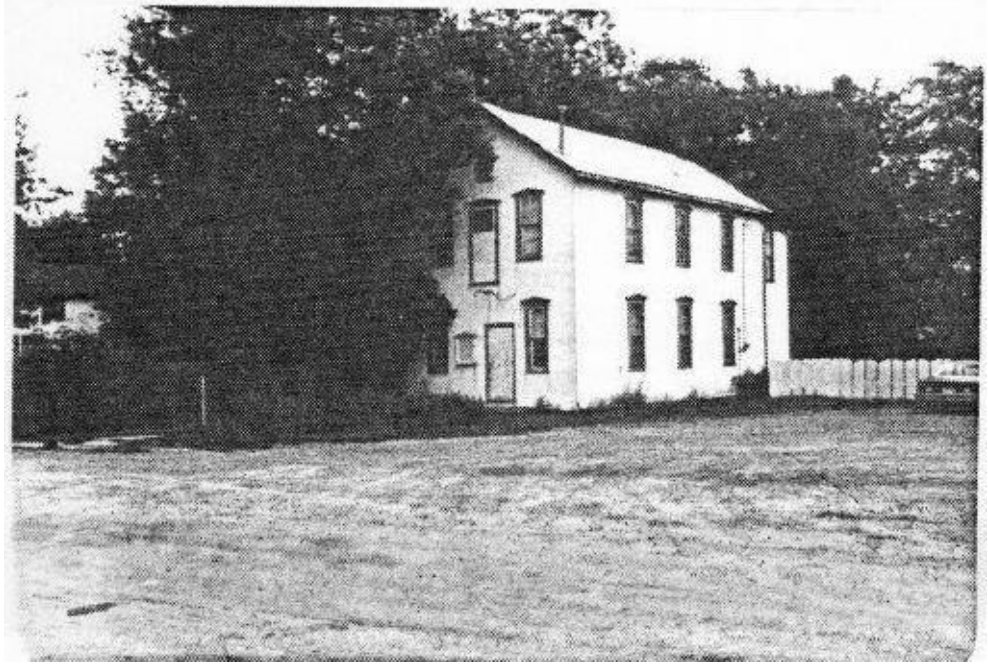
Effect: Education of the public regarding the historical role of the blacksmith and wagon maker. Potential tourist attraction which could inform visitors about the industrial history of the Canal Communities.



Wagon Maker - Blacksmith Shop - Palcso's, Wainfleet



Inside the Blacksmith Shop



Orange Lodge Hall, Wainfleet

Orange Lodge Hall

Analysis

Location: South side of canal, Feeder Road, east of Highway 3.

Ownership: Orange Lodge

Present Use: Meeting of Orange Lodge. They will rent the hall to other groups.

Condition: The two-storey building was moved back from the road a number of years ago. It has been well preserved.

Significance and Historical Sketch: Built in 1890, the Orange Lodge Hall has served a special function as a meeting place for many organizations. As well as the Orange Lodge it has housed the Sons of Temperance (Cedar Branch) meetings and provided room for school children when the schools were crowded. It could be preserved to represent the social organization of an earlier time. The Hall is located very near to, or on, the site of the first school in the Marshville community.

Analysis of Surrounding Landscape: Rural community setting, location next door to a well-used variety store and very close to Highway 3, this building is in an accessible location.

Planning Alternatives

Use: This building could be modified to serve a new purpose. At the present time the facility is being underused. Should the Orange Lodge be willing to sell the building, interior modifications could be made to create a restaurant in the building. Its historical setting could be incorporated in the restaurant's interior design. The menu might also be designed with the canal theme in mind. The proximity to Highway 3 would make it accessible to neighbouring communities and to tourists who travel along that route. (refer to Map 2)

This building could also be modified to create a museum which could house a great deal of information about the Feeder Canal and the Wainfleet Community. Alternately, a craft shop could be set up. The facility would be suitable as a meeting hall, but other buildings are already designated in the area for that purpose.

Although the building has its own sign, another sign should be posted in keeping with the canal system.

Legal: This building is recommended for designation within a Heritage Conservation District in Wainfleet. Adaptive uses may involve additional legal complexities.

Costs: Construction and maintenance of a sign. Additional costs may be involved depending upon the adaptive use which is chosen.

Miscellaneous: It is hoped that local residents will ensure the preservation of this structure until it is designated by Municipal Council. Studies should *be made* concerning potential traffic and parking problems.

Effect: Heritage awareness will be encouraged. A tourist population may be attracted.

Marshville General Store

Analysis

Location: South side of canal, Brown Street, east of Highway 3

Ownership: Mr. & Mrs. Paschert

Present Use: Variety Store

Condition: The store has been well maintained for its function. A number of modifications and additions have been made to the interior and exterior of the building.

Significance and Historical Sketch: This store has served the Wainfleet Community for many years. It was originally operated by Edward Lee who was a very prominent Wainfleet resident. Mr. Lee arrived in Marshville in 1832. He immediately opened a general store to serve the local and canal—travelling population. A portion of the existing building dates back to 1855 and may be the original store. The east wing was added when the old storage warehouse (grain was stored there) was given a quarter turn to its present position.

The store was truly a general store because it featured a wide variety of items including clothing and agricultural equipment. Edward Lee also owned a saw mill and grist mill. He was the postmaster for Marshville and held numerous other civic positions until his death, April 15, 1887. The store has been owned by many other people including William Brown who owned the hotel across the street in 1881. For a number of years a bank was located behind the store. The store owner also operated the bank. Part of that building has since been moved out and the other section may have been incorporated within a Wainfleet family home along the canal.

Analysis of Surrounding Landscape: Situated at the corner of Highway 3 and a rural road, this building is very accessible.

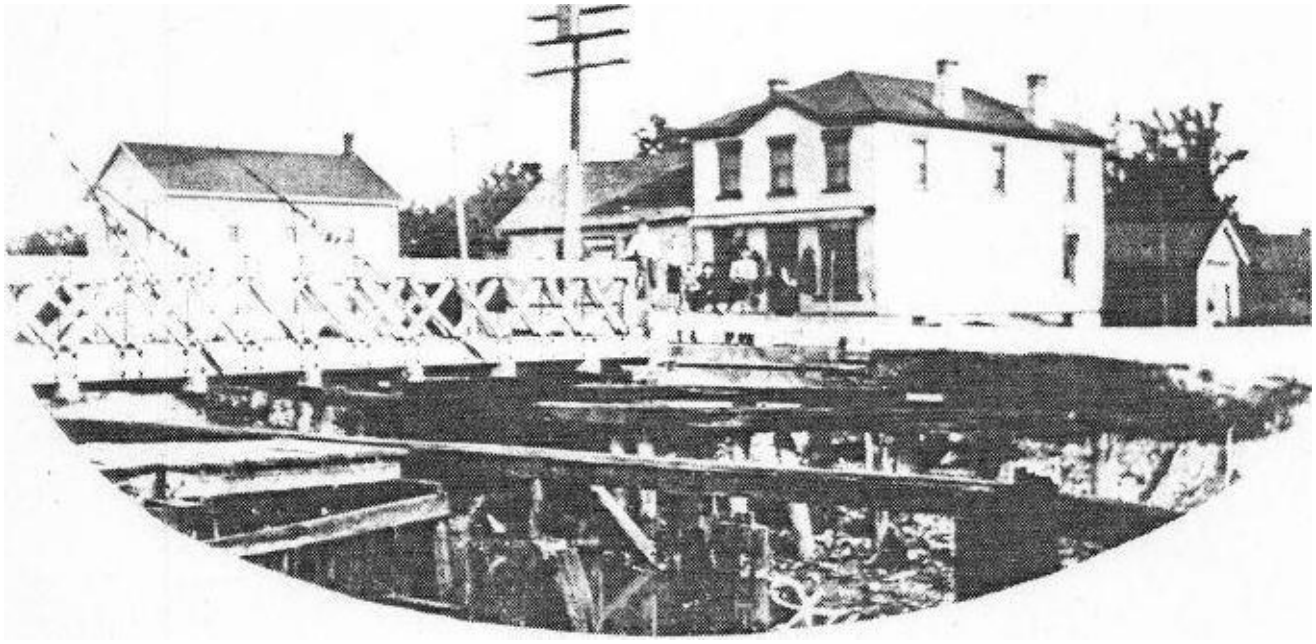
Planning Alternatives

Use: A sign could be posted at the store to identify its historic role.

Legal: The building is recommended for designation within a Heritage Conservation District.

Costs: Construction and maintenance of sign.

Effect: Increased heritage awareness among the local and visiting people. The store may receive additional tourist attention.



Early Harshville, south side of the Feeder

The General Store, Wainfleet - 1979

Edward Lee's Home

Analysis

Location: South of the Feeder Canal and the old General Store, along the east side of Highway 3.

Ownership: Mr. J. Anderson

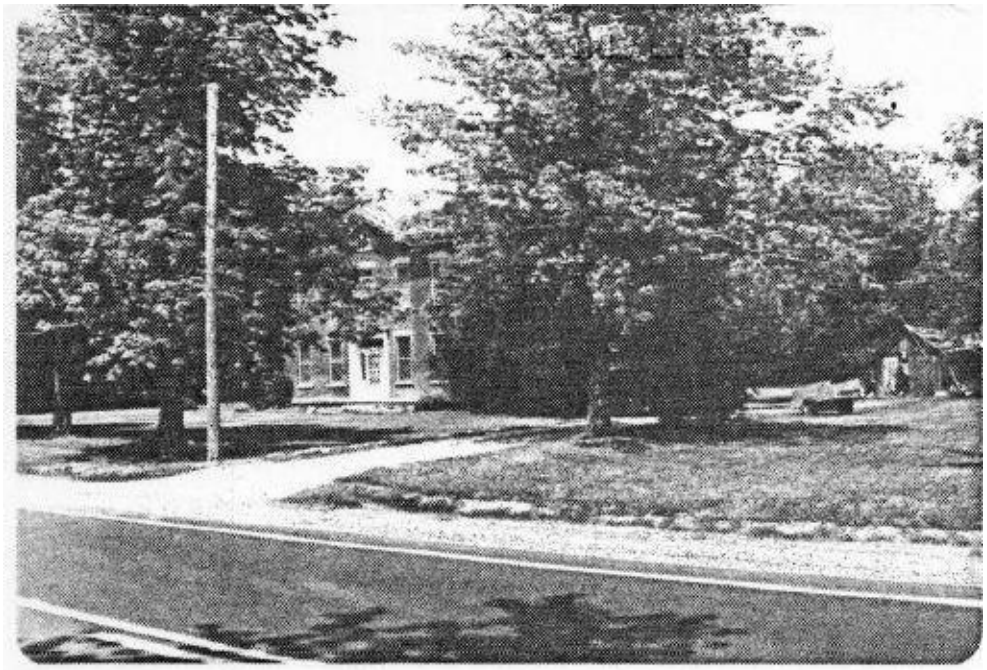
Present Use: Family home

Condition: This building has been well maintained with some interior redecoration. The exterior has been well preserved, although the old front porch has been dismantled.

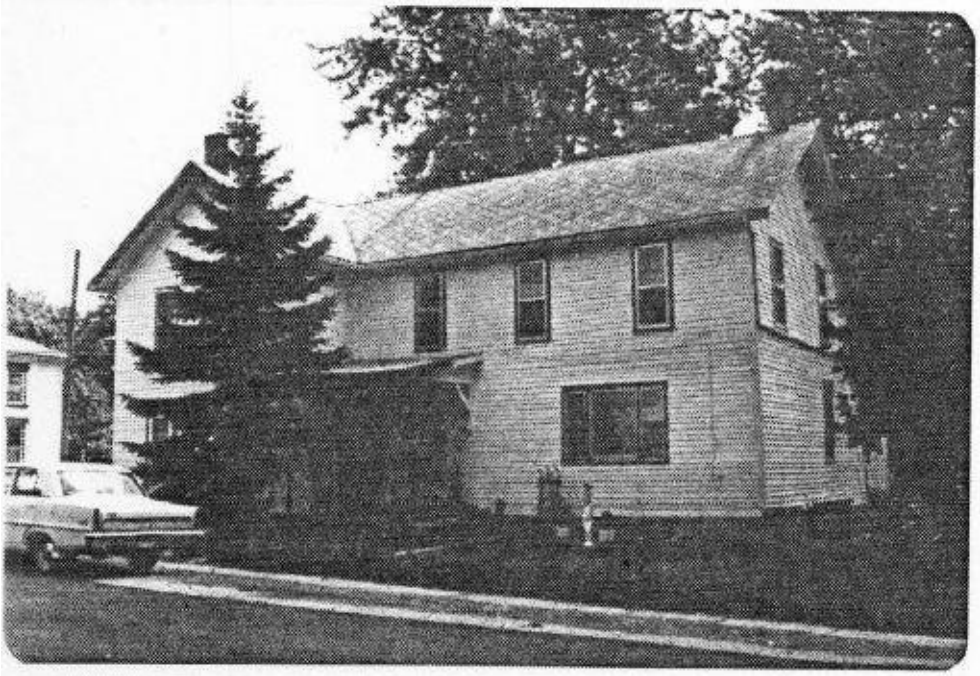
Significance and Historical Sketch: This building was built for Edward Lee. The brick was made at a brickyard located on the banks of the Mill Race. The brickyard was near Church Street and the Anglican Church located there. Mr. Lee has been called the "Squire of Wainfleet". He was born in Monaghan, Ireland, November 4, 1811 and travelled to Canada in 1826. (The Feeder Canal's construction led him to settle in Marshville.) When he arrived in Wainfleet in 1832 there were no roads in the area and only a few huts located along the canal banks.

Edward Lee, Esq., became a community leader. He served as postmaster for 45 years, was appointed as a Justice of the Peace in 1877, was Reeve of the Township Council in 1882, and was Warden of Welland County at the time of Confederation.

Analysis of Surrounding Landscape: Easy access to the structure is possible via Highway 3. The house is located in the Wainfleet hamlet.



Edward Lee's Home
Wainfleet



The Old Hotel
- wainfleet

The Postmaster's
- Wainfleet

Use: The building is well suited to its present function as a family dwelling. A sign would be very appropriate to identify this significant site. Perhaps the importance of Edward Lee as a community founder will eventually lead to the commemoration of this site with a more elaborate cast metal marker.

Legal: This site should also be designated within Wainfleet's Heritage Conservation District.

Costs: Construction and maintenance of sign.

Effect: Community pride and heritage awareness will be encouraged.

Mill Race

Analysis

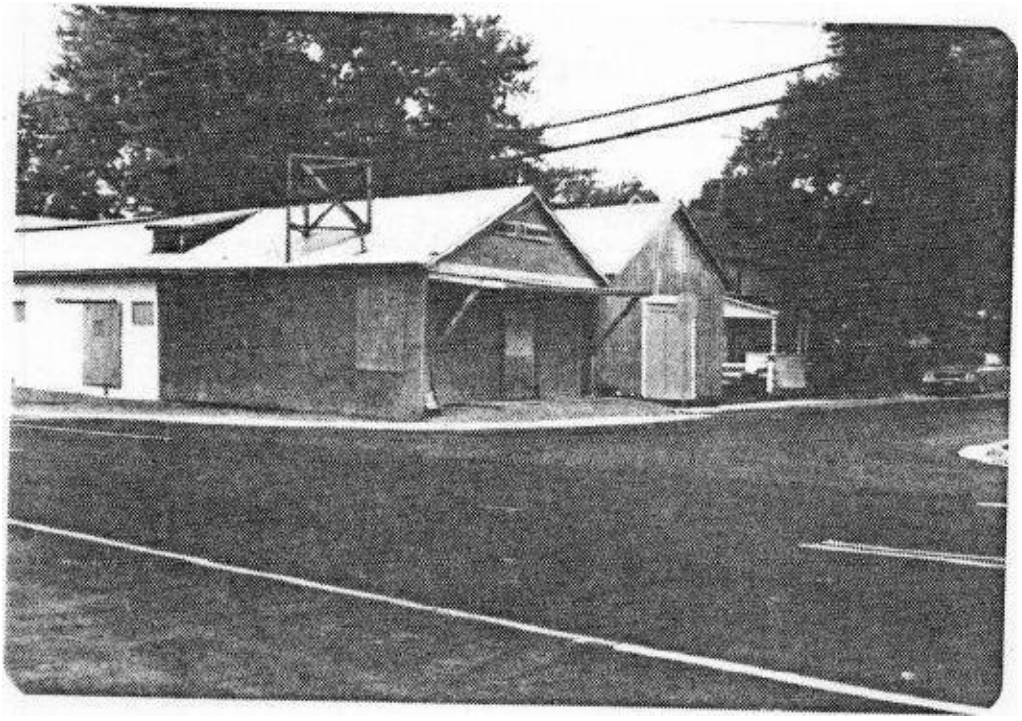
Location: North side of the canal. The mill race originates on the west side of Highway 3 at the canal, crosses underneath the highway and runs on to Forks Creek.

Ownership: Municipality of Wainfleet

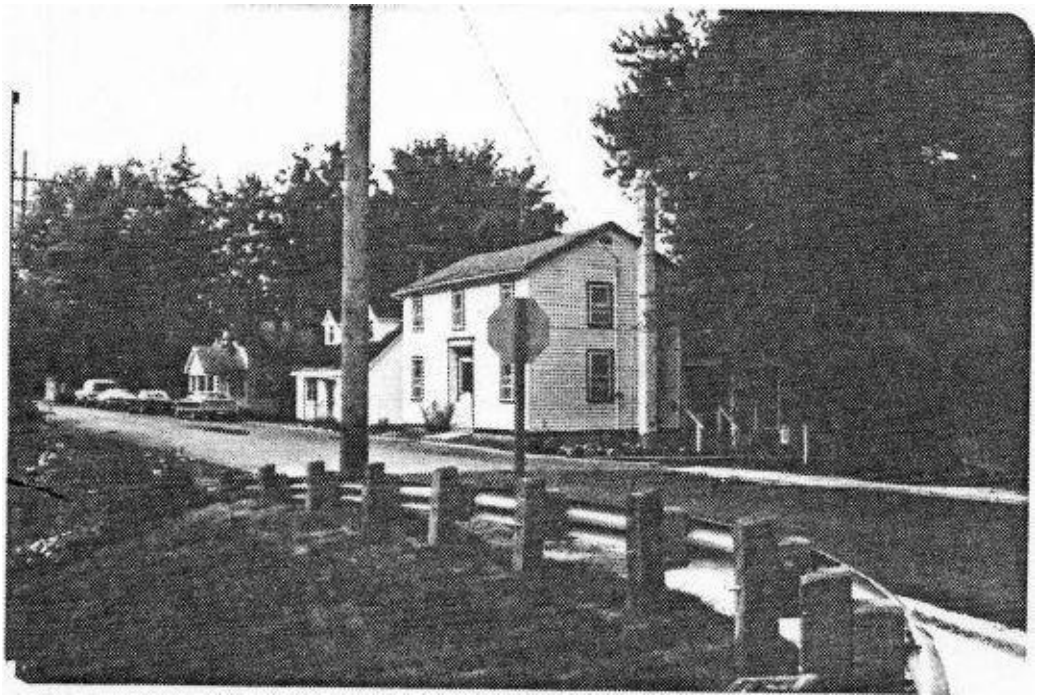
Present Use: Drainage ditch

condition: money received in 19)1 from **the Department** of Transport was used to clean and reconstruct the old mill race at that time. The ditch has been **fairly well preserved although weeds line its banks and infilling** does occur.

Significance: The Mill Race supplied water from the Feeder to power the local mills. It ran **behind** a saw mill and a roller mill along the ***canal*** bank. These two structures were removed a few years before 1929. The Mill Race remains as a symbol of the industrial activity that the Feeder Canal encouraged.



Carter's Storage Building



Northwest view of Wainfleet along the canal

Use: There is a need for signs to be placed along the Mill Race to explain its original purpose. The crossing at Highway 3 would be an excellent place to position a marker. Another sign could be placed at its Feeder origin point.

Legal: Because the ditch is incorporated within the municipal drainage network, it does not appear to require any special protection. Perhaps miniature models of the operating saw and roller mills could be prepared to set on display at a proposed museum.

Effect: Education role regarding industrial activity in the region.

Carter's Storage Building

Analysis

Location: North side of canal, Feeder Road, east of Highway 3.

Ownership: Mrs. Carter

Present Use: Storage shed

Condition: This building has been modified on the interior and exterior to meet the needs of its present function. It has been well-kept in this new form.

Significance: This building served as a blacksmith shop for many years. Recent blacksmiths include Mr. John Carter and Mr. Palcso. It is also rumoured that the building was used as a storage shed during the canal construction period although no evidence has *been* found to substantiate this belief.

Analysis of Surrounding Landscape: The building is located in the hamlet of Wainfleet. The building's location near Highway 3 makes it a very accessible structure.

Use: The building is presently being used as a storage shed. A sign may be placed at this site to illustrate the structure's long history in the Wainfleet community.

Legal: The site may be considered for designation within a Heritage Conservation District.

Costs: Construction and maintenance of a sign.

Effect: The building may be recognized and then studied as a structure which has experienced several changes in purpose.

Brown's Hotel

Analysis

Location: South side of the canal, west of Highway 3, Feeder Road Ownership: Aldridge Family

Present Use: Family dwelling

Condition: The building is generally in good condition. Because it is a very large building, sections of the structure are closed off when the family does not require the extra space. Much of the interior has been modernized and the exterior is well preserved.

Significance and Historical Sketch: This building served as a hotel for many years. At least a portion of the hotel was built in 1850. That foundation was laid by William Gifford and his son, Thomas. William Brown was the proprietor of the hotel during *the* late 1870's and 1880's. During the hotel's early history it catered to canal travellers. Abraham H. Bradley purchased the hotel prior to 1892 and sold it in 1897 to Elba Farr. Subsequently, the Losch, Dayboll, Blanchard and Aldridge families have owned the building.

During William Brown's period of ownership a sample room was kept with suits which could be ordered from the corner store. This room was located "downstairs facing the highway where there's a little step close to the back ditch." At one time the hotel housed Wainfleet's first library in the first floor room at the north-east corner.

The structure has retained some cf its old character. The building *was* lit by coal and then by gas until electricity was installed. Some of the gas pipes are still visible. The cellar floor was originally constructed of brick. There used to be a little shed on the back of the house where beer barrels were rolled down into the cellar, but it has been destroyed. Other bits of hotel memorabilia have been collected by the past owners.

Analysis of Surrounding Landscape: The hotel is located at the busy Highway 3 - Feeder Road intersection. In this rural community it is situated at one of the busiest intersections.

Planning Alternatives

Use: The building is large enough to be used for a variety of purposes. One proposal might be to modify the interior of the building and redesign itto act as a hotel again. This could attract tourists to the region for a quiet overnight visit. This would involve further historical research and private planning to prepare a hotel facility.

Another possible alternative would be to redesign some of the interior to house theatrical displays. Perhaps a local group could be formed to recreate some of the entertainment of the time period when the Feeder was prominent in the region. This might include local musical groups or small dramatic productions.

Significance and Historical Sketch; This building is a picturesque dwelling along the Feeder banks. For many years the general store owners lived in the house (after William Brown purchased the store). These men were in charge of the mail; hence the "Postmaster's House" is the name assigned to the structure. A Dr. Marshall owned the house for approximately four years, breaking the traditional general store ownership pattern. The Minors purchased the house from him and re-established the tradition. The original portion of the house was built some time in the 1840's. In the 1890's the back section was added to the main building. There may have been a wagon maker's shop located in the south-east corner of the property at an earlier date.

Analysis of Surrounding Landscape: The building is located in the hamlet of Wainfleet. Just off Highway 3, it is *easy* to reach. It is tucked back in off the Feeder Road (Brown Street).

Planning Alternative

Use: A sign may be placed near the building to identify its age and role in the community's growth.

Legal: This building may be designated as part of a Heritage Conservation District.

Costs: Construction and maintenance of a sign.

Effect: Other community residents may be encouraged to explore the history of their own dwellings and their local community.

Mill Race
- Wainfleet -

The Pettit Road Bridge

Pettit Road Bridge Remains

Analysis

Location: Pettit Road crossing

Ownership: Municipality of Wainfleet

Condition: Concrete blocks are located at this site where a wooden swing bridge once operated.

Significance: This bridge site is significant because it helps to illustrate the transportation problems posed by the Feeder. While the Feeder aided water transport, it often cut land transportation routes. Many bridges were built to cross over the Feeder. *As* the canal's condition declined more bridges were added to enable local people to cross over the water. An old photograph of the bridge enhances the significance of this crossing.

Analysis of Surrounding Landscape: The bridge site is located in an agricultural section along the canal.

Preservation Alternatives

Use: This crossing could be identified with a sign along a multi—purpose trail. Perhaps a large working model or poster could be displayed here to illustrate the operation of a swing bridge. This would provide a tourist site along the canal portion where there are few buildings to identify.

Costs: Construction and maintenance of sign, poster and/or a working model.

Miscellaneous: The tourist information poster or model could be prepared as a project by local students. It could include a brief general history of the canal as well as specifics about the route.

Effect: This would be an effective educational device explaining the role of the Feeder as a transportation route. (refer to Map 5A regarding Wainfleet's historical resources)

Although Stromness and Port Maitland are now within the Town of Dunnville borders, each will be examined separately because of their unique origins.

STROMNESS

The Feeder Canal strongly affected the growth and development of Stromness. When the Feeder declined, Stromness lost people and industries. Today, the Town of Dunnville may consider the possibility of creating a Heritage Conservation District in Stromness. The heritage of this hamlet will be protected by this device. The LACAC group could investigate more thoroughly the local history of this community. Many of the buildings in this hamlet have interesting histories. Apart from those illustrated in the following pages a number of other interesting structures may be identified. Among these are the old Stromness School which is now a Community Centre and the old general store which is now a family dwelling. That store was once the pride of Stromness with fifty panes of glass in its front windows. Lachlan McCallum built the store which supplied dry goods, groceries and hardware. It also housed the post office and telegraph office. The site of the old ship building yard and the saw mill on the north side of the canal heading toward the Senator's home could also be investigated in more detail. All of these historical resources may be protected if the Dunnville Town Council incorporates the heritage preservation schemes in its Official Plans.

Rittenhouse Church-Barn

Analysis

Location: North side of canal along Feeder Road, just east of Bird Road (Lowbanks).

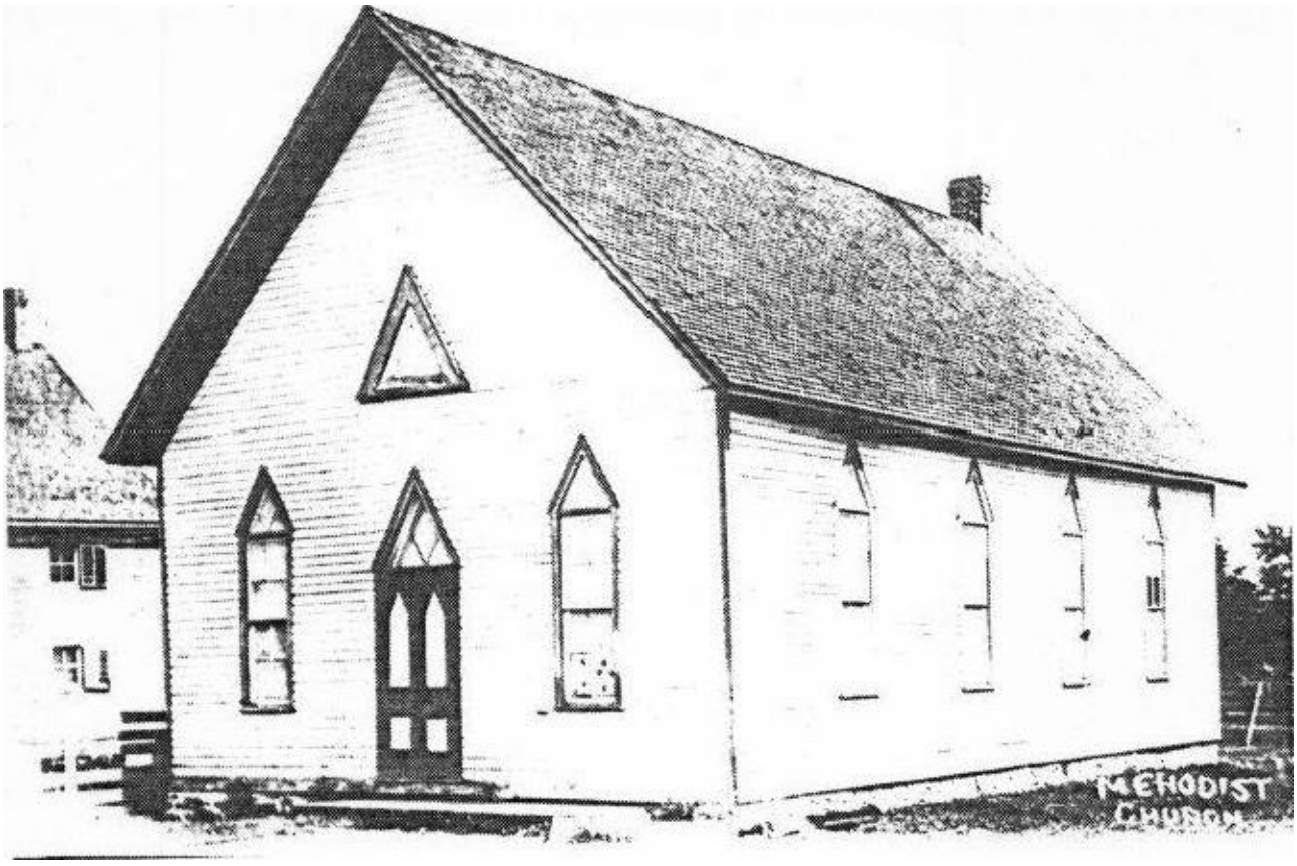
Ownership: Rittenhouse Family

Present Use: Barn

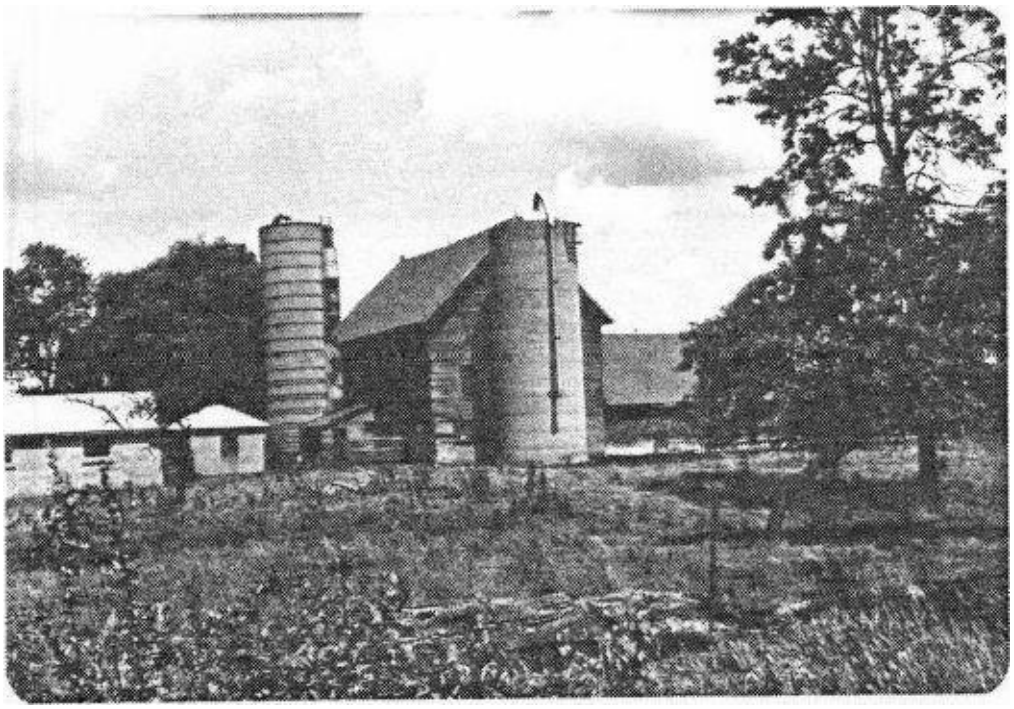
Condition: The building is in good condition for its present function. The exterior still indicates that this building *was* a church because of the roof and window shapes. The building has not been repainted, hence its original white colour is gone. Several modifications have been made to enable the building to function as a barn.

Significance and Historical Sketch: This building served as the Stromness Methodist Church for many years. Mr. Gordon Harris was the last minister. It became a barn in November, 1939, when Mr. Howard Rittenhouse purchased the building from Mr. MacMillan. The church was located on the west side of the Cheese Factory. It was built sometime between 1854 and 1879. Shortly before the church was moved it received a new roof through a donation from the McCallum family. The moving process itself took two to three days because the movers ran into many obstacles. At one point, the building got caught in the "canal dump". This was a mound of earth along the canal bank from its original excavation. The movers had to dig the bank to free the structure. As the stature of the structure has declined so also has the prominence of the Stromness Community.

Analysis of Surrounding Landscape: The building is fairly isolated near a crossroad of two rural roads.



The Methodist Church when it sat at Stromness



The church as the Rittenhouse Barn

Use: The building has been used successfully by the Rittenhouse family after their barn burned in 1939. It should continue in this function although special accommodations may be made to ensure that the church character is maintained. In addition, a sign could be placed along the road to indicate this structure. Many passers-by do not notice its unique architecture.

Legal: A contract or covenant may be arranged between the Town of Dunnville and the Rittenhouses to ensure that the exterior design of this building is preserved. There are no immediate plans to alter this structure.

Costs: Construction and maintenance of a sign.

Effect: This building is rather unique. It may encourage others to examine their own homes to find special historical significance in them.

Mossip Family Dwelling

Analysis

Location: North side of canal, Feeder Road east of Stromness, west of Inman Road.

Ownership: Mr. & Mrs. Doug Chalmers

Present Use: Family home

Condition: This building ahs been altered over time with new additions and modernization. It has been very well cared for.

Significance: This family farmhouse is typical of the farms along the Feeder. Mrs. Chalmers' grandfather, Richard Mossip, settled along the canal over 100 years ago. He was an immigrant from Ireland.

Analysis of Surrounding Landscape: The farm is located close to Stromess along a gravel portion of Feeder Road. Its proximity to Stromness makes it relatively simple to reach, yet it maintains a degree of isolation from the built-up community.

Planning Alternatives

Use: This farmhouse could be identified with a sign indicating the original owners and approximate year of construction. Similarily, the other farmhouses along the Feeder could be identified in this manner by beginning with the oldest buildings.

Perhaps it may be possible to open this home and/or others along the Feeder for educational purposes. School groups might be interested in touring old farmhouses. There are also some communities where people could take a holiday on a farm. A visit to a farm along the Feeder might provide an additional historical attraction. The guests might pay to experience life on a farm for varying lengths of time. This type of open-house could be a learning experience for all of the participants. Legal: This building has been well preserved and does not appear to be threatened. Perhaps the Town of Dunnville could consider establishing some land use controls along this area to preserve its special agricultural character.

Should any plans ***be made*** to open farm homes for boarders, municipal regulations would have to be consulted.

Costs: Construction and maintenance of a sign. Opening any of the farm homes to public inspection might also involve expenses for the individual owners.

Effect: Increased heritage awareness for the private owners and the visiting population.

Cheese Factory

Analysis

Location: South side of canal, along Feeder Road, just off the main road through Stromness.

Ownership: Mr. & Mrs. R. Downey

Present Use: Family dwelling

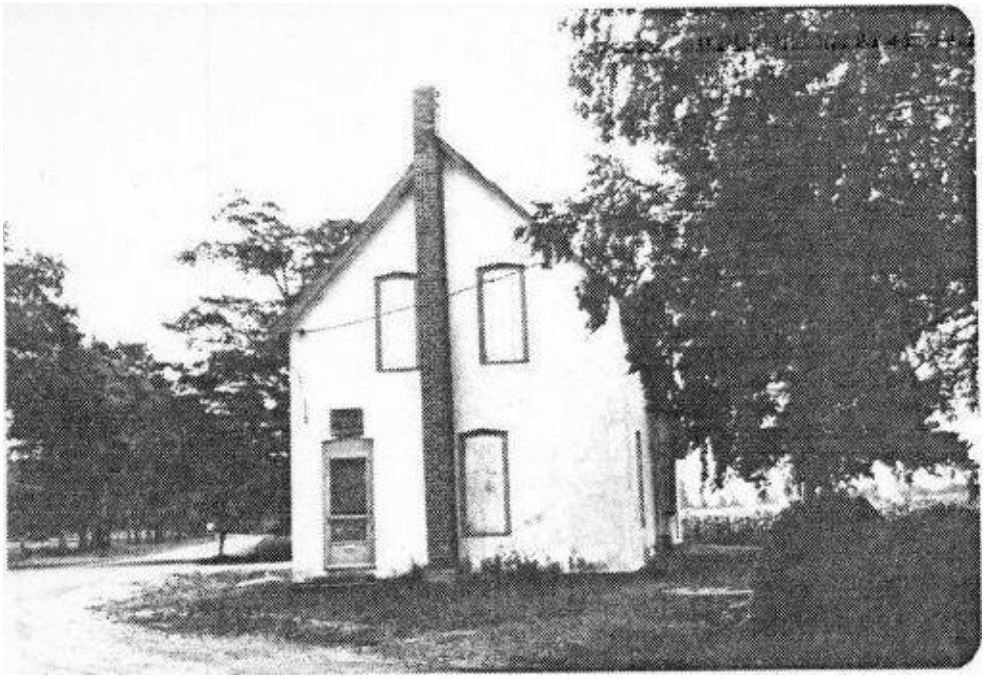
Condition: Much of the interior of the building has been modernized to serve as a home. The exterior portion of the structure has been altered. Sections of the original siding are still visible.

Significance and Historical Sketch: This building was owned by Senator McCallum for a number of years. He changed the building over to a grain storage structure. Canal boats were loaded from this building. When Mr. R. Paisley purchased the old cheese factory in 1933, pieces of track were still there from the grain loading period. Mr. Paisley used the building for a chopping mill two days a week and stored fertilizer and grain inside. The building has been altered several times reflecting changes in the Stromness community. It stands as a monument to the industrial activity which once kept Stromness a busy canal village.

Analysis of Surrounding Landscape: Stromness is located in a rural community setting. The main road provides access to High Banks and the Dunnville town centre.

Planning Alternatives

Use: Initial identification of the building with a sign is required. There are several alternatives for the building. The structure is functioning successfully as a home at the present time. Should the building become available, the Town of Dunnville may wish to purchase it, with advice from



Inman Road Hall
- Dunnville

Cheese Factory
Stromness

Old Hotel
Stromness

the Ontario Heritage Foundation and other government financial assistance. The factory could then be restored to its original function. This procedure would involve more historical research and architectural planning.

Legal: The community may wish to designate this structure as part of a Heritage Conservation District in Stromness.

Alternately, a private contract or covenant could be drawn up with the present owners to ensure the building's survival. Perhaps a cost-sharing agreement could be established to rehabilitate the exterior of the structure to resemble its original condition.

Costs: Construction and maintenance of a sign. Rehabilitation of the building would result in additional costs.

Effect: The preservation of this building will help to ensure protection of the industrial heritage of Stromness. It may act as a tourist attraction.

Stromness Hotel

Analysis

Location: South side of canal, east of Regional Road 3, at the crossroads of that road and Feeder Road.

Present Use: The building now houses two families.

Condition: The original exterior of the building has been covered. The interior has been modified to serve its present function.

Significance: This structure served as a hotel during the busy period of the community's history. It housed canal travellers and workers.

Analysis of Surrounding Landscape: The building is located in a rural hamlet with easy access to Dunnville's town centre via the paved regional road.

Use: A sign should be placed near the main road to identify this site. It is serving satisfactorily as a house at the present time. Some consideration might be given to the purchase of the structure by a local business group. The hotel could be remodelled to resemble its original condition. The building could be developed as a tourist attraction perhaps housing a craft shop featuring canal related items for sale.

Legal: This site may be designated as part of a local Heritage Conservation District.

Costs: Construction and maintenance of a sign. Possible rehabilitation costs.

Miscellaneous: If the structure is re-developed, provision must be made for parking.

Effect: Heritage awareness will be increased. There may be possible economic benefits from tourism.

Stromness Turning Basin

Analysis

Location: Between the two major land bridges crossing the Feeder in Stromness, the canal widens to form a "turning circle".

Ownership: The canal land is "owned" by the Town of Dunnville.

Present Use: Abandoned

Condition: This site is infilled with sediments and plant growth. A section of the canal route toward Dunnville is open more than the Port Maitland portion.

Significance and Historical Sketch: The turning basin was created at the point where the canal divided into Dunnville and Port Maitland sections. There may have been some type of a lock in the basin area at one time. Remnants believed to be pieces of an old boat have been found in the basin. Besides serving as a turning basin, the junction of the two canal channels marked the location of a shipbuilding business.

Analysis of Surrounding Landscape: This basin is located in what was once the centre of Stromness. Today it is practically on the outskirts of this rural community.

Planning Alternatives

Use: A sign could be posted near the main road to identify this feature and the canal. If the water flow is increased, some type of recreational activity may be possible here.

Costs: Construction and maintenance of sign(s).

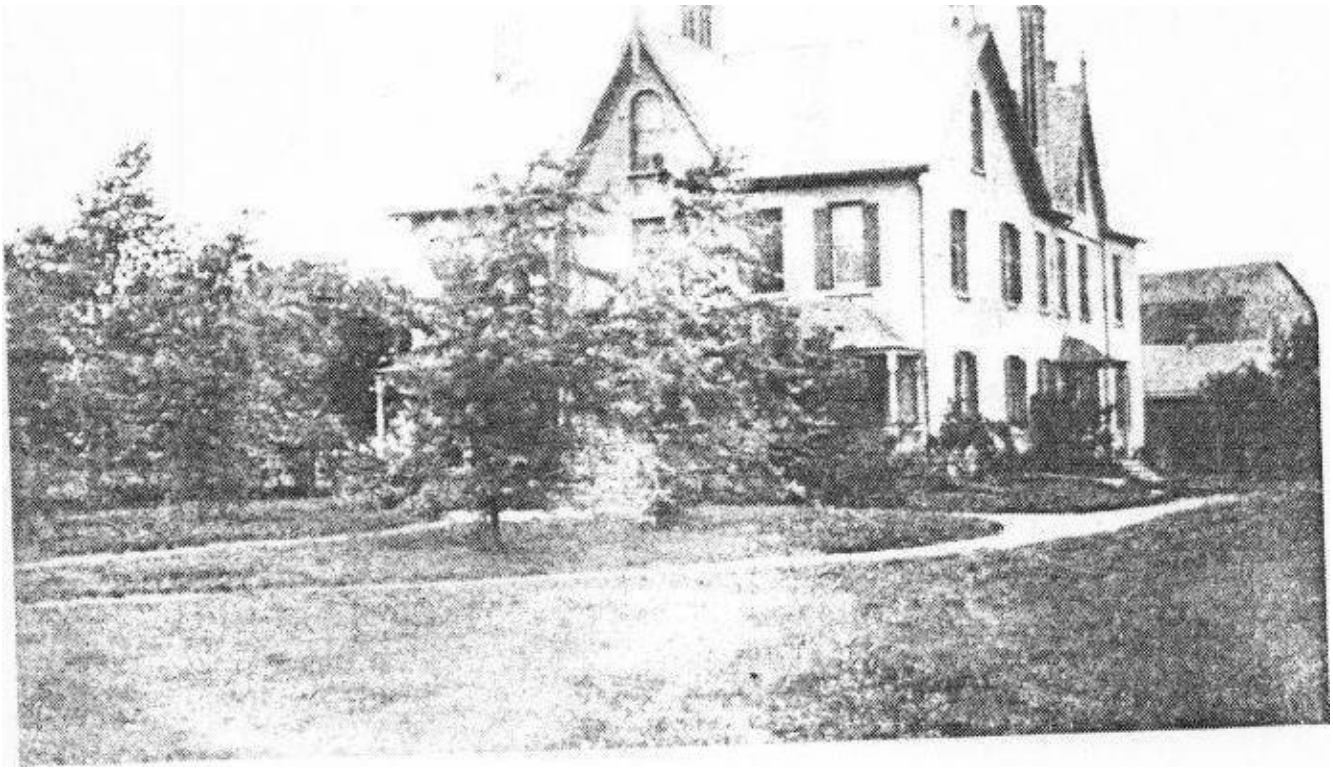
Miscellaneous: A Ministry of Culture and Recreation representative is planning to examine the site to check some ruins believed to be from an old boat. The high level of weeds in the canal makes it difficult to examine the area until the fall. Contact should be maintained with the Ministry about this matter.

Effect: Some type of clearing in this area will enhance the canal's appearance. In turn, the canal heritage will be recognized.

McCallum Mansion

Analysis

Location: North side of the canal, west of Stromness, along the gravel Feeder Road.



The McCallum Mansion, Stromness

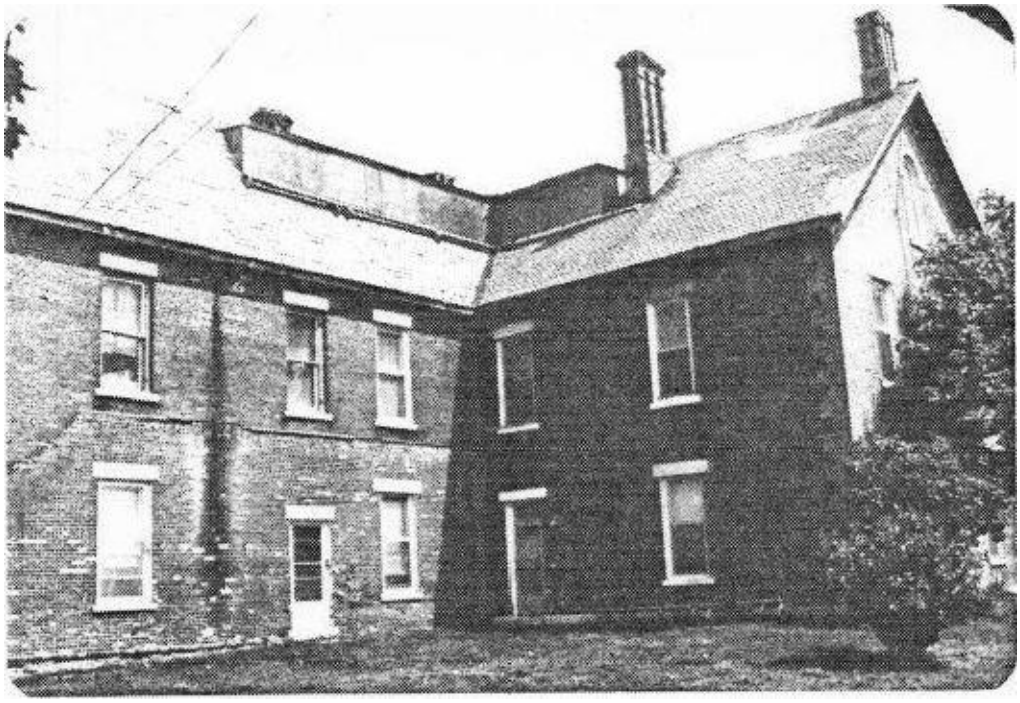
1979 View

Ownership: Mr. Les Snively

Present Use: Family Home

Condition: Repairs have been made to keep the main building in good condition. The "ground floor" has been modernized. The exterior of the building has also been altered with the removal of some porches and other slight modifications. A number of wooden structures located behind the main building have deteriorated. These were probably used as barns or for storage.

Significance and Historical Sketch: The building is worthy of attention because of its size, construction, and the importance of its original owner. The fifteen-room home was built in 1872 for Senator Lachlan McCallum who played a very important role in the growth of Stromness. The Senator combined his political career with his involvement in shipping and canal related activities. He arrived at Broad Creek in 1842. By 1864, he had re-named the community Stromness and assisted its industrial growth. The Senator lived in this house until his death in 1903. The house left family hands in 1933 and was purchased by the Snivelys.
The home stands out in the area *because* of its large size and its stone construction. It was left uninhabited for several years. A carriage house and stables, barns and other storage buildings have been destroyed or have severely deteriorated. Next door to the house stands a farmhouse of cement block. This building (constructed approximately 1900) is well preserved on the exterior. The large orchards owned by McCallum have been destroyed with the industrial developments at Port Maitland. The McCallum family is buried at Sherbrooke Cemetery. The cemetery, across from Sherbrooke Baptist Church, contains information of genealogical interest.



tack View of the Senator's Home, Stromness

McCallum monuments -
Sherbrooke Cemetery

Analysis of Surrounding Landscape: Located on the edge of a rural community, this structure has close access to a frequently travelled paved road. Nearby, industrial activity poses a potential threat to the continuing existence of the structure.

Planning Alternatives

Use: This building is being underused at the present time. The present owners are attempting to keep the building in good condition. Should the building become available, there are a number of possible uses for it. Inquiries have already *been* made by other groups considering the possibilities of establishing a golf and country club, or a private school at the site. Perhaps another alternative would be to restore the house to its original state to act as a museum for the Dunnville area. It might be possible to establish a branch library in one section of the building. The structure would also make an attractive restaurant or inn. The major problem would be coping with the exterior environment. Advice would be required from environmental experts to ensure that the proper vegetation was planted for any attempts at landscaping. It would be very easy to prepare a large parking lot to accommodate overnight guests. A rehabilitated Feeder Canal would offer a potential attraction for these visitors.

An information sign is also essential at the driveway entrance.

Legal: The building should be designated as a historic site as quickly as possible. If the Town Council does not wish to establish a Heritage Conservation District, this site should be designated individually. The owners may be willing to sign a private agreement for the stucture's protection.

If plans are ***made*** for an adaptive use, the Municipal Council should be consulted regarding any applicable by—laws.

Costs: Construction and maintenance of sign. Potential conservation and rehabilitation costs.

Effect: Increased heritage awareness for the local and visiting population. (refer to Map 5B regarding Stromness' historical resources)

PORT MAITLAND

Port Maitland has an interesting military and shipping oriented history. In relation to the Feeder Canal, the Port Maitland Lock is the major site of interest.

Port Maitland Lift Lock

Analysis

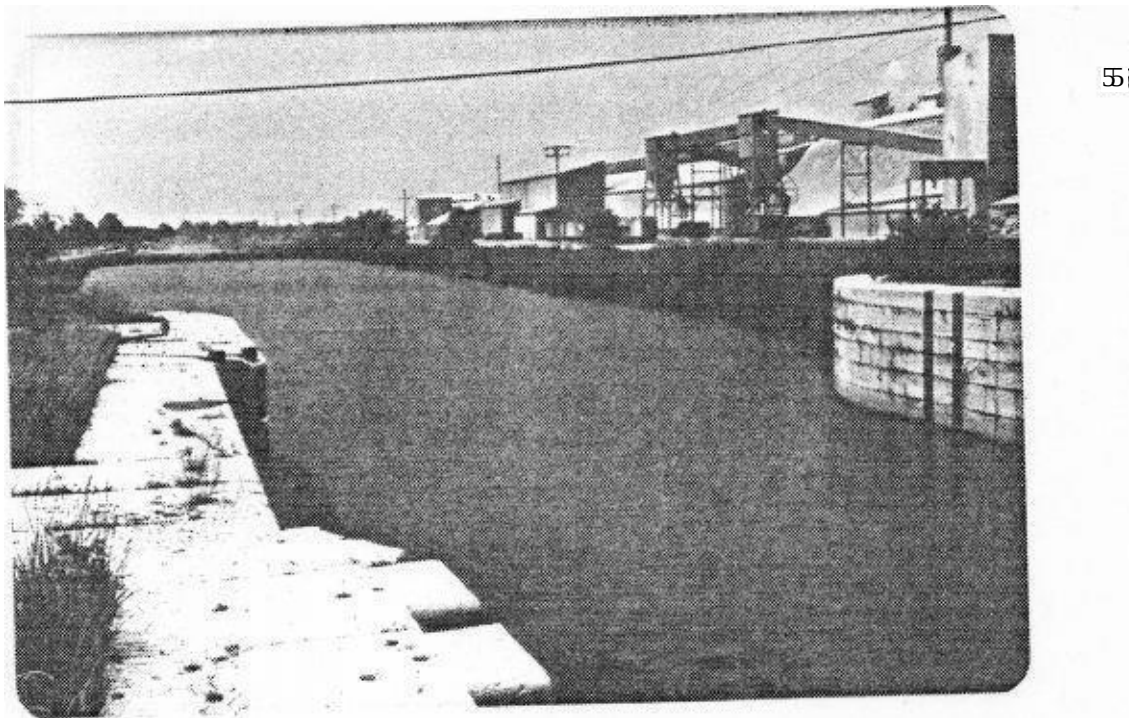
Location: Port Maitland, near the entrace to the Feeder Canal at Dyer Street and Feeder Road.

Ownership: The Town of Dunnville has taken over responsibility for the structure from the old Sherbrooke Township government.

Present Use: Abandoned

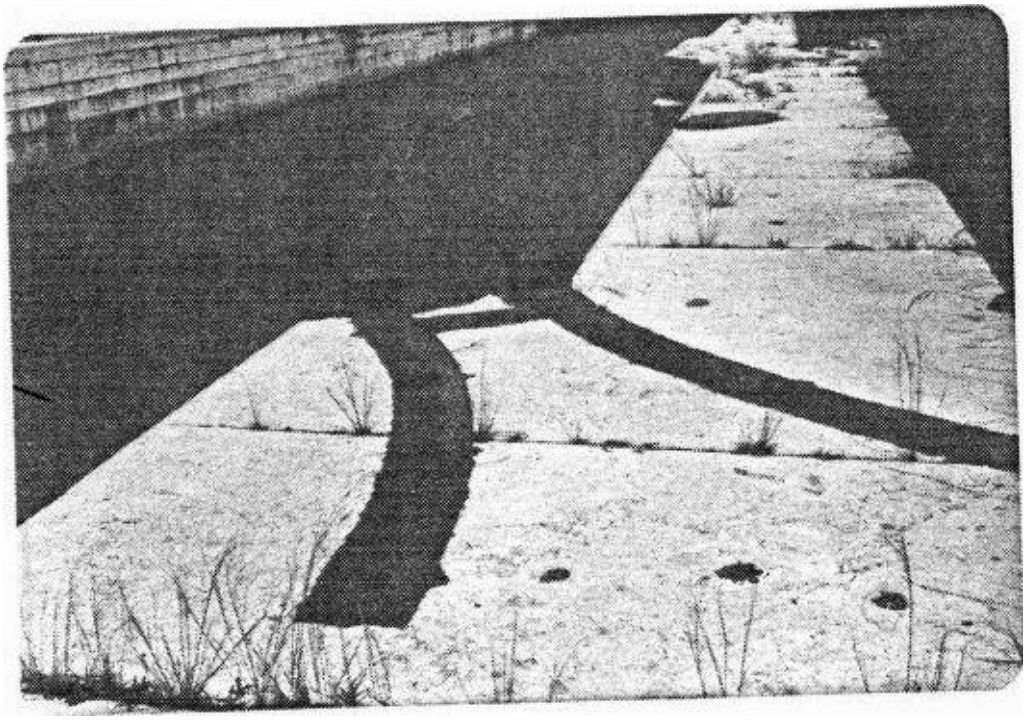
Condition: The stone walls of this lock have been well preserved. The hardware on the locks is also in good condition. The gates are now gone but local residents believe they were removed "recently".

Significance: This lock structure has been well preserved. It is the only remaining feature of this type along the canal. It provided the entrance to the Feeder Canal at Port Maitland for boats coming from Lake Erie or the Grand River. The lock tender's house was located on the south side of the canal. It has been destroyed for many years. The lock was not often used in the last eighty years.



looking west

The Port Maitland Lock



looking east

Analysis of Surrounding Landscape: Situated between the ERCO and IMC plants at Port Maitland, the structure is not in a very attractive location. There may be some problems coping with the industrial activity in the area.

Planning Alternatives

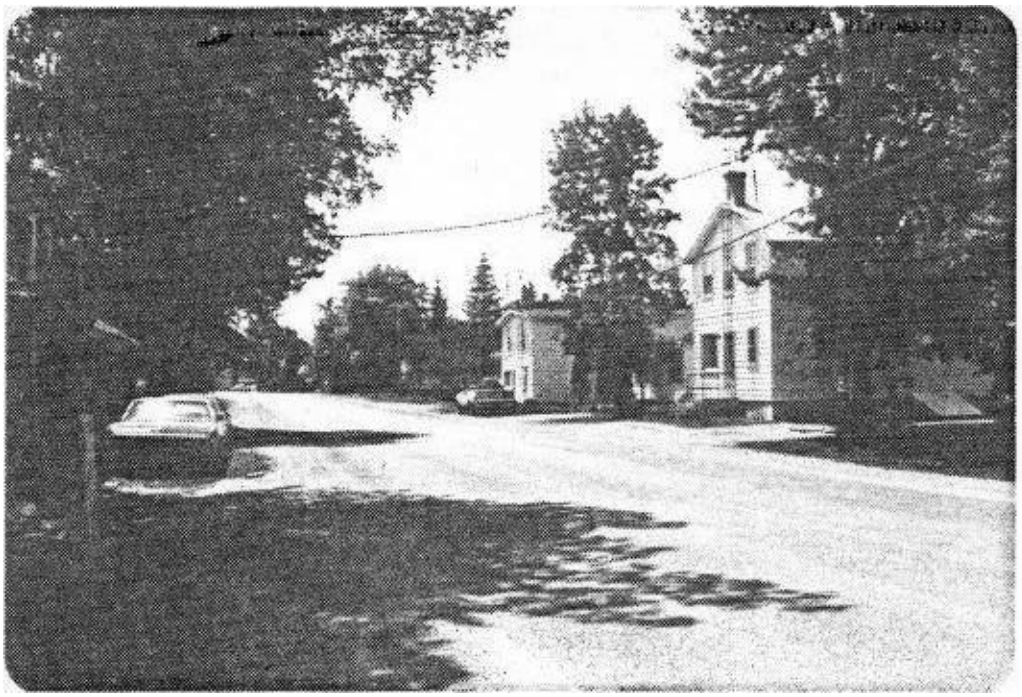
Use: As a first step in the preservation of this site, an information sign could be posted. This might include an explanation of the workings of a canal lock. If the engineering proposal to build a gate at this entrance is accepted, it may be possible to incorporate it within the lock structure. Restoration advice has been sought from the Engineering and Architecture Branch of the Ministry of Indian and Northern Affairs. Further contact with this agency is advised.

Legal: This site may be designated as a historic site by the Municipality. This would *be* a relatively simple procedure because the town already controls the site.

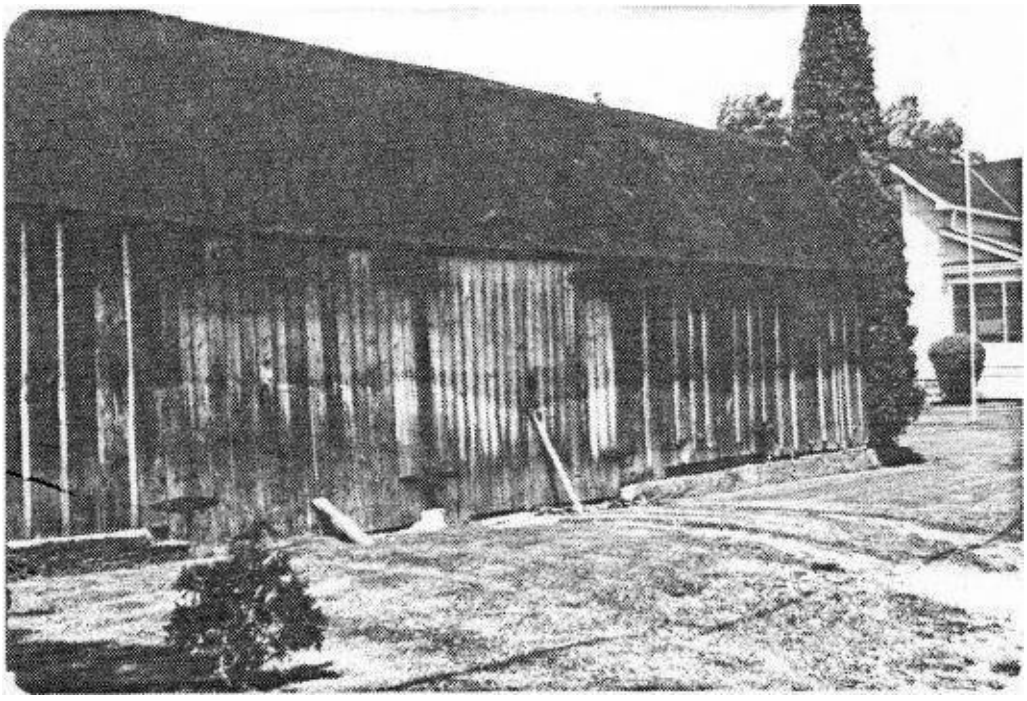
Oasts: Construction and maintenance of sign. Reconstruction and/or rehabilitation costs.

Miscellaneous: Several proposals have already been made to destroy the lock. A municipal stand in favour of heritage conservation is required to ensure the lock's survival. This structure is particularly threatened because of the heavy industrial activity. The companies at this location may be approached regarding the possibility of additional landscaping around their sites to make the lock location more attractive to tourists. Some arrangements regarding parking facilities and traffic flow should also be made.

Effect: This site may act as a tourist attraction. It will serve to educate visitors about the role of the Feeder Canal.



View of Stromness (looking south)



Old Blacksmith Shop, Stromness

DUNNVILLE

It is interesting to note that the Town of Dunnville does not have a historical society. Perhaps it is especially important for the Town Council to adopt a leadership role in the area of heritage preservation. Much of the Feeder Canal has already been destroyed in the Dunnville core area. Those vestiges which remain should be recognized by the community.

Many farms line the banks of the canal toward Dunnville. Some of these buildings have interesting histories worthy of further investigation. Local brickyards have been identified on the Deamude, McAlonan and Paisley properties. The local farmers occasionally find Indian relics (arrowheads) on their land. The dislocation of Indians caused by the construction of the Feeder Canal should also be considered for investigation. Perhaps a monument to these earliest settlers could be established. In the Dunnville town centre much of the Feeder history has been forgotten. New buildings cover the old canal route. Hidden in such street names as Lock Street one finds traces of the Feeder's historic role in the creation of the community. The original route of the canal could be identified in the community by posting a large sign, perhaps near the Grand River bridge. The creation of a LACAC group in Dunnville would help to ensure that the community's heritage is not forgotten.

Inman Road Hall

Analysis

Location: Approximately three miles north of Feeder Road and the canal, along the west side of Inman Road.

Significance: This hall once served as a toll house in Stromness. It is not located near the Feeder Canal, but does deserve some recognition from the local community. There may be several other structures which have been moved away from the Feeder. These features may be identified with the same type of sign as those near the canal. This will help to preserve the local heritage and dramatize the significant impact of the Feeder Canal.

Concrete Road and Bridge

Analysis

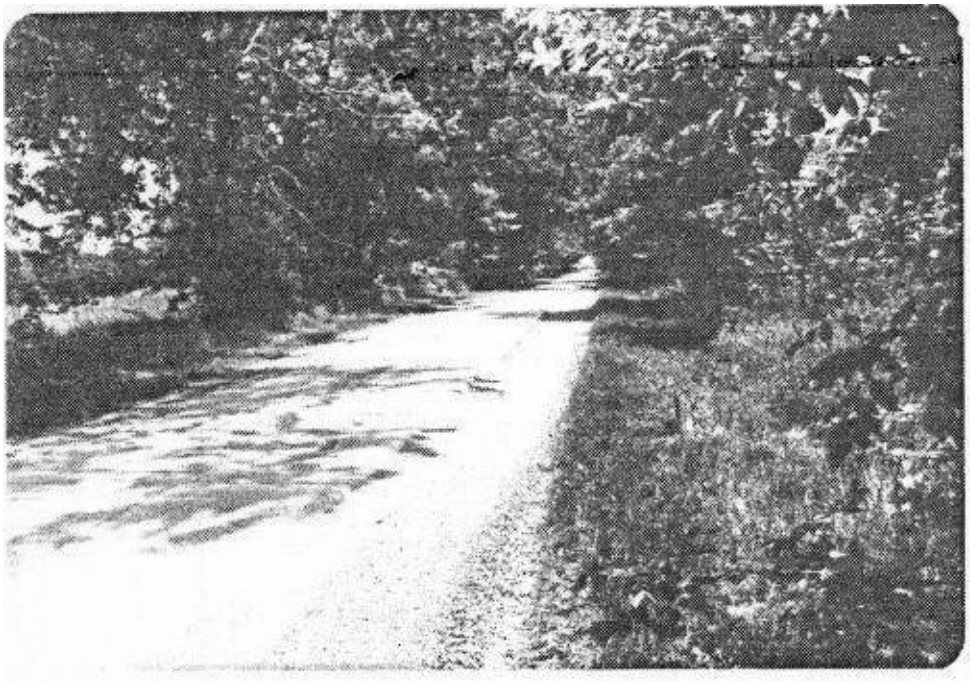
Location: Along the canal from Stromness to Dunnville, the bridge is located north-west of the large hydro towers near Dunnville.

Ownership: Town of Dunnville

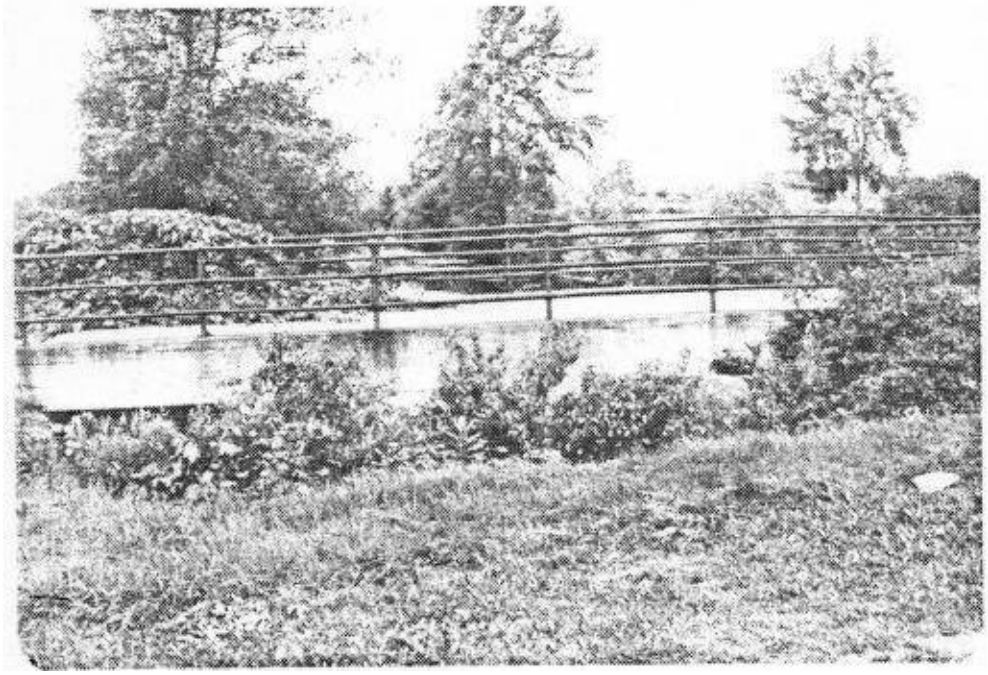
Present Use: Some portions of the road are still used by cars. The bridge cannot be crossed.

Condition: Sections of the road have been destroyed while other patches are in very good shape. The bridge is overgrown with weeds at one end. Many pieces of it are cracked, but it appears sound for small loads.

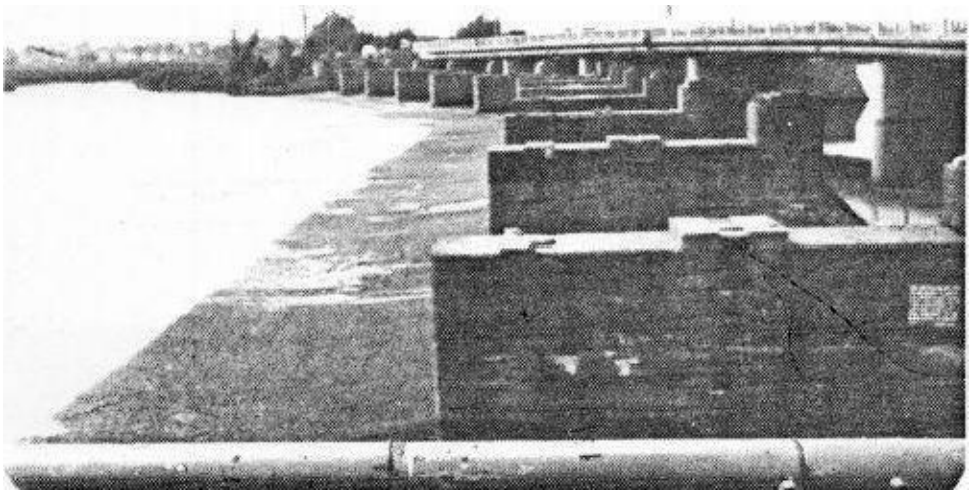
Significance: This road followed the route of the Feeder Canal. It demonstrates the change from water to land transportation in the region.



Concrete Road
- Stromness to
Dunnville



Concrete Road
- Dunnville



Grand River Bridge
- Dunnville

Because it followed the Feeder, it illustrates the important role the canal had in opening up the Dunnville and Stromness area. Some residents recall that portions of the road were built before every election, beginning around 1910. The road was completed in 1922-23. It was a single lane road with special places along the route to pull over and allow one car past. The road ran all the way to Dunnville in 1960. Since then, newer roads have cut out portions of the concrete road.

Analysis of Surrounding Landscape: The road passes through agricultural land along a major regional road.

Planning Alternatives

Use: This road could be identified at a point along its route, perhaps both at the Stromness and Dunnville ends. It may be used for recreational purposes (eg. as a bikepath).

Legal: The municipal government may agree to preserve the road as it now exists. It may qualify for designation as a historic site because it was one of the first good roads in the area.

Costs: Construction and maintenance of signs. Some patchwork may be required along sections of the road if it is used for recreational activities.

Effect: The history of changing transportation methods may be emphasized for the public.

FUNDING

The issue of sources of financial assistance for the rehabilitation of historical resources along the Feeder Canal requires further investigation.

The book, The Welland Canals, prepared by Michelle Greenwald and others from the Ministry of Culture and Recreation lists many possible government funding programs. As well, private individuals, organizations and companies could be approached for some financial assistance.

It is hoped that a more detailed analysis of the individual structures along the canal will be undertaken in the form of an architectural inventory. This will enable a more accurate estimation to be made about the real costs for protecting the existing structures. An examination of Land Registry Office files and provincial and federal archives could also be undertaken. However, it would be valid to approach agencies in advance to learn the amount of assistance available for this project in its present form.

Funding will be required to provide signs to mark the historical sites. Other educational and advertising devices may also require financial assistance. These could include the costs for preparation and distribution of pamphlets which outline the canal history, large signs in the community centres, and preparation of audio—visual displays to be used by local organizations and schools. Again, there may be a wide variety of possible sources for financial aid.

Signs are required to mark the Feeder Canal route, existing structures and those sites *where* properties related to the canal have already been destroyed. There are many possible sign typefaces, colours, materials, sizes and placements.

Typeface: Generally, the type used should be Sans Serif, as clean and clear as possible. A mixture of upper and lower case letters is preferred. This style makes the sign easy to read, thus aiding the purpose of communication.

Colour: A light background with dark printed letters has been proven to be the easiest to read. The ROF Committee could adopt some sort of colour scheme to publicize all of the Feeder features.

Materials: The Niagara Parks Commission produces their own wood signs. This material is the least expensive and easiest for them to work with. Their signs cost approximately seven to ten dollars per square foot which includes wood, labour, three coats of paint, reflective materials and at least two coats of varnish. The wood requires additional coats of varnish after two-and-a-half to three years. The sign life is approximately seven years.

The Ministry of Natural Resources uses galvanized steel signs with a plastic overlay. These may be more durable than the wood signs. Further inquiries are necessary into the costs for these signs. For the initial identification stage, the wood signs would be satisfactory.

The Ministry of Culture and Recreation, Archaeological and Historic Sites Branch, will provide varying amounts of assistance for plaques of cast metal construction. The amount of financial aid depends on whether the site is of national, provincial or regional significance. These signs are very expensive. Perhaps one to three of these plaques could be prepared to identify the canal route at Wainfleet, Dunnville and Welland. The canal itself may be classified as at least provincially significant. However, most of the other structures will *be* classified as locally significant with a few regional sites. Locally significant structures do not receive funds for these signs.

Contact could be made with the regional governments to see if they will assist with any of the sign construction. Private individuals may also be consulted. It may be valuable to consider that the ultimate purpose of the signs is to communicate information. This may be accomplished on relatively inexpensive material which is as functional as the more elaborate signs. There is also a potential problem of vandalism to consider.

Sizes: The size of the signs could vary depending on the nature of each individual historical feature or a fixed size could be adopted for particular structures along the canal. Some localities merely place the name of the building, the year it was constructed and their regional logo on their signs. This represents one of the least expensive ways to communicate basic historical information. The ROF Committee could follow this procedure which would require relatively small rectangular shaped signs. Should funds become available, the information included on the signs could be expanded to point out the structures' significance to the region. Signs explaining

the sites of destroyed features would have to be larger to include a small explanation of the features' significance. The canal route itself could be marked with small signs which might be incorporated with recreational signs such as bicycle path route markers.

Placement: Signs identifying historical features should be placed near the road, multi—purpose trail or canal bank. This will enable easy identification from the main transportation route. Signs marking residences would be placed on trees, fences or poles in front of the buildings or on the structures if this is necessary. The markers should face the canal bank so that they may be read while travelling along the canal in either direction. If future funding permits, signs covtd be placed in advance, indicating to the traveller the'location of nearby historical sites.

Markers for the canal route may be placed along the canal bank near the roads. Historic sites may be marked along the bank if the present property owners are unwilling to have signs erected on their land. In this case, the signs would have to include directions to the property. The municipalities could *be* responsible for maintaining the signs. Alternately, the ROE Committee could accept responsibility for their upkeep.

The local communities may also wish to place some signs *near* their community centres to identify the canal route and some historic sites. This could be in the form of a large map or several small maps in the central core. These would help to direct visitors to the canal region. The local schools might be able to assign the project to their art students. In this way, community involvement in the project would be encouraged. It might also result in some unique tourist maps which could be very attractive.

The appeal to tourism could also be assisted by the preparation of a pamphlet which would identify engineering, environmental, recreational and historical features along the canal. The local tourist information centres, Chambers of Commerce and municipal offices could keep copies available for the public. The Welland Canals Preservation Association (WCPA) has prepared a pamphlet of this type to illustrate their proposed bicycle path. Financial assistance was obtained for its printing from a private corporation.

Another alternative to signs and pamphlets is the construction of monuments. These are expensive and not essential for communication purposes. If an individual or firm wants to construct such a feature, it could be considered; otherwise, the money could be directed to simpler marking devices.

LEGAL ASPECTS

To successfully plan for the conservation of the historical resources, legal aspects must be carefully considered. This section provides a brief overview of some of the issues involved in the planning process. It will be necessary to keep in close contact with the government agencies and planners who are faced with continually changing regulations.

> Heritage legislation is defined, by international consensus, as the body of law which deals with the identification and protection of sites and areas *of* historic and/or architectural significance.
>
> (Marc Denhez, Part I, p. 4)

Legal protection is available in Canada to protect sites of historic and architectural interest. It can be provided by federal laws, provincial laws, municipal by-laws and private contracts. (M. Denhez, Part I, p. 24) Each of these approaches to protection may be examined as they apply to the Feeder Canal and sites along the route.

Federal Government

The federal government's legal jurisdiction over historic sites is very limited. As a result, the protection of heritage property is generally exclusively under provincial jurisdiction. The Feeder Canal, and associated buildings, will fall under the jurisdiction of the Ontario Government because the federal government no longer has any particular responsibility for the Feeder. Any federal support will be limited to research and financial assistance.

Ontario Government

In Ontario, most of the Provincial Government's responsibility for the protection of heritage sites has been delegated to the municipalities. However, the Province has retained some powers to affect the municipal decisions.

There are three basic approaches which can be adopted. Each of these involve complex legal actions.

The Environmental Assessment Act, 1975

This Act requires the preparation and submission of reports which assess the environmental impact of proposed developments. Heritage is incorporated into the definition of environment in the Act. However, currently, the Ministry of the Environment "regards the destruction of the structural environment by demolition as outside the ambit of the Act". (H. Denhez, Part II, p. 12) If the Act is applied to the Feeder Canal it might be more effectively related to the natural physical environment. At this point in time future plans for the development of industrial activity at the Port Maitland end provide the only potential large scale threat to the Feeder and its resources. The Act has not lent itself to the preservation of buildings or sites on a small scale.

The Ontario Heritage Act, 1974

This Act, as it applies to provincial responsibility, states that the only properties eligible for provincial protection are "ruins, burial mounds, petroglyphs and earthworks." (s. 47b) Perhaps the buried sections of the canal would be eligible for some provincial regulation. However, the only possible ruin investigated at this stage is what may be the remains

of an old boat at Stromness. The Municipal responsibilities outlined in the Act are more significant with regard to the Feeder.

Provincial Intervention in the Planning Process

Ontario has reserved the right to intervene in and direct the municipal planning process in special circumstances.

The "development control system" would probably have little relevance to the *Feeder* project. It is a very complex approach subject to much controversy. The general lack of any plans to develop or significantly alter lands along the canal suggests that alternate means would be more suitable for heritage conservation in the area.

The Treasurer of Ontario can "take a directing role both in the drafting of plans and in the enacting of zoning by—laws". (H. Denhez, Part II, p. 30) This intervention is a relatively complicated procedure and is very rare. Any plans suggested would be limited to those powers outlined in the Planning Act and quite separate from the Ontario Heritage Act, 1974. This procedure appears to be unnecessary as no severe crisis immediately threatens the Feeder resources.

Municipal Level

The three statutes which empower municipalities to offer limited protection for historic buildings and sites are the Ontario Heritage Act, 1974, the Ontario Planning Act, and the Ontario Municipal Act. The municipal level appears to be the best place from which to plan for the protection of worthy buildings and the discouragement of unsympathetic infill construction along the Feeder.

Plans

The Regional Municipalities of Haldimand-Norfolk and Niagara both encourage their local municipalities to consider the possibility of heritage conservation in the Official Plans. To be most effective, the Official Plans should be supported by zoning by-laws.

Presently, Welland is the only municipality along the Feeder Canal that has adopted an Official Plan. It does not give any special recognition to the Feeder Canal and its historical resources. The Feeder area is zoned as "rural residential". A positive step in the protection of the historical resources of the canal area would be to encourage the local communities to recognize the special nature of the Feeder in their completed Official Plans. Denhez has outlined "three conceivable legal mechanisms whereby a municipality can control demolition and alterations on specified properties".

Individual Sites (Ontario Heritage Act)

The municipality may pass a by-law to designate a particular property under the Ontario Heritage Act, 1974 (Part IV). This involves serving a notice of intent upon the owner and subsequently passing a by-law to designate the heritage property. The council then has the power to control all alterations to the designated site. It cannot refuse demolition permits on designated structures indefinitely. There are a number of complications in these actions.

Essentially designation of individual sites along the Feeder would **help to** preserve the canal heritage. It would at the least ensure that none of the designated historical resources could be lost without the public receiving some notification of the impending danger.

Heritage Conservation District (Ontario Heritage Act)

These districts represent a collection of "buildings, streets and open spaces that are of special significance to the community". All Heritage Conservation District designations must be approved by the Ontario Municipal Board. The procedure to be followed is available in detail from the Ministry of Culture and Recreation. The basic procedure is outlined below. (see Ontario Heritage Act, Part V)

The municipality must first have an Official Plan. This will pose an immediate problem for the Wainfleet and Dunnville communities. It is strongly recommended that the local residents encourage a rapid completion of the Official Plans for these localities with special provisions for the recognition of historical resources. The Official Plan must include some general statements which indicate the councils' commitment to accept heritage conservation principles and to act in order to protect their local heritage.

It is then recommended that a "Heritage Conservation District Plan" be prepared studying the specific area — in this case the region bordering the Feeder Canal. Stromness and Wainfleet provide the best examples of potential sites for district plans. The plans would be most effective if consultation occurred with a Local Architectural Conservation Advisory Committee (to be mentioned). The municipal councils would also have to pass by—laws sanctioning the studies.

Finally, the Ontario Municipal Board must approve the recommendations. The municipal council (under s.39 and 45) may pass by—laws enabling the making of a loan or grant to the owner of a designated property to pay part or all of the cost of alteration of the building under conditions established by the council. This would help in the case of privately owned

structures along the Feeder where individuals would be willing to improve their buildings if they had funds available. This assistance might be difficult to obtain because of municipal financial problems. Other government associated agencies and private groups and individuals should also be consulted for financial assistance.

Where the interior of a building has been maintained close to its original construction, the building would probably be protected best as an individual site. As in the case of Wainfleet and Stromness, the character of the communities would be best preserved by establishing Heritage Conservation Districts. Heritage Conservation District policies ensure that a site in the area remains subject to Ontario Heritage Act rules on infill construction even after the building is demolished. As well, the Ontario Municipal Board, a more powerful organization, controls appeals regarding districts.

Controlling Infill Construction (Ontario Heritage Act)

It is strongly recommended that the municipalities concerned establish clear guidelines for acceptable changes in the designated areas. These guidelines should be supported by municipal by-laws where possible. This will help to ensure preservation of the municipal plans should any appeals be made by individuals.

Controlling Infill Construction through Municipal-Enabling Legislation

Should the muncipalities decline to designate neighbourhoods as "Heritage Conservation Districts" there are alternate protection devices. Some of this "municipal-enabling" legislation can also be used to supplement the Ontario Heritage Act.

Development control, as mentioned previously (see s.35A Ontario Planning Act), is one complex approach. There are also a number of land use controls which could be adopted including bulk and height controls, design control, use control, regulation of signs, fences, walls and maintenance, as well as trees and landscaping.

If these controls are to be adopted, a more detailed study of what the municipalities desire in the form of heritage conservation will be required. A complete and thorough analysis of the existing structures and their architecture will also be essential.

LACAC

It is strongly urged that the municipal councils along the Feeder Canal (particularly Dunnville and Wainfleet) establish Local Architectural Conservation Advisory Committees. These committees, of no fewer than five members, advise council on works in heritage conservation. The members of the committees should have a broad background and experience in as many disciplines as possible while maintaining some expertise and concern in the area of heritage conservation. The Feeder Canal region can become their initial area of investigation. These local residents will be particularly valuable in the local planning process because they should have a deep appreciation for the landscape of the rural communities along the canal. They will be able to value their neighbours' concern for the region while their expertise will provide them with the skills to plan *effective* conservation programs.

Section 28 of the Ontario Heritage Act, 1974 provides for the establishment of such advisory committees. Consultation with the regional office of the Ministry of Culture and Recreation will provide additional assistance. Until the municipalities concerned establish these committees other local groups can also act to preserve the local heritage by advising councils on their progress. LACAC is beneficial because it must have some municipal support to be created. Once established, it presents properties to council for designation. Such groups also find support from LACAC groups in other municipalities.

Private Level

An owner may willingly agree to subject his property to controls on alteration and demolition.

One form of agreement is a simple contract which will bind only the signatories and future owners. This would not be particularly suitable for future planning.

Easements of covenants may be made to bind future owners as well as the present ones. This is accomplished by clearly outlining that the agreement is for the benefit of another land and not a specified person. Special agreements are possible with the Ontario Heritage Foundation and municipalities through the Ontario Heritage Act. It enables the creation of covenants binding future owners even if no other land is benefited.

This approach is possible only if the present owners are willing to enter into the prescribed agreements. It also involves more individual legal work. It is much less expensive than outright purchase *of* the building if that becomes necessary. If detailed restrictions are properly specified, it is an excellent method of heritage conservation.

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RECREATION

Introduction

Certain regions provide unique leisure opportunities, as is the case along the Feeder Canal. The presence of water, in conjunction with the long narrow strips of land available along the entire length of the Feeder, make this existing corridor most desirable in terms of recreational development.

The linear orientation of this abandoned transportation channel provides an excellent opportunity for trail-related as well as water-based recreational activities. The long narrow strips of land adjacent to the Feeder can prove to be of utmost importance when considering open space for recreational uses. Although the canal has lost its original transport function, through rehabilitation it can acquire a number of new uses, primarily recreational in nature.

The purpose of the study is to examine the recreational possibilities along the Feeder. Three objectives provide a framework for examination:

1) identify recreational activities which are possible considering the given physical conditions and constraints.

2) identify specific areas for development using criteria such as accessibility.

3) list alternatives and recommendations determining costs, maintenance and phasing of proposed facilities.

Rationale For Public Use

The amount of land available for outdoor recreation in Southern Ontario is decreasing, yet participation is ever-increasing. Thus, the rising demand for outdoor recreation space is of concern. As a result, the redevelopment of the Feeder Canal area merits consideration in order to perhaps remedy the situation to an extent. Recreational demands increase due to a high population within a region. The Feeder Canal is located in Southern Ontario which contains the bulk of Ontario's population. The Niagara Peninsula, itself, has experienced phenomenal growth; hence, proposed recreational facilities will serve a great number of people. The geographical location of the Feeder will influence its use for recreation. Its proximity to the international border and to concentrations of population both beyond the boundary and within the Peninsula exemplifies the fact that potential urban markets in Canada and the United States are only a short distance away. The use of Highway 3, during the summer months, to route many tourists through the Village of **Wainfleet** illustrates the potential attraction factor.

Existing open space is under constant pressure as a result of the increasing rate of urbanization. Open space is of irreplaceable value. Within Southern Ontario, the loss of prime agricultural land is a problem of major concern. Recreational development in the southern portion of the Peninsula will perhaps allow for the preservation in the northern sector of its agricultural land. In this way, the rehabilitation of the Feeder Canal serves a dual purpose.

Ownership/Right-of-Ways

Land along the Feeder and the canal itself are owned by the Township of Wainfleet, Town of Dunnville, the Federal Department of Public Works, and Canadian National Railway.

The Feeder and adjacent lands within the bounds of Wainfleet Township are owned by this Township. Similarily, the extent of the Feeder located in the Town of Dunnville is owned by this Town.

The Federal Department of Public Works controls and owns the Feeder property between the junction of the City of Welland and the Township of Wainfleet, more specifically from Townline Road to, and including, the Brown Tap Drain.

Canadian National Railway lines intersect the Feeder. In this case, the railway company owns * right-of-way sixty-six feet in width.

Hence, permission from these groups is to be obtained for development to take place.

Government Responsibilities

The Ontario Government's primary responsibilities in the field of recreation are as follows:

1) to ensure that all residents of the Province enjoy sufficient opportunity for satisfaction of their free time needs

2) to ensure that, in plans for leisure, recreation and tourism, the environment is protected and managed as an essential factor in the over-all quality of life

Based on these goals, the following objectives are to be used in government programs:

- to provide recreational areas, corridors, facilities, attractions, programs, and supporting infrastructure at appropriate locations, and to provide satisfactory public access to these features
- to protect and manage special and unique landscapes, habitats, sites, features and processes (Ontario Future Trends and Options: Design For Development, March, 1978)

'The government will continue its programs to provide suitable land and waters for public recreational *use* and access to them, expressing the distinctive opportunities associated with each component in the open space framework." The development of a "system of recreational areas and connections to serve the urban population of Southern Ontario" is also a stated objective. (Ontario Future Trends and Options: Design For Development, March, 1978, p. 40).

Government Policies

Levels of government provide, within their plans, objectives and list policies which they intend to follow in order to preserve, protect and develop areas.

Regional Niagara Policy Plan, 1978

This plan lists two basic functions regarding natural resources and environmental areas. The plan *seeks* to "provide guidelines for the location and type of development in both urban and rural areas". Secondly, it promises to identify the environmental resources of the region and to develop measures for their protection and management.

Also noted in the Regional Niagara Policy Plan is the observation that the Welland Canal lands are one of "the primary areas for the provision of recreational, open space and park areas in the region." The Feeder Canal, although generally forgotten as an active segment of the original Welland Canal, should be recognized as part of what is referred to as the "Welland Canal lands". The Regional Plan suggests that these lands and similar areas be recognized and protected to prevent their loss. Their ecological value as well as their increasing need as possible recreational areas and historical significance make them irreplaceable.

With specific reference to recreation and open space, the objective of the Regional Plan is "to ensure sufficient recreational, open space, and park areas within the region to meet leisure needs and desires of present and future residents and visitors." The Regional Municipality of Niagara

makes reference to lands owned by a public agency. The following policies are stated:

Policy 7.A.2 The Region recognizes that the primary role of local municipalities in the field of recreation and open space should be the development of policies and programs for the acquisition, use, management and distribution of recreation and open space areas which best serve the needs of the residents of that municipality.

Policy 7.A.4 The Region will evaluate the potential of all puhlic lands for recreation and open space uses. Those lands considered desirable for recreation or open space uses should be retained in public ownership with the operational responsibility transferred through lease or other arrangements if necessary to the appropriate recreation, conservation or park agency.

Policy 7.A.5 Arrangements for the multiple *use* of publicly owned lands with recreation potential will be made, wherever possible, recognizing both the needs of the public agency owning the lands and the desirability of recreational uses. The possibility of developing a walking or riding trail system using public utility rights-of-way will *be* explored.

Policy 7.A.6 The Region supports and encourages continued liason between the Ministry of Natural Resources, the Ministry of Culture and Recreation, the Niagara Parks Commission, local municipalities, other relevant agencies, and the Region in the acquisition, *use* and management of recreation and open space lands and the development of recreation programs and activities.

The Feeder Canal and its associated lands are classified as a hazard area. The Regional Municipality of Niagara has set policies and objectives with regard to hazard lands. These are as follows:

Objective 7.D.2 To preserve and conserve the character and quality of natural areas and the environment in general.

Policy 7.D.7 The conservation of soil, water, flora and fauna will be encouraged in all hazard land locations.

The Regional Plan makes it clear that is the present practice of the Ontario Government to require that all local Official Plans contain policy maps and statements intended:

- to indicate the **location** of all hazard lands
- to restrict the development of such lands primarily to such uses as agriculture, outdoor recreation, forestry, wildlife conservation and public or private recreational facilities

The Official Plan For The Haldimand-Norfolk Planning Area, 1978

This Official Plan, with regard to recreation states that it is important "to promote, where appropriate, the provision and use of open space for trail-oriented recreation activities in connection with transmission corridors, abandoned railroad rights-of-way, and creek and river valleys".

Ontario Hydro Corporation

The Ontario Hydro Corporation leases land from the municipalities in order to pass transmission lines. Along the length of the Feeder Canal, **a twenty-foot easement is maintained by** hydro. Although no official policy is stated, an informal policy has ***been*** implemented, involving hydro right-of-ways and **recreational activities. Suitable hydro lands may be, and are encouraged** to be used for recreation, primarily as bicycle or walking trails.

Accessibility

The use of recreational areas is influenced by conditions of accessibility. It is logical to assume that if the facility is easily accessible, then it will be used more frequently by the population. Normally, given several comparable facilities, a participant will frequent the nearer facility.

The significance of location and accessibility is fundamental to any site evaluation. The entire length of the study area is bordered by the Feeder Road. The Feeder is also crossed by Highway 3, a major transportation route. The channel ends at Highway 58, a route which connects the southern portion of the Peninsula with the northern portion. Other gravel roads cross and/or meet the canal and Feeder Road which parallels it. (refer to map 3)

It should be noted that a "30 mile radius has proved to be a significant and often adopted measure of the distance that day-visitors will travel by car on weekends". These are the people who it is envisaged would visit the Feeder area. Proximity to many area tourist attractions would possibly influence the visitation rate to the Feeder Canal area. Tourist attractions, including Niagara Falls, the Welland Canal and nearby locks are numerous.

Traffic volumes in the area, particularly on Highway 3, are high, especially during summer months when much of the traffic originates from the northern United States. These visitors might visit the proposed facilities along the Feeder, if clean up and designation of the route was completed.

Close to the Feeder area are located major urban concentrations. These population centres could be marked as possible originating points for Feeder visitors. (refer to Map 1)

In terms of accessibility and road standards the area is adequately supplied. Of primary importance, however, are the large traffic volumes using these routes.

Compatibility

Compatibility of activities is one factor which must be considered when suggesting activities which can be pursued on a multi-purpose trail system.

Significant differences among the various trail activities, with respect to quality of trail alignment and the type of recreation experience sought by trail users, indicates that few trail activities are fully compatible with othectrail activities. For example, conflicts between power and non-power uses or between high-speed uses and low speed uses result in incompatibility.

More specifically, pedestrians and cyclists seem to share the same paths happily enough, provided safety and comfort are experienced by all. But, bicyclists and equestrians are incompatible, both as to type of riding, surface required (paved versus loose earth) and in terms of the aesthetic, psychological and physical factors involved. Bicycles and off-road motorbikes and motorcycles generally are incompatible because of their speed differential.

Not only does incompatibility result from trail use itself, but sites may be unacceptable due to incompatibility with surrounding land use. Such is the case at the Port Maitland end of the Feeder, where its course passes through ***an area*** made unattractive and uninviting because of heavy industry. As a result, the continuation of a multi-purpose trail system towards this segment of the canal is not recommended.

Physical conditions of the Feeder area, generally, limit the possible recreational activities which can be pursued. Characteristics such as restricted land availability, linear orientation, homogeneous terrain, and proximity to other recreational facilities are criteria which must be considered in the choice of selected activities.

Along the channel, opportunities for secondary recreational activities exist. Potential for activities such as fishing and picnicking serve to heighten trail interest.

Bicycle Trail

Along the Feeder the proposed bicycle path should take two different forms - an exclusive bikeway and a bike route. "Exclusive bikeways are those in which a completely separate rigttof-way is designated for the exclusive or semi-exclusive use of bicycles. Bike routes are those in which the right-of-way is shared by the cyclist and other vehicles and, which are designated by signing only". (Hamill & Wise, 1974, p. 2) The establishment of both of these forms is encouraged since railway tracks must *be crossed* at public crossings.

The purpose **for** development of such a trail is to connect points of interest to give the user an opportunity to experience nature, to preserve the Feeder as a historical transportation route, and to increase the dwindling amount of open space available in order that recreational activities and their benefits can be enjoyed. With the development of such a trail, the preservation and environmental quality of the area will also be sustained.

In recent years there has been an increase in the popularity of trail activities, and in turn, the demand for recreational trails has grown rapidly. "Forecasts indicate that at least 40% of the population will have bicycles by 1980". (Ontario Trails Council Final Report, 1977, p.28) It can be stated that many people bicycle and do so quite frequently. Bicycle riding is a means by which different people pursue different objectives.

Riding is popular in its many forms, whether the purpose be pleasure-oriented, exercising or merely an alternative and legitimate way to travel. (When considering the energy situation, perhaps bicycles may help to relieve the fuel shortage problems common today.)

"A widening gap between supply and demand of trails is evidenced by serious overuse of some trails and by the proliferation of informal trails on undeveloped land near urban centres". Within the Niagara Region there is a definite shortage of publicly provided trails for bicycling.

The Canal bank will make an excellent bikepath in that for the most part it is nearly flat and it would make an interesting cycling trail since it parallels a watercourse. The beauty of water and the access to water-based recreation are strong points for locating a trail along a rehabilitated Feeder. In addition, the fact that the proposed bikepath development would ***be*** located on public lands makes the area preferable. The rural setting, its close proximity to urban centres and historical sites, make this area a prime candidate for a recreational trail development, and bicycles and bicycle paths cause little disruption to the environment.

The Feeder provides an excellent opportunity for the construction of a multi-purpose trail system. Its linear orientation and the relatively unvaried topography along its length are advantages to the location of such a trail.

Design Guidelines

Trail Layout or Alignment

The trail layout is recommended to be linear in form. This type of trail is specified since land availability is restricted to a long narrow strip adjacent to the channel. Physical conditions make it impossible to develop a more complicated trail system unless private land is used or purchased.

The linear form is commonly used for long distance and for goal-oriented trails. Thus, such a trail could provide access to other proposed recreational facilities, and sites of historical significance along the Feeder's length.

A flat terrain can *be* monotonous. In order to alleviate this problem, different types of vegetation should be planted and the trail should be routed around already existing trees. The vegetation may be used to alleviate the feeling of unvaried straightness which is a primary objection of many trail *users.* A curvilinear form may be another alternative.

The fact that bicycle trips may *be* made in conjunction with another mode of travel should be kept in mind in the planning of bicycle facilities. St. George Park in Welland would make an excellent entry point and parking area for trail users, since travellers often carry bicycles on a rack on an automobile. Many recreational trips begin in rural areas on bicycles transported by the private automobile.

The proposed trail is one which could be used by pedestrians as well as bicyclists. Both bicycles and pedestrians can use the same facility, providing the combination of bikeway widths, volume of bicycles, and volume of pedestrians permits a satisfactory degree of safety and comfort.

The design factors such as grades, superelevations and turns are not criteria which are of exceptional importance since the area is flat and straight in character. It should be considered that it is undesirable to have greater than a five per cent maximum grade (desirable range between 0 and 3%) and secondly, any turns that may occur on the bikepath should be gradual and not hidden from the bicyclists' view.

Widening of the trail at points where the bicyclist may wish to pull off to the side should be provided. These points make excellent locations for park benches or logs in order that the trail users may rest or enjoy a particular site. Thus, they can be integrated into points of interest, but set back from the proposed path.

The initial trail route between Welland and Wainfleet is suggested to follow primarily the north side of the Feeder. In order for the railway tracks to be crossed at public crossings the initial segment of the trail must follow Feeder Road on the south side of the canal, then cross over to the north side for the trail continuation. It is important to note that a dirt trail or a gravel road parallels the canal on the north or south side, enabling trail construction to be carried out more readily and easily.

The use of already existing facilities will enable costs to be kept down. Therefore, it is suggested that the proposed trail begin in Welland. An excellent starting point would be St. George Park, located in the south-west section of the City of Welland where parking is already available. The Welland Landfill Site, however, is located between the canal and the park. In order to avoid this area, the path entry point would have to be placed slightly east of the park or situated along the Brown Tap Drain (found at the extreme easterly edge of the park). Another alternative would be to begin the path on the closed off section of Feeder Road which meets Highway 58 near the Broadway Bridge. In these cases the dump site would be avoided. The latter alternative has an advantage in that the unused portion of Feeder Road can be used as the bikeway. Its surface is in excellent condition, thus requiring little construction along this stretch.

If a trail were routed along the dump, its location would undoubtedly require the use of City of Welland land and/or land belonging to the Federal Department of Public Works. Permission from the Welland City Council, and Public Works would be necessary in order that the land be used for the proposed route of the trail. To date, there are no tentative plans to continue development of the St. George Subdivision, and no application for re-zoning has been submitted.

Trail Length

Cycle speed as well as the ability of the average trail user should be factors in determining the path's length. The average cyclist sustains a speed of between 7 - 15 miles per hour. "The consensus of park and recreation administration having bikeway development experience

is that the average recreation cyclist will ride a distance of five miles one way covering approximately a 30 minute period". (Jarrell, 1974) Professionals agree that the average pleasure ride length is estimated to be between three and six miles . "Along a waterway or a scenic overlook, a return on a single route may be worthwhile". (Jarrell, 1974)

Support facilities such as toilets, bicycle stands, parking areas, benches and waste containers should be made available and provided where necessary. The construction of comfort stations along the canal is not necessary, since communities adjacent to the Feeder are found at regular intervals. Particular buildings in communities can be designated and public washrooms at the trail entry point can be used requiring no construction and further cost.

Tread Width

The tread width should be selected on the basis of type and amount of use, whether travel is one-way or two-way and on the basis of trail appearance and terrain. Desirable widths for a one-lane trail range from 4.0' to 5.0', but it is recommended that for new construction a minimum of 8.0' be used. "A one-lane path allows only traffic-with-no provision-for-passing and is not generally recommended for new construction." (National Capital Commission Bikeway, p. 40) A bicycle itself is approximately two feet wide and compensation for the swinging movement and extra room required for passing, results in the eight foot minimum width quoted. Combined-use bicycle and pedestrian paths are recommended to be a minimum of eight feet wide. It is possible, however, to minimize the width requirements slightly in order to enhance the rural setting of a trail.

Right-of-way Clearing

"Vegetation should be cleared only to the degree necessary to provide for safe and unimpaired movement along the trail". (Parks Canada Trail Manual) Small trees and shrubs that will grow quickly into the trail should be removed. Small plants, turf, and surface soil material should *be left* in the tread area when surfacing is not to be applied. These will help protect underlying soils and give a more natural appearance to the trail.

Fixed objects such as trees should be kept back approximately one foot from the edges of the path. A clearing height of seven feet should be maintained thus requiring the removal of vegetation found overhead. It is recommended that greater heights be cleared for cross-country skiing use of the trail to allow for snow depth and drooping branches from the weight of snow. (Parks Canada Trail Manual)

Tread Surfacing

A key consideration regarding tread surfacing is that it be firm and smooth. Many different types of surfacings have been ahalyzed and it has been found that asphalt or compacted crushed stone will be required rur uac by bicycle,.

Crushed stone is highly suitable for trail surfacing. It is durable, firm and smooth. Crushed stone has advantages over asphalt, in that it Can be repaired more easily, it does not look as patchy after repaired, and it is less expensive.

While asphalt is less compatible than stone with natural settings, it is less likely to become rutted and may give a slightly smoother ride than a crushed stone surface.

Careful planning and construction of subbases and bases is necessary so that the surface of the bikeway will not rapidly deteriorate and become unusable. Requirements for depth of surfacing and degree of compaction will depend upon the conditions of the subsoil and whether trails will also be used by service vehicles or cross-country skiing. Engineering expertise should ***be*** used to determine these requirements.

Signing

The function of signs is to identify trail access points, the type of trail, its destination and its length. Signs should also identify regulations governing trail use. For example, since bicycle paths are not intended to be used by motor vehicles of any kind, this regulation can be enforced with a sign such as "Motor Vehicles Prohibited" at all points of entry to the bicycle path. A typical sign recommended for bikeway identification shows the black outline or a bicycle on a wnite background inside a green or blue circle. Guide signs (14" x 14") should be smaller than regulatory signs (14" x 18").

Crossing signs should also be erected. These signs should be placed prior to any point at which the bike path crosses another route of transportation, be it a railway crossing, highway or street. Positioning of the sign should be approximately fifty ***feet*** from the point of intersection.

Multi-purpose paths such as the one which has been proposed should be designated by a sign reading "Bicyclists Yield to Pedestrians".

Metal sign posts are recommended since less maintenance is required. The approximate annual cost of maintenance is $2.00 once they are up. Plastic overlays on these galvanized steel structures can

be purchased for approximately $0.65, and should last up to three years.

For a more detailed discussion of signs the Parks Canada Sign Manual

should be consulted.

Examples of trails exist throughout Ontario. The following illustrates costs involved in the construction of bicycle paths using a crushed stone surface.

The bike trail proper in Point Pelee Motional Park is Approximately $2^{1}/_{2}$ miles long. The trail is hard packed gravel and construction cost was **approximately $7,000.00 per mile. This cost included labour,** minimum clearing, sub-excavation (for pathway to be flush with the ground) and

the brave' base.

In St. Catharines, the Welland Canals Preservation Association has initiated the beginnings of a bicycle trail. The following cost

figures were compiled in 1978; approximately 10% should be added to account for inflation.

Their bike path is to consist of a base of common fill varying in depth depending on the slope of the area. On top of this would be placed approximately 6 inches of Granular "A", followed by an inch or two of Traffic Binder. Labour cost works out to about $6.08/foot. This is

based on an eight man crew working eight hours a day and completing thirty feet a day. In addition to this, there is the cost of supervisory staff - $3.38 per foot. This is based on one project manager and two supervisors working eight hours a day and completing thirty feet per day.

It should be noted that none of these costs include grading machinery; all labour is manual.

Canoeing

Canoeing has recently become a widely popular activity, but Southern Ontario is lacking in designated routes. In its present condition, the Feeder makes canoe tripping an unlikely pastime. The area is environmentally unattractive to canoeists. Canoeing is affected by pollution, obstacles and vegetation in the water, all characteristics belonging to the Feeder. A waterway must be of sufficient length and have an adequate summer flow to enable its use for canoe tripping. The required minimum depth is four *feet* with a minimum length of 1_1 mile. Variations in the watercourse, that is in width, current, gradient and direction, are positive attributes. There is also a need for
sufficient moorings, ramps and parking. The Feeder's existing inadequate culverts and interruptions from fill for roads limit its **value for** canoeing. Other negative factors include the Feeder's high banks which would limit potential user view, and its almost straight course, cutting through flat agricultural land for its entire length.

The limited amount of land bordering the Feeder Channel is a factor which limits the construction of support facilities. Thus, in order for the Feeder to be used for canoe tripping the requirements include steadily flowing water, removal of some road fills and/or the installation of adequate culverts in others.

Culverts where they exist are for the most part of insufficient capacity to provide an adequate flow of water to permit recreational uses. As well, they are of inadequate size to allow the passage of a canoe and its occupants.

The best location for canoeing on the Feeder would *be* along the Wainfleet segment of the canal corridor. This iS recommended since existing portions in the Wainfleet Village area are currently being used by a *few,* admittedly enthusiastic, canoeists.

Cross-Country SkiinK

Cross-country skiing, which has gained popularity recently, is another activity which could be pursued along the banks of the Feeder Canal. This activity involves the use of a trail. It is important to note that the proposed trail which could be used during the spring, summer and fall months for hiking and cycling could also be used for cross-country skiing during the winter months.

According to projections made by the Canadian Ski Association, Ontario will have between 700,000 and one million cross-country skiers by 1981. Thus trails are in great demand, particularly in the Niagara Peninsula where a large user population exists.

The most logical starting point, similar to the bicycle path, would be in Welland where a large user population is located and where facilities (for example, parking) are in existence. Wainfleet could also serve as an entry point for this trail.

Weather conditions are of major concern for cross-country skiing and winter trail use. Desirable conditions include protection from prevailing winds for the comfort of skiers, and to reduce drifting, the wind packing of snow. A minimum snow depth of 15 cm. is desirable in order to give adequate cover over the trail, rocks, etc.

In order to promote the route for cross-country skiing, signs at entry points and along the route would be required.

Fishing

Fishing depends upon such factors as quality of water, depth, flow and bottom conditions. This activity is also influenced to an extent by the aesthetic quality of the waterway, and its surroundings.

Fishing is an activity enjoyed by people of all ages, and can be associated with other recreational facilities, such as picnicking. The advantage of allowing fishing to take place in the Feeder is that minimal costs and disruption are associated with this activity. Due to anticipated water conditions, fish species would be restricted to such fish ***as*** carp and catfish. However, it is important to note that lake fish may travel into the canal and inhabit its waters.

Easements would be required to give access to the banks of the channel. With a low volume of visitors and local people being the most likely to engage in this activity, support facilities such as parking areas are not extremely necessary.

Fitness Trail

People have recently become increasingly aware of the advantages of physical fitness. As a result, interest in fitness trails has escalated.

In the establishment of a fitness trail, the search is for an easily accessible area where all age groups will be able to exercise. Thus, basic requirements are that the trail site be easily accessible by road and that the trail itself be comfortable for running on.

A fitness trail could be situated in a multi-purpose area, for example, near a picnic site. An alternative location would be in the wooded area in close proximity to the City of Welland. This would probably be the best location, if permission from the City of Welland could be obtained for the construction of a bicycle path east of St. George Park. The exercise circuit would therefore fuction more fully since it would be integrated into the existing recreational facilities. And the use of existing parking and washroom facilities would further reduce the cost of development of the project. Finally, the easy access by a large number of people living in or near the area would also ensure greater usuage. The Wainfleet end of the trail could serve as the site of a fitness trail station.

It is recommended that the site have a varied terrain; however, it is possible to *create* a suitable setting for a fitness trail by the creation of landforms and the addition of vegetation.

General principles for the layout of such a trail are as follows: the maximum recommended length is 3,500 feet long with exercise stations placed 500 feet apart. (Fitness Trails, 1975)

A fitness trail along a segment of the Feeder would take advantage of views of the channel and different degrees of enclosure. "Vegetation microclimate and topography have a considerable bearing on the proper development and maintenance of the trail and stations". (Fitness Trails,1975)

In the construction of this trail whether it be separate or in association with the proposed bicycle path, existing trees, shrubs, and ground covers should be preserved wherever possible. The only vegetation which must *be* removed is that which will interfere with either the use of the trail or stations. Pruning or trimming should be kept to a minimum. The existing vegetation may be used to provide shade, wind screening and perhaps provide privacy around exercise stations. "The trail should be positioned to minimize removal of vegetation as well as to take advantage of openings and enclosures." (Fitness Trails, 1975)

Trail location should be diverted from sensitive ecological areas which could not withstand the impact. Removal of vegetation cover should be kept to a minimum since removal will increase the rate of runoff and soil erosion.

Trail stations should be located, when possible, to catch the morning sun in order to dry the equipment of dew and prevent slipperiness and rot. During the remainder of the day, the station should be ideally shaded to reduce the temperature. Preferably, shading should be with deciduous trees, so that in winter the site is in the sun as much as possible.

Horseback Riding (Equestrian Trails)

"The concentration of horses and riders is quite apparent in Southern Ontario, where there is a critical shortage of equestrian trails." (Ontario Trails Council, 1977) Yet the use of lands along the Feeder for an equestrian trail would appear to be undesirable.

As with the establishment of snowmobile trails, the establishment of equestrian trails usually results in environmental damage. Horses can cause significant disruption by changing plant distribution and succession along trails, and fragile native species may be eliminated by browsing and trampling. Other trail users usually resent the ecological disruption caused by horses.

Large areas of land for simple corrals for horse securement are required on or near an equestrian trail. The trail route is recommended to be no less than 100 metres away from water, requiring more land than is available on Feeder property.

A trail designated for horseback riding may not be used for any other activity. A multi-purpose trail associating horseback riding and other activities is unfavourable mainly due to aesthetic reasons. Incompatibility also results from spooking of horses by other activities, such as bicycling.

Because the Feeder channel is located in a rural area, trail use would probably be limited. And because already existing equestrian facilities are located nearby and equestrian trail maintenance costs are high, such a trail is not recommended.

Ice Skating

Ice skating has long proved to be a very popular winter pastime. In the winter months, this outdoor activity could undoubtedly take place on the Feeder providing that a minimum ice depth of four to eight inches is attained. Less ice depth would be favourable where there is low use and uniformity of ice conditions. The use of the canal for ice skating would require little maintenance and cost. Maintenance would involve the pushing aside of snow and, when necessarylthe flooding or watering of the surface.

The best location for such an endeavour would be along the Wainfleet and Welland segments, where a large user population exists.

Picnicking

Picnicking is considered, by many, a pleasant family-oriented activity. Picnicking can *be* destination-oriented with it as the primary activity, or it may be enjoyed in conjunction with other activities. The increased popularity of hike-in and bicycle picnic sites attests to this fact.

Since Highway 3 bisects the Feeder Canal, and is used extensively by travellers, access to picnic sites would allow them to enjoy picnicking and the ***scenic*** landscape.

Picnicking sites must meet particular requirements so that the areas will best be utilized. Firstly, in order that potential users reach the chosen site, easy access is necessary. It is important to designate picnic sites within approximately a two mile distance of any transportation

route if travellers are to be attracted. Poor or unsightly travel routes represent inconveniences which could deter visitors from travelling to the picnic sites.

Signs informing travellers of the existence of picnicking facilities should be erected on main routes within a short distance of the Feeder and picnic sites. These signs would be placed along Highway 3 in wainfleet and perhaps along Forkes Road and Boulton Ditch Road (close to the Feeder Road exit).

In terms of specific design guidelines for picnicking areas, the sites should be oriented to provide maximum shade from approximately 1:00 A.M. to 3:00 P.M. during the summer months. Therefore picnic units along the banks of the channel would require adequate landscaping. Fortunately, the Feeder route displays characteristics which allow for minimum re-development. The area is relatively flat and everywhere within a reasonably short distance of a main transportation artery.

In order for the proposed picnic units to cater to travelling visitors, pull-off space for their vehicles would be essential. Less space, however, would be necessary if the picnic units were to be used only by cyclists and pedestrians. Chosen sites would have to be compatible with adjacent land uses so that the on-site experience would be aesthetically attractive.

Other requirements such as comfort stations (at least 500' from the units) are recommended, but would probably not be required at picnic sites closest to communities along the canal.

Picnic tables should probably he secured in order to control deterioration of the site and prevent theft. Removal of the tables might be necessary in winter months to prevent damage from heavy snowpack and possible vandalism. Waste containers at each site should also be provided, the number depending upon the anticipated amount of *use* the area would receive. The space standard is approximately 3.5 people/table. Hence, the number of tables to be installed would be influenced by the user turnover rate. The local season length for picnicking is estimated to be 135 days.

Although picnicking would be an excellent activity to be undertaken along the Feeder's banks, specific problems would have to be overcome to ensure that the experience is a satisfactory one.

The location of picnic areas to be used by motorists could represent a problem. On the south side of the Feeder where the main road presently exists, few areas have a wide enough shoulder to permit parking and picnicking. This would suggest that picnicking be restricted to the north side along with the trails. To encourage picnicking, the problem of road dust would have to be resolved. At present, re-surfacing of Feeder Road has begun, but must be extended its entire length or continual dust control would have to be undertaken in order that picnicking be enjoyable.

Map 4 indicates possible picnic sites along the Feeder Road. Picnic sites along the proposed bicycle/walking trail would be especially welcome to users providing them with a chance to rest and enjoy the area.
(See Appendix for cost information)

Snowmobiling.

The establishment of a snowmobiling trail on the banks of the Feeder is an alternative to the use of the proposed bicycle/walking trail in the winter months. But snowmobiles present problems. These problems include noise, pollution, trespassing and possible damage to fields. Along with the problems caused by snowmobiles, the physical characteristics of the Feeder lands do not provide the best conditions for snowmobiling. Unvaried terrain, and the limited land available to provide parking areas adequate to accommodate vehicles with trailers would also cause problems.

Snowmobiles may cause harm to the environment. For the environment, the snowmobile is all cost and no benefits. There is evidence that they are detrimental to both flora and fauna. Their exhaust emissions cause air pollution and these machines represent a non-essential use of scarce energy. Not only is the noise they emit damaging to the drivers, but it is also a nuisance to others who are involuntarily subjected to the noise. Thus, snowmobiles interfere with other recreational pastimes and are especially incompatible with cross-country skiing. The winter landscape would be much more peaceful without snowmobiles.

Although snowmobile trails could be set up relatively early, they are undesirable because of their incompatibility with the existing land uses and because facilities for snowmobiling are *already* in existence nearby.

Swimming

Swimming is an activity enjoyed by many, both for fitness as well as recreational reasons. But the use of the Feeder for swimming is

questionable. In order for swimming to take place, a minimum water depth of four feet is recommended. Depending upon rehabilitation engineering guidelines followed, this depth may not be acquired. Along with the depth factor, the water quality and channel bottom are two other unfavourable factors limiting the potential for swimming. With other facilities within close proximity to the Feeder, it. is suggested that swimming not be encouraged as a recreation activity on the channel.

Phasing

Before Feeder development is to take place, a schedule of priorities must be set. In terms of the proposed bicycle/walking/cross-country skiing trail, the Feeder segment from Welland to Wainfleet is the recommended location for initial construction.

Reasons for this decision include accessibility, existing potential user population and pre-existing facilities which could *be* used. If found viable, the construction could continue. The path starting point would best be located in Welland, in or on the outskirts of the St. George Subdivision. Washrooms and parking facilities for motorists who bring bicycles and/or skis are readily available. And because Welland is an area of relatively high population, it is a traffic generation point.

Maintenance

Responsibility for the operation and maintenance of the proposed recreational facilities, particularly with regard to the bicycle/walking/ cross-country skiing trail, would reside with the municipalities.

Maintenance would primarily involve the following: garbage collection (picnic sites), trimming, trail grooming and grass cutting in picnic *areas.* Each municipality involved would be responsible for erecting and maintaining signs in their respective areas. Signs would include those on the trail route itself and those along road portions warning motorists of crossing trail users.

If maintenance by a municipality is not possible, the problem could be resolved by either raising the necessary funds locally, using volunteer workers or requesting the local Conservation Authority to take over the responsibilities.

Public interest in the restoration of the Feeder Canal is high. As a result, clean-up projects involving community people could be carried out. Although this is not common practice in Canada, the British experience has been successful and well supported. Perhaps the same could be true for the Feeder Canal.

Of interest, is an example of operation and maintenance costs and duties required on a hard packed gravel trail at Point Pelee National Park. Maintenance costs are approximately $500.00 per mile per year (the trail is approximately $2^{1}/_{2}$ miles long). This cost includes adding gravel and grading three times a year, and the cutting back of vegetation.

Problem Areas

Along the proposed trail route problem areas exist. These include:

- the Welland Municipal Landfill Site
- areas where the proposed path is to cross railways

The landfill site should be hidden from the view of trail users. A berm already in existence serves the purpose, but perhaps it can be landscaped, thus giving this area more scenic appeal. This landfill area can also be used as an educational site (see Environmental Section for a more detailed discussion).

Canadian National Railway lines, three of which must ***be*** crossed by the proposed trail, are problem areas. Application to allow such crossings on the north side of the Feeder was declined. *Therefore,* an alternative route for the portion of the trail which crosses the three tracks was chosen. Instead of routing the trail on the north side of the canal, where large depressions would have to be crossed, the proposed trail would be routed along the south side of the Feeder Canal, on Feeder Road. Cyclists and pedestrians would have to traverse the tracks' public crossings. Other recommendations to alleviate future problems include erecting signs warning trail users of railway crossings, and requiring cyclists to dismount their cycles in order to cross the tracks.

Recommendations

1. ~~It is reco~~mmended that crushed stone or gravel be used in the initial construction of the proposed multi-purpose trail. If this surface proves to he unsatisfactory, and when sufficient funds are made available, then perhaps asphalt can be applied.

2. The trail construction should be phased, if funds are limited.

3. Where cyclists must cross railway lines they should be required to dismount and walk.

4. Signs identifying the trail route should be erected. Cross-country skiing signs should be added to or replace bicycling signs in the winter months.

5. Motorized vehicles should be prohibited from the trail.

6. When the bicycle trail must follow Feeder Road, signs should be erected warning motorists.

7. Recreational activities should ***be limited*** to specific locations.

8. It is recommended that the vegetation, particularly the trees lining **the banks of the Feeder**, ***be*** **trimmed to** provide views from the trail and enable trail users to better appreciate the scenic beauty of the canal.

9. The City of Welland should consider taking over responsibility for the Welland section of the Feeder from the Federal Department of Public Works. It this is done, Welland could *use* the land to develop much needed recreational facilities of the type proposed. Welland should preserve this section of the original Welland Canal, the canal that gave it its origin.

10. To promote use of other proposed recreation facilities, signs should be erected on the major local transportation routes notifying visitors of their existence.

11T Some landscaping is required primarily at picnic site locations. It is also important to note that some cover of vegetation is desirable over the trail route.

12. Precautions should ***be*** taken to protect cyclists at road crossings. All crossings should be signed both on the trail and on the road. Where there is not clear visibility for a minimum distance of 300 metres in both directions along a road, cyclists should be required to walk across it.

Economic Impact

The Feeder Canal is a man-made resource that has in the past influenced the economy of the surrounding area. This historic route, with rehabilitation, has the potential to once again contribute to the local economy, although on a much smaller scale. This contribution could result from encouragement of related private-sector services because of the Feeder's potential to bring in people and money to already existing services.

The position of the Feeder Canal, in terms of its nearness to popular tourist attractions (i.e. Niagara Falls, Welland Canal system, Provincial Parks and Conservation Areas), could generate more tourism to the area and in turn positively influence the use of proposed facilities. Visitors making use of the major transportation routes, particularly Highway 3, which bisects the Feeder, could provide a substantial market for businesses located nearby.

All of the communities on or near the Feeder could benefit economically from a rehabilitation program.

Social Impact

The social impact of recreational and historical development along the Feeder Canal is difficult to predict. Similar projects have been undertaken in other areas. One major effort in Canada is the Ontario Rideau Trent Severin Project. That program has involved a much larger area, but planning members are available to provide expertise and information. On a smaller scale, the Chesapeake and Ohio Canal system has been developed in the United States. Many other canal development schemes have been undertaken around the world. In the immediate area developments are being planned along the old and new Welland Canals apart from the Feeder. The Welland Canals Preservation Association (WCPA) deals with an urban area unlike the predominantly agricultural and rural Feeder region.

Development of historical sites and recreational potential promises benefits for local communities. By reviving a purpose and use for the old canal the area may experience an increased self-awareness and pride. This may be accomplished by linking historical sites by a recreational trail. It is hoped that an increased awareness of the local heritage would result. In turn, a recognition and understanding of the past may encourage the local population to become more involved in planning future community development. As well, historically significant structures are especially important to smaller communities where many people can closely identify with them.

The canal may also attract attention to some of the other interests of a rural oriented population. Successful rehabilitation of the canal might encourage protection of the physical environment of these agricultural communities.

The project could draw a tourist population in the rural area. It is difficult to analyze the potential impact of tourism in the region. The scale of the proposed development does not suggest any dramatic problems. It is hoped that the facilities will be designed to encourage visitors to enjoy the historical and natural resources of the canal without any large scale commercial developments. Hence, the region will be able to retain its "small town commmunity spirit".

It will be important to encourage community involvement in this project. Community support will lead to assistance with collecting data, preparing and maintaining the facilities, and providing finances when necessary. The formation, and current public support, of the Rehabilitate the Old Feeder Canal Committee suggests that there is already a strong community interest in the canal rehabilitation project.

The local and regional pride which may result with the rehabilitation of the canal will ensure the project's success. The environmental, recreational and heritage awareness which the canal rehabilitation would encourage, could in turn provide a positive symbol for other areas of the country.

Fundins

Financial assistance for improving the Feeder for recreational purposes could be obtained from Wintario under the Ministry of Culture and Recreation.

Another source of funds might be the "Agreements for Recreation and Conservation Branch" (Parks Canada) initiated in 1972. More specifically the "Byways and Special Places" program may prove to be an important source. The purpose of the program was the establishment of a nation-wide system of wild or historic waterways, historic land trails and scenic and historic parkways. It established a federal-provincial basis for the development of linear parks throughout Canada. The main objective of A.R.C. is to ensure the conservation of the Canadian heritage, and to increase associated recreational opportunities for all Canadians; the A.R.C. Branch of Parks Canada will co-operate with federal and provincial agencies in the identification of land and water corridors and will participate through federal-provincial agreements in the planning, development and operation of the corridors' resources. Other sources of funds exist and should be investigated further. (Greenwald, 1977 p. 145)

Conclusion

Under present conditions, the Feeder Canal fulfills little use, but with some rehabilitation, clearing, and the addition of flowing water, the canal would be a suitable location for recreational development. The scenic and aesthetic appeal of the channel could be enhanced, thus making this abandoned area useful, and design potential, along with the presence of water, contributes to the Feeder's suitability for recreational development.

Leisure can be described as "a state of being free from the necessity to work, while recreation is that which one does when at leisure". (Leisure Today: Selected Readings) Changes in recent years in the physical and mental demands of work have emphasized the need for challenging and satisfying leisure pursuits. "It is predicted that by the year 2000 leisure time will absorb some 44% of a person's day". A number of factors have combined to place a premium on open space. These include increasing population density, increasing economic growth, and increasing amounts of free time.

The re-development of the existing Feeder Canal corridor would to some extent alleviate these problems while preserving part of our history.

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Introduction

The Niagara Peninsula provides visitors with numerous areas of scenic beauty. One can marvel at the natural setting and agricultural environment as the Welland Feeder Canal route runs through rural landscape. A few tree stands have been left in their natural state giving one an indication of what the first settlers of the area encountered. Since the introduction of the canal in 1829, many events have taken place changing the landscape.

This once proud navigational route is now home to a diverse group of animal varieties, its banks abounding with numerous species of hardwood trees and wildflowers. Through neglect, the canal has become a great eyesore, its banks sliding into the dirty algae filled water. Trees, shrubs and weeds grow densely along its route.

By careful environmental investigation and prudent conservation management, however, the natural setting could be preserved, and nature trails and interpretive sites could provide both scenic and educational possibilities for the trail user and the student.

Present Canal Conditions

Water Environment

The depth of water in the canal is variable. Data shows a depth of a few inches to fifteen feet, the latter being recorded at Port Maitland where the Feeder opens up into the Grand River. The average depth of the water is between two and three feet. In certain areas there is a noticeable flow, but in others no flow exists. The fastest flow can be observed in the Welland Brown Tap Drain (Government Ditch). Along the segment where dredging has *been* carried out there is a dividing line, one section flowing south to Port Maitland and the other flowing north-east to the Welland River. The Dunnville branch has no recorded flow at all.

The general appearance of the water changes due to regional differences. The water in the Brown Tap Drain appears an amber colour; according to the Ministry of the Environment, this is due to the decomposing vegetation **matter**. From Welland to a point three miles west of the Village of Wainfleet the water is clear and colourless; farther west at Dunnville and Port **Maitland the** water appears cloudy.

The many aquatic plants growing in the canal are responsible for the unpleasant appearance and odour. The most numerous emergent aquatics are cattails, arrowheads, waterlilies and mare's tails. The water also contains pondweeds, duckweeds and filamentous algae (see aquatic vegetation list). Most of the canal length is filled with these aquatic plants. By early July some areas where the water was originally one and a half feet deep in the canal are completely dry. These areas are very thick with cattails.

Many of the plants give clues as to the water and soil bed conditions:

Mare's tail - clear, still or slow running water, calcareous

Duckweed - stagnant water rich in nutrients

Pondweed - slow flowing, muddy conditions, dissolved nutrients

Water Plantain - stagnant water

Milfoil - warm stagnant water with dissolved nutrients

Water Pepper - indicator of nitrogen

Greater Reedmace - still water rich in nutrients

Some areas of the canal are in an advanced state of aquatic succession. The turning circle of Stromness and the Lowbanks area are classic examples of a water environment changing to a terrestrial environment through silting and land being reclaimed by plants. Cattails are very abundant here and the previous year's growth can be uncovered.

The canal bed is composed of organic soil, with many weeds in it, the soil trapping floating silt. The decaying vegetation is responsible for the high nutrient levels. Painted and snapping turtles have been found, along with bull frogs, leopard frogs and carp. Although no pike were spotted by our survey team, there are reports that pike can be found in this watercourse. Groundhogs and muskrats build their homes close to the water's edge; the muskrat lives more in the water and is known to build beaver-like dams in stagnant areas of the canal. Mallard ducks and blue herons also have been spotted, the herons preferring more reedy areas and the ducks open water.

Water environments are the source of all food chains for the animals of the area. Many mammals are dependent on plants and micro-organisms. Small organisms thrive in these warm waters, the most noticeable being mosquitos

which are provided with a perfect breeding ground. Filamentous algae and emergent aquatics are also a source of food for some terrestrial animals, but fish eat very little of these plants.

Terrestrial Environment

The soils of the area are mainly clays, loans, silt and sand loans. All soils and associated landscapes were deposited as a result of glaciation. The land is basically flat with some undulation but this lack of relief combined with the soil types provides for poor natural drainage. No natural outcrops of bedrock appear, but base rock has been exposed in Port Maitland through quarrying. The clays on the surface pack very well and retain water; as a result, ponding is visible at times.

On the lands adjacent to the Feeder, farming is carried out. The most frequent crops grown are corn and wheat. Market gardens appear near Stromness and a few sod farms are located west of Wainfleet. Some of these farms have drains emptying directly into the Feeder; in every case this water was ladden with silt from the fields. Many creeks and ditches run along side the canal and through farms; these flood in early spring and as a result a large amount of land is unworked for long periods of time.

Erosion is a very evident problem along the canal banks. Slipping and gulleying occur to varying degrees along every section of the canal. Lack of vegetation cover adds to the rate of erosion by leaving the soil exposed to rain and snow. Some areas are totally void of trees while others are very densely packed, but this is not a natural succession growth since the banks were cleared when the canal was first excavated.

This area of Ontario lies within the deciduous forest region which is comprised of mainly hardwoods, the most abundant species being sugar maple; minor species are hickory, cherry and ash. The study region is mostly composed of red ash (white ash near Dunnville), followed by elms and maples. Many species of willows are also found along the canal banks. Numerous shrubs grow along all sections of the canal; the most abundant are dogwoods followed by hawthorn, cherries, sumacs and raspberries. Like the trees, shrubs vary in their density. It was noted that ashes grew along all positions of the *canal* bank. Where there was sufficient soil, ash shrubs also line the canal water edge. Elms and maples were also located in the middle of the slope and up to the back ditch, where they find drier soil conditions.

The shrubs are mainly ornamental, the flowers producing berries late in the summer. Dogwoods prefer moist soil conditions, while sumacs and cherries grow best in well drained to dry conditions. These preferences hold true, as indicated by their positions on the banks of the Feeder.

When trees and shrubs become very thick, light is absent or very diffused on the ground floor and this influences the type of plants that will be found. Where there is an absence of sunlight hardy plants grow.

The channel roadside plants are hardy and very resistant to trampling and can grow in very compacted soils. Small shrubs and ground cover plants can be found on the south side of the canal from Boulton Road to Etromness. When this section was dredged, larger trees were removed and have not as yet been re-established. The dredged soil was thrown on the bank and covered with shrub cuttings. Shrubs have established themselves on the banks but the soil is still sliding.

The banks of the canal take on varying shapes and designs. The greatest angled slope is located along the Brown Tap Drain. This slope is very high (over 10') and steep. Many gentler slopes also exist, the gentlest being just west of Forkes Road. West of Wainfleet terraced slopes were observed, these being the result of massive slipping. The flattened parts of all the terraces are ideal for the planting of trees which will stabilize the banks.

Small mammals inhabit the canal region, with the shrubs and other vegetation providing a good source of food. Blackbirds and sparrows eat berries; rabbits and chipmunks eat raspberries and deer prefer the berry stems. Dogwood shrubs are also eaten by deer as a winter subsistence food. The water environment as well provides a good source of food for waterfowl such as mallard ducks and blue herons.

Vegetation

The trees that grow along the Feeder Canal are hardwoods which are characteristic of this region of Ontario. Ash trees (red and white), are the most predominant species found along the entire canal length. Next are the elms, maples and willows; poplars and cottonwoods are also found in the region. All these trees grow to heights of thirty to fifty feet and provide a large canopy for shade on the surface. Growing all along the slope, these trees provide adequate shading but the view of the Feeder is sometimes obstructed by a dense bottom branch growth. With the removal of these branches not only will there be a pleasant view, but the growth may also be strengthened by this "pruning".

Many different ages of stands occur, most of them being in the climax stage of succession with a thick shrub layer beneath. The older ashes have diameters that were measured at $1^1/_2$ feet and the maples and willows have even greater diameters. The conditions that prevail along the canal are not ideal for tree growth. The Wainfleet to Welland section has been classified as a hazard land by the local Conservation Authority. This is a result of poor drainage, steep slopes, erosion and general degradation of the environment. Silver and sugar maples which are found along the back ditch tolerate the moist soil conditions. Ash trees which are found everywhere do well in moist to wet clay but prefer dry higher land. Elms do well in moist environments but prefer a drier landscape; this is reinforced by their location on the canal. Willows are suited to moist soil conditions and this is true as to their placement along the canal. Although all of these trees are not growing under the best conditions possible, they are tolerating the environment.

Numerous shrubs were found along the canal slopes and also on the land adjacent to the back ditch. Many species of willows, dogwoods, hawthorns are the most abundant; raspberries, cherries and sumacs also cover large areas. The dogwoods and willows grow very well in this area since they thrive in areas that are moist to wet; they do well in full sun and can tolerate shaded areas. The cherries, raspberries and sumac shrubs grow on steeper slopes where the soil is well drained but can withstand a moist environment. Like the dogwoods, these shrubs grow best in full sun, but will persist in a semi-shaded to a totally shaded environment. The dogwoods grow to medium shrub height (8 *feet)*, the cherries are small trees (10 feet to 15 feet) and willows grow to great heights (20 to 30 feet).

Shrubs$_p$as well as some trees, provide a necessary food source for many animals of the region. Most shrubs bear fruit that is eaten by birds and small mammals$_o$and the honeysuckle berries remaining through winter attract deer and rabbits; these plus raspberries are great winter subsistence for the animals. Buds and small twig ends are eaten in early spring by squirrels and chipmunks.

A few black walnut trees were growing in the Village of Wainfleet; this highly marketable tree does best in well drained loams. In areas where these situations prevail the walnuts may be encouraged to grow, but this species also demands a great amount of light. The rarest tree found is the clammy locust; it is of great importance since it is one of the best trees to plant in order to prevent erosion of clay slopes (similar to black locust). It is also of great importance as a decorative tree with its pink flowers in hanging clusters, and a fragrant scent attracting ray birds and bees.

A great variety of herbaceous plants are found along the canal. Most of these are tolerant of harsh conditions, grasses being an example. Many species of the grass family such as barnyard grass and foxtail barley can survive under a wide variety of environments; these do well in deep soils but also grow abundantly where little or no soil is found. They are most commonly found along the road side where the clay soil is constantly being covered by crushed stone from the road.

Other prolific roadside plants are the plantains and dandelions; many species of each *were* observed. Each plant can grow well in severe soil conditions with taproots growing deep into the ground to reach water. They prefer loamy or sandy soils that are rich in nutrients, especially nitrogen$_s$and both plants are able to survive a great amount of trampling. The dandelion is the most abundant plant since it will grow anywhere and can tolerate a wide range of soil and water conditions. Field horsetail is also widespread, the largest accumulation being near Welland; very little is found in the Dunnville area. This plant can also tolerate a wide range of conditions but does best in a nutrient rich soil.

Most of the plants produce flowers; these are generally larger than the non—flowering plants and bloom from spring to fall with numerous shapes, sizes and colours of flowers. Many of these provided Indians with dyes as well as roots and leaves for food.

Where flowers are found, the soil is usually fairly compact (some plants require a tightly packed soil), and the tree canopy is thin enough to permit sufficient light to filter through. In densely treed areas these flowering plants tend to accumulate along the tree edge and diminish in variety under the trees. Due to insufficient ground cover, the soil is

eroding towards the canal bank and exposing the tree roots. The anchorage of tree roots in damaged and a few trees have been observed to lean in the direction of the canal.

The roots of most of the flowers are shallow, some are either tuberous or fibrous, and they are actively holding the soil. Fibrous roots are a better anchor for soil, since they are shallow, can cover a large area and have numerous parts to their root system. This enables the soil particles to adhere to the hairy surface. The combined effect of root systems and the great number of plants result in a stable soil surface; erosion does occur, however, where plants are sparse. The angle of the slope is great along the canal edge where fluctuating water levels destroy plant settlements.

Plants can solve many engineering problems:

– fleshy leaves deaden sound

– spreading, climbing roots hold soil

– hairness (pubescence) on leaves holds dust particles

– stomata (openings) in leaves help to interchange gasses

- leaves stop the fall of moisture

– leaves and branches slow erosive winds

- dense foliage blocks light

– blossoms and foliage provide pleasant odours

- light foliage filters light

The greatest cause of soil erosion is due to lack of proper soil character and ground cover. The severity is determined by exposure to wind, water and climate, as well as soil character and orientation of slope.

Dense leaves and needles create an effective barrier to moving air passing through the leaves, and branches close to the ground control this air movement. Multiple stems and rough bark deter ground air movement, and fibrous roots tend to prevent soil from being swept away. The best wind control plants are ground covers, or densely branched shrubs with shallow or fibrous root systems.

As rain falls on vegetation, initially the drops are caught on the broad leaf surface of the super canopy. The drops then fall to the shrub layer beneath, thus lessening impact; just before striking the ground, the raindrops fall on the ground cover. The impact becomes less severe as the density of the vegetation increases. Deciduous plants reduce splash erosion to a greater extent than coniferous trees.

Run-off erosion can also *be* controlled by certain plants which have shallow fibrous roots spreading throughout the soil. Secondary roots and hairs hold soil, but also tend to loosen soil which increases permeability. Plants also impede run-off as water velocity is slowed down upon contact with the stems and ground. Dead plant material on the surface increases the organic level, and the soil becomes loose, increasing water rate absorption.

It is a very complex procedure to assess the impact on vegetation due to the introduction of recreation activities in the area since the impact will depend on the species of vegetation involved. The main problem resulting from recreation activities is trampling of the soils and vegetation by trail users. Initially, ground cover will decline rapidly, but a recovery rate follows, and the rate of decline, **with use**, tends to taper off over time.

The most fragile species will be the first to disappear, while the most resilient species persist; the latter are plants whose leaves and stems are resistant to injury and their growing point is protected. The recovery rate is a result of the vegetation adapting to a new environment with the more resilient species becoming dominant.

New species that are introduced may dominate but may also add to the diversity of the area so that the variety will not decline substantially. On trampled areas, natural regeneration of the vegetation is more difficult. Areas receiving more sunlight have a high production rate of regeneration but also tend to be drier. As a vegetation community increases in seral stage (reaching a climax stage of succession, becoming a stable community), the tolerance to trampling increases and the effect is modified. The compactive effect of one snowmobile pass is proportional to fifty people passing on snowshoes.

Trampling also decreases heights of plants and the frequency of flowering. Although plants become resilient due to the changing environment forced on them, reproduction rates may decline since no litter layer is available on the ground for seed protection. This will alter the age structure of the plant community since the plants cannot re-seed, and the existing community dies without regeneration.

As brush and trees are cut and cleared, new habitats will be created; the area will then become an earlier stage in the succession development. This area will be suited to different plants; pioneer species such as hardy weeds, and also new wildlife species will be introduced. Both plants and animals will compete for sun and space, the result being an interesting

variety both biologically and aesthetically. Since this new environment is created in such a short period of time, new species may be inhibited due to increased erosion on the site. Due to constant trampling on the path area plants will flourish but will be different from the surrounding environment since soil nutrients are altered. Because nitrates will decrease and phosphates increase, nitrogen-requiring plants will dominate, creating a balanced soil.

With an increase in recreational activity, physical damage to vegetation beyond trampling can be anticipated. Flowers will be cut and gathered. Young tree limbs and trunks might be used for fires. Plastic ground sheets for tents or picnics can destroy ground cover by suffocation, blocking light and air. Roots may be exposed by erosion causing mechanical damage and increased susceptibility to further degradation. Like ground sheets, excessive amounts of litter and debris on the ground lead to destruction by suffocation. Plants may be destroyed or damaged when stones and gravel from camp fires and roadsides accumulate around them. If paths do not have enough side clearance, tree branches may be broken and trunks scored by faster moving vehicles. If dirt or stone roads create large amounts of dust, the pubescence of some plants enables this dust to accumulate on the plants. This may become a sufficient amount to inhibit plant respiration, thus reducing the purification process which may ultimately lead to plant destruction.

Geology

The Feeder Canal study region, as well as the Niagara Peninsula, has been formed as a result of glaciation and its associated actions. Today's topographic features were formed by the Laurentide ice sheet of the late Wisconsin period over 10,000 years ago. The Niagara region was moulded by the Ontario-Erie ice lobe which moved in a south oriented direction; local features show the advance was in a SW-WSW direction. Scarring of base rock and a washboard pattern of relief (1' - 2' in height) have been identified in the Welland area, and this reinforces the direction of the ice movement.

As the glacial ice lobe retreated, the larger, denser particles that were entrained in the ice block were the first to settle out. Gravelly silt was deposited over the entire area with a finer clay and silt on top. Large sand deposits cover the area known as the Port Maitland moraine; this is a fine sand and silt which gives rise to a coarser beach sand and gravel. Later, an ancestral Grand River entered a lake from the northwest in the area of the present site of Dunnville. This lake covered an area enclosing the southern Niagara areas - sections of Wellland, Dunnville and Winger. The lake was shallow, depositing fine to very fine grained sand and silt. A delta-like landform was deposited at the river mouth near Dunnville. Upstream, alluvial terraces could *be* found. When the lake dried, these deposits were blown by wind, creating parabolic dunes which today show the orientation of the winds that formed them.

These parabolic dunes are west of the Village of Wainfleet; they consist of fine sands resting on shallow water or deltaic sands. During the Holocene period, organic material was deposited in depressions below the Onondaga escarpment. The largest accumulation is the Wainfleet bog which is situated near the Feeder Canal's route.

Great depths of soil must be excavated In the area before bedrock is exposed. There are some Paleogoic bedrock outcrops along the Onondaga escarpment. In the Dunnville area these are composed of Silurian dolostone which are overlain by Devonian cherty limestone. The soils today range from coarse gravel to a very fine clay and silt mixture.

Soils

The Feeder Canal and adjacent lands are situated in the Haldimand Clay Plains. The Welland area is composed of clay loans such as Caistor Clay Loam, Jeddo Clay and Welland Clay. These are dark grey and light brown in colour. Few stones are found in the soil. The clay loans basically overlay the clays throughout this area. The land is basically flat, with some rolling terrain and pond depressions; as a result, the natural drainage is very fair to poor. The soil is strongly acidic, requiring the application of organic matter such as lime and phosphates. Grain crops such as wheat, oats, barley and corn are grown in this soil. Surrounding Wainfleet are mainly silt loans and Toledo clay. The silt loam is dark grey to brown in colour and is found over stratified silt and clay. The Toledo clay also contains stratified clay with a dark grey, black coloured clay. Both these soils are stone-free. Like the preceding clay soils these have very poor natural drainage and require the same fertility requirements.

The Caistor clay loans around Welland also appear in the Stromness region. Along the canal towards Dunnville, Wauseon sandy loam.is found. This is a dark grey sandy loam over grey sand, which has a clay base at 1' - 2' below the surface. The surrounding farm land is nearly flat, resulting in poor natural drainage. General farming of grains takes place. A few vegetable farms also exist. Phosphate fertilizers and potash must be applied in order to change the nearly neutral conditions of the soil.

Natural plant growth is a slow process on the clay soil and only hardy, resistant plants are able to dominate. Due to its poor drainage capabilities, the soil varies between wet and dry conditions throughout the summer. Plants growing here can usually withstand dry *seasons.* The water

retention characteristics of the clay also allow some areas to become saturated and form a marsh-like environment. Some plants such as cattails and dogwood shrubs thrive in moist habitats like these. The clay can be used as a trail surface but would be unusable when it becomes saturated by rain water. Equestrian trails, in fact, are best suited to clay trails. As a base for a crushed stone trail, clay is a possibility, but actual construction decisions should be made by trail contractors.

As rain reaches the ground some of it is absorbed by the soil, but an excessive amount of rain can result in run-off. Erosion occurs when soil is moved from one spot to another. The detachment of the soil particles and their movement result in the process of erosion.

Rain is the most common cause of soil detachment, but frost, trampling and even gravity can release the soil particles from their surroundings. Striking the surface, the raindrop velocity generates energy which is then released into the soil. If the energy is sufficient, the soil will break into smaller particles permitting movement. This action is referred to as splash erosion since it may be possible to find a fine splash on close structures or neighbouring plants. The soil particles then move in a suspension and are re-located *away* from their original position.

Many forms of erosion can be found along the slopes of the canal, the most noticeable and frequent being slumping. Slumping was found to exist in almost every section of the canal surveyed. This process occurs when soil or the ground surface becomes saturated with water. Usually *a* slowly permeable layer, such as the clay in this area, is overlain by a saturated layer. If a sufficient slope is also present, the upper layer will lose its cohesion with the lower layer and flow downhill. Clay, silt and loam all

act accordingly, are very slippery when wet, and act as a lubricant.

Along some sections of the canal terraces have been formed as a result of slumping, the sharp steep slopes being almost free of any vegetation; the flat stable sections are the site of many trees and shrubs.

Sheet erosion is a process that is similar to slumping in that a thin soil layer is dislodged by rain and moved downhill. This is very evident along the canal water edge. The clay becomes saturated by water from rains or by fluctuating water levels; when the water level drops the soil is exposed, becomes detached, and falls into the canal.

Along the Brown Tap Drain in Welland, the banks are very high (over 10' in height). This area is very **seriously** affected by rill and gully erosion. Rills and gullies are formed by **a large amount** of water being confined to a small elongated depression. Some gullies are extremely deep, up to three feet in depth, and are actively being deepened as the cloudy silt laden water flows into the canal. Rills are more numerous and are found along all the slopes. They are also smaller in size. Spring run-off provides the greatest source of water to initiate erosion, and it is re4nforced by rainwater throughout the summer months.

When all of these processes take place, the ground cover is moved with the soil; this exposes more soil that is now very vulnerable to further erosion. After the initial clearing of the vegetation erosion proceeds rapidly. To reduce rates of erosion, different vegetation types can be planted to hold the soil and decrease the force at which the water strikes the surface. Grasses or any plants with fibrous roots retain the soil on **slopes** quite well. The many root hairs bind the soil and only with a forceful rush of rainfall will the roots release the soil. The existing trees along

the canal provide adequate footing for soil adhesion with deep tap roots that anchor the soil.

If the soil has rills and gullies, there are many ways to reduce or even abate the results formed by these procedures. The must frequently practiced method is the formation of a grass waterway in the gully channel. Grass may be planted in the gully **or** natural vegetation may be encouraged to grow. The gully could also be excavated to provide stable dimensions that would be sufficient for the water flow, and reduce erosion along its sides. Water conservation methods above the gully could also reduce the flow within it.

Many forces act on the soil when land is under the influence of recreational use, and a variety of conditions result. The impact of recreation is primarily felt on campgrounds, picnic sites, trails and paths. Usually most recreation takes place on shallow infertile soil, which limits the type and growth rates of the vegetation. In Canada, summer months are most popular for recreation. It is unfortunate that this is also the growth period for plants. The winter months act as time of rejuvenation for soil and plants, but today this season also holds some attraction for snow associated sports. It is the removal of the protective snow layer that damages the lands. By the heaving of the soil through frost action, the effects of the previous recreation season are lessened.

The major effects of all recreational activities are run—off and erosion, the compaction of the soil and the altering of soil moisture, vegetation and habitats of soil organisms. As the soil compacts it becomes dense and firm. It is then permeable to air and water will roll off its surface. The exchange of gases between the atmosphere and the

soil will be inhibited. Due to soil compaction, plant roots will be growing in a different environment and plants may either be stunted or die completely. These are usually extreme cases but they indicate the relationship *between* soil conditions and other environmental concerns. The greatest amount of research carried on is concerned with the trampling of the soil by pedestrian use, or to a minor degree, vehicles.

Assessing trail damage is a very difficult procedure since it involves amount of use. the surrounding soil, drainage and vegetation along the trail's route. it is envisioned that user frequency along the proposed trails will be low but as leisure activities increase the existence of these trails may attract a large number of particpants.

When a trail becomes difficult to travel for a hiker, a newer, easier trail is cut. If trail users should walk up and down the canal *banks,* the traffic would tend to uproot vegetation cover and the soil. The planting of a hardy cover on the banks would help to prevent such damage. In the clays and sandy loams, the top layers of the soils are affected by trampling, with the first six inches (root zone) being compacted in relation to intensity and duration of use.

The bulk density of the soil is proportional to the number of passages by cars or humans but it will reach a level where there will no longer be compression. The natural density and organic matter is used as a regulator for the depth and degree of the compaction. Fertile soils with low natural densities are affected less than coarse-textured soils with low organic matter. Trampled soils have reduced air space, but field capacity is increased. Adequate air space is necessary for good soil aeration and the intake of water. Nutrient levels in the soil change as

a result of reduced aeration, movement of soil water, change of soil bacteria and organisms, and the amount of vegetation cover. The humus layer may be reduced or obliterated by trampling, run-off, and cleanup. This layer is important because it acts an an insulator for soil retention, and reduces rapid infiltration. Clays compact more easily than soils high in organic matter and do not deteriorate as quickly.

In winter the soil temperature is lowered greatly due to compaction of the *snow,* and the air space in the snow is reduced. This is known as the insulating factor. The greatest reduction in temperature is recorded on snowmobile trails but other winter trails also affect the temperature although to a lesser degree. The duff layer) which is the top layer of decomposed organic matter, has been found to be colder by 11°C below snowmobile trails. When freezing of this upper layer occurs during spring thaw, the soil remains colder for one month longer. This results in the jeopardization of growing seasons and life cycles. The lower temperatures place a stress on plant growth, inhibiting good growth; hardier plants are left to survive.

In the summer months, soil that has been under the influence of winter compaction loses most of the vegetation cover; therefore any increase in temperature is modified by the compaction of the soil. Trampled soils that are void of vegetation freeze to a depth of 3 to 4 inches while only the very top layer of soils having vegetation cover appear frozen. Again the compaction of soils is the greatest factor affecting run-off, drainage and erosion along the canal slopes. Run-off will increase in trampled area because the water will not be able to percolate effectively through the soil. This also reduces the response of infiltration. Under snowmobile trails water holding capacity is reduced by 70%; these changes cause soil erosion.

It is reasonable to state that any recreational activities can cause acceleration in the rate of erosion, since the surface would be more vulnerable to the effects of water and wind. The degree of erosion is dependent on intensity of use, amount of slope, vegetation cover, and percentage of silt and clay in the soil. The amount of use predicted on the Feeder trails will have little effect in terms of erosion. If, however, user participation grows and many people use the trails, and climb along the slopes without any vegetation cover, the results could be severe. Today the clay surfaces are not very stable, especially in areas where there is a minimum amount of vegetation cover. The Brown Tap Drain slopes appear to pose the greatest problem due to their height and the angle of the banks. Already, great gullies have formed by water draining off the adjoining land and through motorbike trails.

During construction, large machinery will cause great erosion channels in soft soils, and only careful conservation procedures will prevent possible devasting changes caused by erosion. Snowmobiles cause the greatest problems, removing snow and any ground cover and thus exposing the soil to harsh conditions. As the soil is washed off the banks the water will become very turbid, and nutrients will then be added to the water, resulting in an increase in aquatic plant growth.

Water Environment

The Feeder Canal has degenerated to the state of a large ditch. The entire length is almost totally overgrown with many emergent and submergent aquatics. The water dries up in many sections of the canal in early June. As the summer progresses more aquatics become visible. A form of filamentous algae covers large areas with its characteristic bubble shape. Duckweed also spreads very heavily over previously open areas. An odour is evident at certain times which intensifies as the temperature rises.

The water itself varies from an amber colour to a cloudy appearance to an absolutely clear condition where it is possible to see directly to the canal bottom. The abundance of plant growth is associated with the large amounts of nutrients found in the silt on the canal bottom. Many plants found along the canal are good indicators of high concentrations of nitrogen and phosphorous.

These aquatic plants compete for space as do some terrestrial plants. The water environment is unstable and it is very sensitive to fluctuating temperature changes.

Algae has two basic functions - the production of oxygen and as a basic food source from which all food webs extend. By producing oxygen, algae maintains a balanced environment; planktonic forms that undergo photosynthesis liberate oxygen which can then be dissolved in the surrounding water. This procedure is the primary source of dissolved oxygen in the water beneath the ice in winter. Some forms of algae are the basic foods for herbivorous animals that inhabit aquatic environments. Just as some grasses are preferred by *certain* animal species, some species of algae are desirable.

Plankton and bottom microflora are the most sought after species, rather than the filamentous forms. Plant cells and debris from all forms serve as food for fish, but plant material is only a small portion of their diet.

Water temperature is kept low by water surface vegetation. This is essential for certain fish species. Shade also offers protection for young game and forage fish. Fish as well as many species of waterfowl consume the algae. Filamentous algae is classified as a nuisance because it impairs swimming and boating by rising and sinking as summer proceeds. Winter kill of fish may be due to severe oxygen depletion from decomposing vegetation matter during the winter months.

In its present state, the canal is an excellent breeding ground for many insects, the most obnoxious being the mosquito. For the past three years the Niagara Regional Health Unit has been monitoring mosquito populations in the Village of Wainfleet with the use of a New Jersey mosquito light trap. The station readings in 1977 showed 1,050 Culex species and 3,499 aedes vexens. Judging by 1977 data, large numbers of mosquitos breed in the canal, preferring the shallow, nutrient rich and warm water. Abate larvaciding has been carried out to keep the population in check in order to prevent an outbreak of disease. ***The*** Regional Health Unit also states that they do not carry out any other entomological studies on the canal or know of any facilities that do. From observation it was found that many smaller insects do live in this aquatic environment; these were not identified but were found to be another source of food for waterfowl, fish and amphibians.

Aquatic plants are divided into three categories according to the Ministry of the Environment.

1) submerged rooted aquatics - these plants such as pondweeds and milfoil make up the largest collection in the Feeder Canal. As the name states, the plants are rooted in the canal bed, and the main parts of the plant float in the water with some leaves or flowers floating on the surface.
2) emergent plants - have upright leaves that may float on the surface water but usually have sufficient support for free standing leaves. Cattails and arrowheads are part of this diverse group.
3) algae - this is the characteristic "pond scum", with colours ranging from green to brown. Algae can be filamentous or a submerged plant.

Almost all aquatic plants prefer either slowly flowing or stagnant water. Duckweeds and cattails like water rich in nutrients and the latter is a pioneer of a terrestrial environment, signalling a change from aquatic to terrestrial. This **was** evident just east of Stromness where six or more feet of land was created through bank erosion and by vegetation debris buildup. Most pondweeds and submerged aquatics prefer the muddy water conditions of stagnant water that is poor in nutrients.

There are many ways to control aquatic plants, both chemical and mechanical. One mechanical procedure is the dragging operation that has been used successfully for the control of submerged rooted aquatics over a small area. A drawback to this procedure is the collection of cut debris. All of the plants must be collected to prevent them from floating downstream and rooting again. Any dredging done on the canal bottom will act to remove the problem aquatics, but dredging is usually associated with a large scale clean up operation. Shoreline plants, however, can be pulled by hand or by using a cutting tool.

One of the more interesting methods *of* plant control comes about through the use of a very heavy construction plastic placed on the canal bottom. The plastic sheet is lowered onto the canal bed, preferably in late winter, and is weighed down by rocks or anchored. This inhibits plant growth since the plastic cuts the necessary light from reaching the ***canal*** bed. Air holes must be punched in the plastic for the ***release*** of gases. Studies indicate that variable success has been found due to the plastic tearing or being moved by strong wave action. Any debris settling on the plastic can provide enough substrata for plant growth, and plants have grown through the air holes.

The direct removal of water during early winter to allow plants to freeze is another practice. Parts of the Welland end of the canal do dry up during winter but this does not alter the next season because the plants re-establish themselves at similar levels. Flushing is a similar technique but no powerful water source is available.

Plants that are controlled by chemical means can be destroyed for a period ranging from a few *weeks* to a season. Algicides and herbicides that will be most effective are not generally available and must stunt or kill plants without harm to other aquatic life. There are many products each suited to a single purpose, but no one herbicide can control all forms of aquatic plants. The environment must be investigated very carefully, and water temperature, plant species and other water characteristics must be known. Chemical treatment is always the last alternative in controlling algae, because in choosing chemical treatment the dangers to the environment must be compared to its usefulness. The application should minimize any reaction to damage the environment. Usually large areas are not helped by chemical methods since the problem spreads.

Treatment when used should start in spring or early summer as plants are just developing. Water temperatures should be fairly warm for the application of herbicides, usually over 65°F. Algae and submergent plants should be checked each year to determine the success of the previous year and to decide on possible alternative courses of action. When applying a spray to emergent plants it is necessary to do so when the plant is in flower or is about to seed. Success will be dependent on weather conditions and advancement of seed production. Dredging would probably be the most successful procedure in the canal *since* the entire plant and root system would be removed.

New chemicals are being developed dailyrfor a complete list of these formulas *see* publication 75 of the Ontario Ministry of Agriculture and Food, published by the Ontario Herbicide Committee. The Ministry of the Environment, Pesticides Control Section, also has information dealing with chemicals and chemical suppliers.

The water in the canal does not meet government standards for usable water for swimming, drinking and irrigation. The water from the Grand River may be an ultimate source of water but certain parameters must be corrected for use in the Feeder. Direct drinking of the water is impossible; discolouration and high levels of industrial chlorides must first be corrected. For recreational use, swimming is possible, but due to periodic high levels of fecal coliform this must be monitored before safe conditions are present. Fish may become tainted which may discourage fishing. When the water is flowing through the Feeder some additional problems will be encountered. Both swimming and sport fishing will be limited by water depth. Swimming water depth should be more than four feet and good fishing water at high summer temperature should be over fifteen feet deep. Warm water fish from Lake Erie can survive in shallow water; these are carp, bullhead and bass.

All waterfowl, plus turtles. muskrats and frogs depend on slow moving or stagnant water in which plants and smaller micro-organisms thrive. Expected flows would not be strong enough to drive these animals away but the food source would be greatly decreased as the aquatic plant life also vanishes.

The use of motorboats in the water could cause the greatest damage by disturbing bottom sediments,and the dumping of oil and gas into the water could block the light and reduce phytoplankton production.

With increased activity along the banks, sediment runoff would also reduce light penetration. This would reduce photosynthetic activity and the oxygen content of the water.

Air Quality

Air pollution can affect our everyday lifestyle. High levels can be harmful to our health, to animals and to vegetation. As a result of prolonged exposure, plants can be marked, stunted or die early.

An example of air pollution in the Feeder study region is the Port Maitland area. During the late '60's a serious problem of fluoride pollution became evident as vegetation was marked, and cattle became sick and lame and some died. The Ministry of the Environment carried out an investigation into this problem and the results were published in the "Report of the Committee Appointed to Inquire and Report Upon the Pollution of Air, Soil and *Water* in the Townships of Dunnville, Moulton and Sherbrooke and Haldimand County" (September, 1968). This report contains all information about and recommendations for this problem; as a result, a monitoring system was set up throughout the Dunnville, Port Maitland and Stromness area.

Fluorides enter the air from the production of phosphate chemicals and fertilizers. When exposed for more than a week in levels of less than one part per billion, plants may be injured. Higher concentrations for shorter periods of time can have similar effect. As plants grow, fluorides can accumulate in the leaves although no great concentrations occur in the air. Little damage occurs at the site of the absorption but in broad leaf trees the leaf margin becomes affected. This is called necrosis, where the injury starts as a gray or light green water-soaked lesion which turns tan to reddish-brown. The increase in necrosis is linked to a decrease in photosynthesis. Plants that are most sensitive to fluorides are sweet corn, grapes, plums, tulips, irises and St. Johnswort.

Cattle can suffer from a disease called fluorosis if levels reach 40 ppm for an extended time. Characteristics of this disease are mottled teeth, swollen bone surface tissue, lameness and possibly decreased appetite and milk production.

Any problems resulting from air pollution can be investigated by the Phytotoxicology Section of the Ministry of Evironment.

Wildlife

Mammals and waterfowl depend on water as a source of food. With the introduction of recreation the area may see a decrease in the variety of wildlife, but this is dependent on the volume of recreational activity. It is assumed that increased activity will not be great enough to decrease population communities drastically.

The animals in the area have already adapted themselves to the presence of man, but isolated areas may experience increased stress as picnic sites appear. Some species may leave but others will adapt and flourish in the enlarged territories. Snowmobile trails may completely destroy smaller animal habitats because many animals, such as mice, depend on the insulating factor of the snow. As some trees and shrubs are cleared, shelters and food sources would be destroyed. As the canal advances in eutrophication the habitats will be ideal for only a small percentage of the animal varieties.

Educational and Interpretive Sites

Canby Marsh Trail

This marsh is a very good example of a colder environment marsh or swamp. The area is covered year round by water but smaller sections have been observed to dry up. It is the home for many animals including mallards, gulls, ferns, snakes and muskrats and the occasional blue heron. The marsh receives its water from the Grand River and smaller amounts from drainage ditches in the area.

Vegetation within the marsh is composed of cattails, pondweeds, duckweeds, water plantain and arrowheads. Some of these plants provide for the variety of animals living within the marsh.

If this area were developed, a boardwalk could be built with winding paths throughout the marsh; raised platforms placed at periodic intervals would allow visitors to view the marsh. The marsh could become a conservation area which would be used by naturalists and by environmental students of the region. A boardwalk would have to be raised to permit water to continue to flow beneath it.

Welland City Municipal Landfill Trail

This site would only be useful for educational purposes; user participation of this trail would be very minimal. Students could observe the practice of dumping and land reclamation. The landfill site is only noticeable at the entrance, and where the site is close to the *Feeder*, a burm (embankment) is found. Attempts should be made to plant trees and other vegetation on this slope so that the fill site is blocked from the view of Feeder trail users.

Industrial Trail

The Port Maitland area provides an excellent opportunity for an interpretive industrial trail. Located in this area is I.M.C. (International Minerals and Chemicals), Electric Reduction Company (E.R.C.O.), gypsum settling beds and a limestone quarry. This type of trail could provide a clear awareness of the *need* to preserve nature, and its relationship to industrial location and operations. Subjects for study could include air and water pollution control by industries, the purpose of settling beds and the diversity of animal communities in the area. Through observation, conservation methods would become apparent and environmental impact could be studied.

Recommendations

It is recommended that:

1) As much of the naturalness of the environment be preserved as possible. Areas that have a very thick shrub and tree growth and where the light does not reach the ground should be cleared enough to permit the light to enter where it will then initiate ground cover growth.

2) These areas are usually also suffering from severe erosion problems; the introduction of grass waterways and erosion conservation methods will impede this problem.

3) Where recreational and historical sites are established along the Feeder, the canal banks should be cleared of debris and excess vegetation. In other areas, the vegetation can be left to grow naturally providing a variety of habitats.

4) Dredging will remove problem aquatics, but these aquatic plants must be checked yearly so growth does not get out of hand.

5) When water is received from either **Lake Eric or the Grand River, a** monitoring system should be set up to check levels of effluent to remove the risk of possible fish tainting and health hazards.

6) Air monitoring is also necessary in the Port Maitland area to protect against vegetation and structural damage. Dust control must also be monitored as a possible source of vegetation kill.

7) Interpretive sites such as the Canby Marsh should be protected from development that may upset the sensitivity of the natural setting.

By preserving habitats, and through conservation methods, the wildlife community may continue to live alongside a rural environment without ill effects.

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ENGINEERING

The Welland Feeder Canal stretches some sixteen miles from the Welland River in Welland to Stromness where it branches off to Dunnville and Port Maitland. In its entirety, it passes through twenty-two miles of land in the City of Welland, Wainfleet and Moulton Township areas. Originally, the canal carried water from the Grand River in Dunnville and Port Maitland to the Welland River; the water flow was maintained by a vertical drop of only eleven feet between the Grand and Welland Rivers. Through the years, deposition of silty clay soil has left the canal with an almost level profile along its length. In addition, lack of adequate culverts has retarded the flow in the channel to the point where the water has become stagnant.

The engineering task at hand is to design a channel that will support a steady flow of water taking into consideration the effects on drainage and irrigation. Sources of water and possible outlet areas must be identified and incorporated into the final designs. Other physical limitations such as culvert replacement, cnannel capauiLico, ***flow*** **EQ8'asislar.**, and variability of water supply will be given equal attention.

Canal Inventory

The engineering study was initiated with a field survey of the existing canal. Wooden stakes were driven in alongside the canal every five hundred feet and then elevations were transferred to each of the stakes by means of a level and rod. By using the stakes as bench marks, cross sections indicating the present grade and shape of the canal were taken every five hundred *feet.*

Next, the locations of all road and railway crossings were recorded along with the size, type, and invert elevations of all existing culverts. Of major concern is the fact that the existing profile of the canal indicates that the channel is more or less level for its entire length with the exception of a mile length at the Welland River. Consequently, a channel sloping from Port Maitland and Dunnville to the Welland River would require between ten and fifteen feet of excavation by the time the Welland River is reached. Also, the canal is characterized by frequent road and rail crossings thereby necessitating the replacement of numerous culverts. Field data indicated that the old ***canal*** is interrupted by 32 gravel road crossings, 7 railway crossings, 15 paved road crossings, and 4 drainage ditch crossings. A set of drawings showing plan and profile views **as** well as existing culvert locations along the Feeder Canal can be made available by contacting the Feeder Canal Committee.

Water Sources and Available Outlets

Potential sources of water include Lake Erie, the Grand River, and major drainage ditches. There are no other major bodies of water close enough to the Feeder Canal to be considered potential suppliers of water. Lake Erie and the Grand River are both considered to be attractive sources because of their abundant supply of water, their low seasonal variation in water level, and their proximity to the existing Feeder Canal. The attractiveness of drainage ditches is discounted by their seasonal variation in water flow; i.e. during dry summer months several of the ditches are completely dry and the grade at which they cross the canal is usually such that flow into the channel is impractical.

The Welland River in Welland and Forks Creek in the Township of Wainfleet are the only two areas close enough to the canal to be considered as potential outlet areas. Utilization of Forks Creek as *an* outlet would require diversion of Feeder water through existing drainage ditches which do not have the necessary capacity. Costly excavation and land acquisition would be necessary, and interference with existing drainage patterns would be met with opposition from local residents. In addition, the increased flow in the Forks Creek might cause backing up of other municipal drains now emptying into the creek. The Welland River remains as the only viable outlet area for the size of flow expected with a rejuvenated canal system. During the spring run-off, the Welland River handles flows up to 1400 cubic feet per second which is well in excess of a maximum design flow of about 60 cubic feet per second in the Feeder Canal and hence downstream conditions would remain virtually unaffected. No problems are anticipated in getting permission from Ontario Hydro, who operate a dam downstream, to **use** the river as an outlet. Other outlet areas along the Welland River other than the present one would require acquisition of large areas of privately owned land and costly excavation and have been ruled out as a result. The design proposals for a rejuvenated canal system indicate use of the Grand River and Lake Erie as water sources and the Welland River as an outlet.

At present, the Feeder Canal begins at the Taylor Side Road in Dunnville and at Lake Erie in Port Maitland; water could easily be supplied in Port Maitland by following the existing canal route; in Dunnville, however, the canal has been filled in where it originally tapped into the Grand River.

The existing canal is closest to the Grand River at its junction with the Taylor Side Road. At that location, a channel could be excavated from the Grand River to the Feeder Canal that would supply the Dunnville section with the required water flow. The new channel would necessitate the purchase of a strip of land 100 feet wide by approximately 2000 feet long. In its present state, the land is supporting growth of trees and scrub-brush and the owners should be quite receptive to purchasing negotiations. Grand River Distillers Limited and S. Brown of Dunnville are the appropriate parties concerned.

Further along the canal, where the Boulton Ditch Road intercepts the Feeder Canal, exists another possible attractive source of water. The Boulton Ditch runs one and one-half miles on the north-east side of Boulton Ditch Road from the Feeder Canal to Lake Erie. The existing ditch would require some widening and deepening before it could supply the ***needed*** water. Other routes to Lake Erie were considered but were deemed unattractive because of the large amount of excavation involved as well as the need to purchase privately owned land. Widening and deepening of the existing Boulton Ditch would also provide some drainage benefits in the area.

Drainage and Irrigation

The land adjacent to the reader **Canal io mostly farmland with** wheat. barley and corn being the major crops cultivated. Some wooded areas are in existence yet probably over ninety per cent of the land traversed by the canal is used for agricultural puxposes Consequently, local residents are quite concerned about maintaining proper drainage ditches and sources of water for irrigation.

In Moulton and Wainfleet Township the land can be described as being flat and low lying. As a result, during the spring when water levels are high, much of the land experiences some type of flooding. In addition, the clayey nature of the soil does not permit a very high rate of seepage that would allow water to become part of the ground water system. In Wainfleet Township many of the drainage problems have been overcome through construction of the Consolidated South Wainfleet Drainage System in the 1950's. The Feeder Canal is not really included in the Township's drainage scheme, although some farms with tile drained land outlet their water into the canal. Presently, much of the farmland is drained by backditches that run parallel to the Feeder Canal. Occasionally, the backditches become blocked causing water to back up onto the farmland. Culverts with openings that can be opened and closed could be used to connect backditches to the Feeder Canal thereby providing an outlet for backed up water.

In the Moulton Township area, the Feeder Canal is used more extensively for drainage purposes. However, lack of adequate culverts and proper slope on the existing canal have caused backing up of drainage ditches particularly in the area where Hutchinson Road intercepts the Feeder Canal. The problem became so acute in 1975 that local farmers pooled their finances to have the canal dredged out from Boulton Ditch Road to Stromness. Yet a more permanent solution is needed to effectuate proper water control. Proper excavation of the canal with the addition of necessary culverts would ensure a more steady water flow. (Drainage ditch location plans for Moulton and Wainfleet Townships can be made available by contacting the Feeder Canal Committee.)

Presently, the Boulton Ditch drains into Lake Erie near Lowbanks. On occasion, the wind patterns cause the Lake level to rise in the vicinity of the ditch outlet causing the direction of flow in the ditch to be reversed. The water then backs up not only in the Boulton Ditch but in the Marsh and Furry Drains which outlet into the Boulton Ditch. If the Boulton Ditch were to supply the Feeder with water, then the continual water flow would prevent backing up of ditches. Improved drainage would enable farmers to utilize a higher percentage of their land and permit the movement of heavy farm equipment at an earlier date.

If the Feeder Canal were to support a steady flow of water, it would be available to irrigate adjacent farmland during periods of dry weather. The benefits of an irrigation scheme include higher yield per acre for existing crops and increased viability of growing garden crops that require frequent watering. A few sod growers in the area are already using the canal to irrigate their land, yet variability in water level is making most farmers hesitant to venture into similar agricultural practices. Canal reconstruction would allow farmers to utilize their land more efficiently by providing ample water for irrigation and by improving drainage conditions. In addition to providing improved drainage and irrigation, Feeder water is considered as a major source of fire protection; at present some sections of the canal become completely dry during mid-summer. Rehabilitation of the canal would allow the planning and implementation of an updated fire protection scheme in the area.

Canal Design Proposals

~~Three different d~~esign proposals that allow water to flow from the Taylor Road in Dunnville, Port Maitland and the Boulton Ditch to the Welland River have been investigated. The three proposals described are considered to be the most feasible designs possible given the physical restricions of the existing canal area. Their relative attractiveness is presented in the ensuing discussion.

Four Foot Proposal

As its name suggests, the four foot proposal assumes a uniform grade for the canal bottom from Dunnville and Port Maitland to the Welland River allowing four feet of water to pass through the channel. It was predetermined that a four foot water depth would be attractive for recreational development. The canal bottom begins in Port Maitland at 569.0 ft. and drops to 557.3 ft. at the Welland River. Assuming a uniform cross section having a 20 ft. wide bottom with sides sloping at $1^{1}/_{2}$:1, the total amount of earth to be excavated would approach 938,500 cubic yards. The channel as described would support water flow of approximately 145 cubic feet per second in the Welland-Port Maitland Branch, and 89 cubic feet per second in the Stromness-Dunnville section. Apart from the large quantity of earth that must be excavated and hauled in this proposal, its construction would require that all existing culverts be replaced. In total, culverts would have to be redesigned and replaced at some 58 locations. Included in the total is a'large concrete box culvert under Highway 3 in Wainfleet and a concrete arch culvert under railway tracks at the outlet in Welland. It is doubtful that plans for replacement of the two concrete culverts could be negotiated successfully and hence a design that leaves these culverts in place is needed. In addition,

the proposed elevation of the channel bottom gives a bank height that ranges between ten and fifteen feet above the water level. As a result, the recreational value of the canal would be limited in some respects.

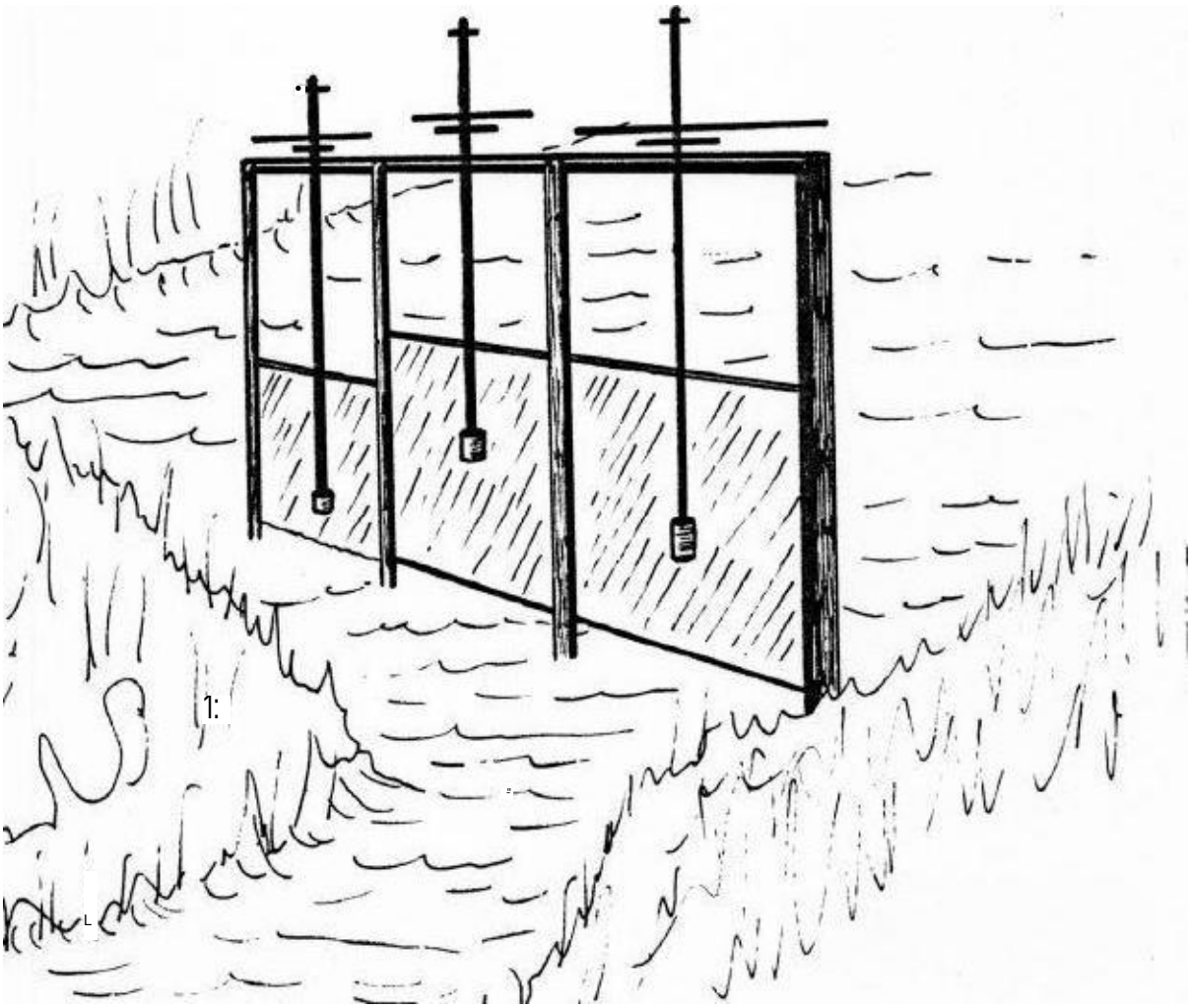
One Foot Proposal

This design is an attempt to reduce the amount of earth that would have to be excavated and hauled by simply shifting the proposed grade of the four foot proposal up three feet. Total rehabilitation of the canal would necessitate the excavation and haulage of up to 582,000 cubic yards of earth. Once again all existing culverts would need replacement including the two concrete culverts mentioned earlier. For these reasons and the fact that the canal could only support a flow of about 15 cubic feet per second, this proposal is considered as an impractical design for rehabilitation.

Gate Proposal

As with the other proposals, this design inlets water from the Grand River along a channel at the Taylor Road in Dunnville, at Port Maitland, and from Lake Erie into a channel along Boulton Ditch Road. The elevations of the channel bottom have been chosen to minimize excavation yet maintain an average water depth of about three feet. Water control would be established by placement of two gates at the Taylor Road inlet, at Port Maitland, at Stromness, at the Boulton Ditch inlet, at the intersection of the Boulton Ditch channel and the Feeder Canal, and about $1^{1}/_{2}$ miles before the outlet in Welland.

TYPICAL GATE STRUCTURE



The canal bottom would require a more gradual slope than presented in the four foot and one foot proposals. This would be necessary in order to minimize the amount of excavation along the flat lands that the canal passes through. The canal water levels would be obtained by opening the inlet gates with all other gates closed. Given a dry canal to start with, it would take about three weeks to fill the entire canal to maximum capacity.

Water flow would then be regulated by opening the outlet gate in Welland and the inlet gates mentioned earlier. A uniform cross section having a bottom width of twenty feet and side slopes of 1:1 gives a total of about 375,000 cubic yards of earth to be excavated for rehabilitation of the entire canal system. The excavation would be accomplished by means of a drag line bucket; the excavated dirt could be spread over adjacent farmland and hauled to fill sites.

Six soil samples were taken at carefully selected locations in the canal at a depth of about two feet. The samples were then sent to the Ontario Ministry of Agriculture and Food for testing. The tests indicated that the samples were not of inferior quality as compared to existing farmland and hence it is likely that local farmers would be receptive to having canal earth spread on low lying farmland.

The design ***allows*** for a flow of about 30 c.f.s. in the Dunnville - Stromness and Port Maitland-Boulton Ditch sections, while a flow of 50 c.f.s. could be maintained from Boulton Ditch to Welland. (Flow calculations are based on graphs given in Appendix 1). The maximum water velocities in the canal would not exceed one foot per second which is well below the velocity at which a clay and ***silt*** type soil starts to erode - i.e. two feet per second. The section from the outlet gate to the Welland River would slope six feet over a distance of about a mile and a half. This would allow rapid drainage of the canal to take place if necessary. The design also provides enough water for fire protection and irrigation. If the demand for water were high, it would be a simple task to close the outlet gate and allow more water to flow through the inlets.

The gate proposal requires that all existing culverts be replaced and positioned according to design grades except for the concrete culverts in Wainfleet under Highway 3 and under the railway tracks in Welland. The culvert in Wainfleet however, should be deepened between one and one-half to two *feet* in order not to restrict waterflow. By utilizing existing culverts still in good condition, the proposal requires the purchase of 5343 feet of 6' - 1" span - 4' - 7" rise steel culvert pipe. In addition, there *are* four locations where municipal drains must be siphoned under the canal; they are charted below:

Drain Name/Number	Station
#4	521 + 20
#3	438 + 00
#2	345 + 10
Maple Creek	132 + 00 Dunnville

From an engineering standpoint, the gate proposal is the most attractive of the three proposals investigated. The design minimizes total excavation while maintaining water flow and depth suitable for recreation, irrigation and drainage. Water control is effectively achieved through the network of gates described. The major drawbacks of the design *are* that it would take up to three weeks to fill the canal and the water velocity in the canal might not be fast enough to inhibit all types of weed growth. The gate proposal does, however, have the lowest total cost as illustrated in the following table:

ESTIMATED AVERAGE COSTS OF DESIGN PROPOSALS *

	TYPE ESTIMA	ONE FOOT PROPOSAL	FOUR FEET PROPOSAL	GATE PROPOSAL
Excavation, haulage, spreading, brush, clearing	$1.83/yd.	$1,066,000	$1,719,000	$ 687,000
Culvert pipe & installation **	158.00/ft.	994,000	994,000	884,000
Land Acquisition		10,000	10,000	10,000
Syphons for municipal drains	237.00/ft.			45,000
Gates and installation	5000.00/gate	40,000	40,000	70,000
SUB TOTAL		2,110,000	2,763,000	1,656,000
15% Contingency Fee		316,000	414,000	248,000
TOTAL COST OF CONSTRUCTION		$2,426,000	$3,177,000	$1,904,000

* Based on 1979 costs

** includes $150,000 *for* replacement of culvert under Highway 3 in Wainfleet and culvert under railway tracks in Welland

EXCAVATION QUANTITITIES (YD^3)

	0+00-588+00	Boulton Ditch	588+00-905-00	813+00-200+00	Taylor Road	Total Excavation
4 Foot Proposal	649854	69341	134620	75454	9167	938436
1 Foot Proposal		37709	48616	50765	4889	582033
Gate Proposal	203560	44603	51652	67646	7620	375081

WATER FLOW ($FT^{3/S)}$

4 Foot Proposal		310	145 89	89	
1 Foot Proposal	32	15	10	10	
Gate Proposal	50	60	25 30	30	

WATER VELOCITY (FT/S)

4 Foot Proposal	1.60	3.40	1.60	1.00	1.00
1 Foot Proposal	.70	1.55	.70 .45	.45	
Gate Proposal	.60	.90	.50 .60	.75	

AVERAGE WATER DEPTH (FT.)

4 Foot Proposal	4	4	4	4	4
1 Foot Proposal	1	1	1	1	1
Gate Proposal	3.6	2.9	2.4	2.4	1.8

Appendices

iTARIO MINISTRY OF AGRICULTURE AND FOOD

DATE REPORTED August 1 in 9

Feederbend Farms,
R. R. *II* 3,
WAINFLEET, Ontario. Ph. 732-7552
LOS 1VO

IF FURTHER ASSISTANCE IS REOUIRED CONTACT
Keith Clay, Agr., *Rep.*
OMAF
574 South Pelham St.,
WELLAND, Ontario.
L3C 3C6

COUNT(Niag. So. TWP. COPY TO REGISTERED NO. 1436

SUGGESTED TREATMENTS: MIXED FERTILIZER OF SIMILAR RATIO OR FERTILIZER MATERIALS, OTHER THAN THOSE SUGGESTED BELOW, MAY BE SUB-STITUTED WITH RATES ADJUSTED TO SUPPLY THE SAME AMOUNTS OF NITROGEN, PHOSPHATE AND POTASH. SEE BACK OF LABORATORY REPORT FORM FOR EXPLANATION OF RATIOS, GRADES AND COMPARATIVE APPLICATION RATES. ON THE REVERSE OF THIS FORM ARE GUIDELINES FOR SAFE RATES OF NUTRIENTS APPLIED AT SEEDING AND TOXICITY OF COMMON PERTH. IZER MATERIALS.

APPENDIX ONE

1. Wheat 300 kg/ha of 10-20-10 (seed drill)
   - Plus 180 kg/ha of amm. nitrate (March)

2. Wheat 275 kg/ha of amm. nitrate (March)

3. Wheat 100 kg/ha of 10-20-20 (seed drill)
   Plus 240 kg/ha of amm. nitrate (March)

4. Wheat 250 kg/ha of 10-20-0 (seed drill)
   Plus 200 kg/ha of amm. nitrate (March)

5. Wheat 300 kg/ha of 10-20-10 (seed drill)
   – Plus 180 kg/ha of amm. nitrate (March)

6. Wheat - 100 kg/ha of 10-20-20 (seed drill)
   – Plus 240 kg/ha of amm. nitrate (March)

Additional Soil Test results available upon request.

ENGINEERING DRAWINGS AVAILABLE FROM FEEDER CANAL COMMITTEE

1. Profile of Boulton Ditch
2. Profile of Existing *Feeder* Canal (Welland to Port Maitland)
3. Profile of Existing Feeder Canal (Stromness to Dunnville)
4. Plan of Typical Gate

DRAWINGS AVAILABLE FROM FEEDER CANAL COMMITTEE

1. Plan and profile views and culvert locations along Feeder Canal
2. Roll cross-sections with tables of excavation quantities
3. Drainage plans for Moulton and Wainfleet Townships
4. Surveyor's plan of Feeder Canal
5. Aerial photographs of Feeder Canal Region
6. Municipal drain crossings
7. Field books

TIME TO FILL CANAL USING GATE PROPOSAL

Taylor Road Section
Heading Southwest From Canal to Grand River (572.90)

Water Depth	Average Flow	Volume	Time
	CFS	FT^3	SEC
0-0.5	40	15375	384
.5-1.0	26	16125	620
1.0-1.5	14	16875	1205
1.5-2.0	5	17625	3525
2.0-2.4	1	14640	14640

20374 • 6 hours

DUNNVILLE BRANCH 0+00-200+00

Water Depth	Average Flow	Volume	Time
0-0.5	34	199512	5868
.5-1.0	24	214272	8928
1.0-1.5	15	219240	14616
1.5-2.0	8	229248	28656
2.0-2.5	3	238788	79596
2.5-2.76	0.5	122400	244800

382464 a 606 hours

PORT MAITLAND-STROMNESS 813+00-905+00

0-0.5	33	95040	2880
.5-1.0	24	103680	4320
1.0-1.5	16	109440	6840
1.5-2.0	9	106920	11880
2.0-2.5	4	112320	28080
2.5-3.0	1	117360	117360

382464 48 hours

STROMNESS-BOULTON DITCH 813+00-590+00

0-0.5	49	229320	4680
.5-1.0	38	246240	6480
1.0-1.5	29	261000	9000
1.5-2	20	276720	13836
2-2.5	13	291320	43857
2.5-3.0	7	307000	43857
3.0-3.28	2	172000	86000

170280 = 52 hours

BOULTON DITCH 0+00-89+00

0-0.5	62	89280	1440
.5-1.0	46	99360	2160
1.0-1.5	32	103680	3240
1.5-2.0	20	108000	5400
2.0-2.5	11	114840	10440
2.5-3.0	4	129600	32400
3.0-3.25	0.5	57600	115200

170280 = 48 hours

BOULTON DITCH 590+00-35+00

0-0.5	Average Flow	Volume	Time
0-0.5	55	574200	10440
.5-1.0	43	588240	13680
1.0-1.5	32	610560	19080
1.5-2.0	28	635040	22680
2.0-2.5	16	696960	43560
2.5-3.0	9	706320	78480
3.0-3.5	4	434400	183600
3.5-4.0	1	759600	759600

1131120 = 314 hours

TOTAL AVERAGE CANAL FILL TIME
= 6 + 106 + 52 + 314
= 478 hours/ 20 days/ 3 weeks

CULVERT REQUIREMENTS FOR GATE PROPOSAL

0+00-35+00

design flow = 50 cfs
design velocity = 3 fps
design area = 50 = 17 ft^2
7-

STATION	TYPE	NUMBER	LENGTH
12 + 80	6'-1" span/4'-7" rise	3	207
34 + 75		3	207
14 + 00		3	207
25 + 00		3	198
30 + 25		3	150

all culverts other than the 6[1]-1" span/4'-7" rise type are existing culverts that must have their existing grades changed
35+00-590+00
design flow = 50cfs
design velocity = 2fps$_2$
design area 50 = 25 ft
f-

STATION	TYPE	NUMBER	LENGTH
80+20	5' Dia Steel	3	
81+50	5' Dia Steel	3	
87+85	4' Dia Long	2	
	5' Dia Steel	1	
116+64	4' Dia Steel	2	
	5' Dia Steel	11	
251+29	6' Dia Steel	1	
	5' Dia Steel	1	
	4' Dia Steel	1	
262+75	6'-1"/4'-7"	2	100
344+70	6'-1"/4'-7"	2	138
437+60	6'-1"/4'-7"	2	138
512+25	6'-1"/4'-7"	2	138
521+50	6'-1"/4'-7"	2	
571+23	6'-1"/4'-7"	1	
588+80	$3^{1}/_{2}$' Dia	1	
	6'-1"/4'-7"	2	138

590+00-905+00

design flow = 25cfs
design velocity = 2fps
design area $\frac{25}{7}$ =.12.5ft^2

STATION	TYPE	NUMBER	LENGTH
590+00	$2^{1}/_{2}$' Dia Long	1	
	6'-1"/4'-7"	1	120
704+90	$5^{1}/_{2}$' Dia Steel	1	
	6'-1"/4^{1}-7"	1	65
720+75	3' Dia Steel	1	
	6'-1"/4'-7"	1	69
756+30	4' Dia Steel	1	
	6"-1"/4^{1}-7"	1	69
812+75	4' Dia Steel	1	
	6"-1"/4'-7"	1	69
863+00	5' Dia Steel	1	
	6"-1"/4'-7"	1	69
883+00	5' Dia Steel	1	
	6'-1"/4'-7"	1	69
892+50	5' Dia Steel	1	
	6'-1"/4'-7"	1	69

CULVERT REQUIREMENTS (CONT'D)

DUNNVILLE
0+00-200+00
design flow = 30cfs
design velocity = 2fps
design area 30 = 15ft

STATION	TYPE	NUMBER	LENGTH
10+00	$2^1/_2$ Dia Long	1	
	6'-1"/4'-7"	1	168
13+00	6'-1"/4'-7"	1	168
	3' Dia Steel	1	
24+00	$2^1/_2$ Dia Long	1	
	6'-1"/4'-7'	1	50
50+50	6'-1"/4'-7"	2	450
72+00	6'-1"/4'-7"	2	100
76+20	6'-1"/4'-7"	2	100
88+00	6'-1"/4'-7"	2	100
99+50	6'-1"/4'-7"	2	100
114+40	6'-1"/4'-7"	2	100
125+00	6'-1"/4'-7"	2	300
140+00	6'-1"/4'-7"	2	300
150+05	6'-1"/4'-7"	2	100
184+00	6'-1"/4'-7"	2	120

BOULTON DITCH
0+00-0+89
design flow = 60 cfs
design velocity = 2 fps
design area 60 = 30 ft^2

CULVERT REQUIREMENTS (CONT'D)

STATION	TYPE	NUMBER	LENGTH
41+00	5' Dia Steel	1	
	6'-1"/4'-7"	2	138
48+00	$3^1/_2$' Dia	1	
	5' Dia Steel	1	
	6'-1"/4^1-7"	2	69
50+00	6'-1"/4'-7"	2	138
66+50	$2^1/_2$' Dia	1	
	5' Dia Steel	1	
	6'-1"/4'-7"	1	69

CULVERT REQUIREMENTS (CONT'D)

STATION	TYPE	NUMBER	LENGTH
72+00	6'-1"/4'-7"	2	138
75+15	6'-1"/4'-7"	2	138
84+50	6'-1"/4'-7"	2	138
88+00	6'-1"/4'-7"	2	138
44+35	4' Dia Steel	1	
	3' Dia Steel	1	
	6'-1"/4'-7"	1	69
TAYLOR RD. UNDER TRACKS	6'-1"/4'-7"	3	207

TOTAL CULVERT 5343 Ft.

LENGTH REQUIREMENTS

6'-1" span/4'-7" rise

may 1979

MONTHLY MEAN WATER LEVELS
MOYENNE MENSUELLE DU NIVEAU DES EAUX
Present, Past and Probable Future Levels
Niveaux Presents, Passes et Probables

	Thunder Bey	Gocksich	Belle River	Part Colborne.	Kingston	Jetty NO. Jade No 1
MR.AN FOR MONTH MOYENNE MENSUELLE	183.13	176.65	175.23	174.32	74.98	7.91
LAST YEARS MEAN FOR MONTH MOYENNE MENSUELLE OE 1. ANNEE DERN1ERE	18198	176.39	175.17	174.43	7513	7.64
MAXIMUM MEAN FOR MONTH YEAR	181 35		175.55	174.73	75.58	8.87
MOYENNE MENSUELLE MAXIMALE ANNEE	1951	70 96	1974	1974	1952	1974
MINIMUM MEAN FOR MONTH YEAR	182.41	175.52	174.32	173.25	7198	6.36
MOYENNE MENSUELLE MINIMALE ANNgt	1926	1964	1964	1934	1935	1968
MEAN FOR MONTH. LAST 20 YEARS MOYENNE MENSUELLE. io DERNIERES	183.11	176 57	175.27	174.44	75.05	7.82
ANNEES MEAN FOR MONTH. ALL YEARS MOYENNE MENSUELLE DE TOUT TEMPS	183 03	176 25	174.99	174.00	74.82	7.62
PROBABLE MEAN FOR NEXT MONTH MOYENNE 1160BABLE DU MOIS PROCHAJN_	18123	176 74	175.32	174 43	75.00	6.88

METRIC - METRIQUE

CONVERSION TABLE
TABLE DE CONVERSION
METRES TO FEET / METRES EN PIEDS

	0	1	2	3	4	5	6	7	8	73	74	75	173	174	175	176	182	183
								FEET I REDS										
.o	0.0	13	18	9.8	131	16.4	19.7	23.0	252	239.5	2428	2461	567.6	570.9	5741	577 4	597.1	800.4
.1	0.3	36	6.9	10.2	13.5	16.7	20.0	23.3	255	239.8	243.1	2464	567.9	571 2	574.5	577.3	5974	600.7
.2	0.7	39	7.2	10.5	118	17.1	20.3	23.6	269	240 2	243.4	2467	568.2	571.7	574.8	578 1	597.8	601.0
.3	1.0	4 3	7.5	10.8	14.1	17 4	20.7	24.0	27 2	240.5	243.8	2470	568.6	571.9	575.1	578.4	598.1	60E4
.4	13	46	7.9	11.2	14.4	17.7	21.0	24.3	276	240.8	2441	247.4	568.9	5722	575.5	578.7	5984	60[1].7
.5	1.6	4.9	8.2	II 5	14.8	18.0	21.3	24.6	279	241.1	244.4	247.7	569.2	5725	5758	nal	5988	6020
.8	2.0	52	8.5	11.8	151	184	21.7	24.9	282	241.5	244.8	2480	569.6	5728	5761	579.4	599.1	6024
.7	23	56	89	121	154	187	220	253	285	241.8	245.1	248 4	569.9	573 2	5764	579 7	5994	6027
.8	26	5.9	9.2	125	15.7	19.0	223	256	28 9	2421	245.4	248.7	570.2	5715	5768	580.1	5997	6010
.9	10	62	9.5	128	161	19.4	226	25.9	29.2	2425	245.7	249 0	570 5	573.8	577.1	580.4	600.0	6013

MONTHLY MEAN WATER LEVELS

MOYENNE MENSUELLE DU NIVEAU DES EAUX

Present, Past and Probable Future Levels

Niveaux Presents, Passes et Probables

	Thunder Bay	Goderich	Belie Rive	Port Colborne	Kingston	Jetty No. 1 Jet6e NO 1
MEAN FOR MONTH MOYENNE MENSVELLE	183.28	176.72	175.25	174.39	74.95	6.92
LAST YEARS MEAN FOR MONTH MOYENNE MENSUELLE Of *LANNEE* DERNIERE	183.08	176.45	175.17	174.41	75.05	6.81
MAXIMUM MEAN FOR MONTH YEAR MOYENNE MENSUELLE MAXIMALE ANNE f	18144 1916	177.05 1973	175.60 1973	174.79 1973	75.61 1962	8.06 1974
MINIMUM MEAN FOR MONTH YEAR MOYENNE MENSUELLE MINIMALE ANYE.E	18251 1926	175.54 1964	174.30 1964	173.25 1934	74.06 1935	6.04 1968
MEAN FOR MONTH. LAST to YEARS MOYENNE MENSUELLE. 10 DERNIERES ANNEES	183.19	176.73	175.30	174.46	75.06	7.05
MEAN FOR MONTH. ALL YEARS MOYENNE **MENSUELLE OE TOUT TEMPS**	183.12	176.31	175.02	174.04	74.87	6.92
PROBABLE MEAN FOR NEXT MONTH MOYENNE PROBABLE DU MOIS PROCHAIN	18133	1 176.76	175.27	174.35	74.88	6.53

METRIC - METRIQUE

CONVERSION TABLE

TABLE DE CONVERSION

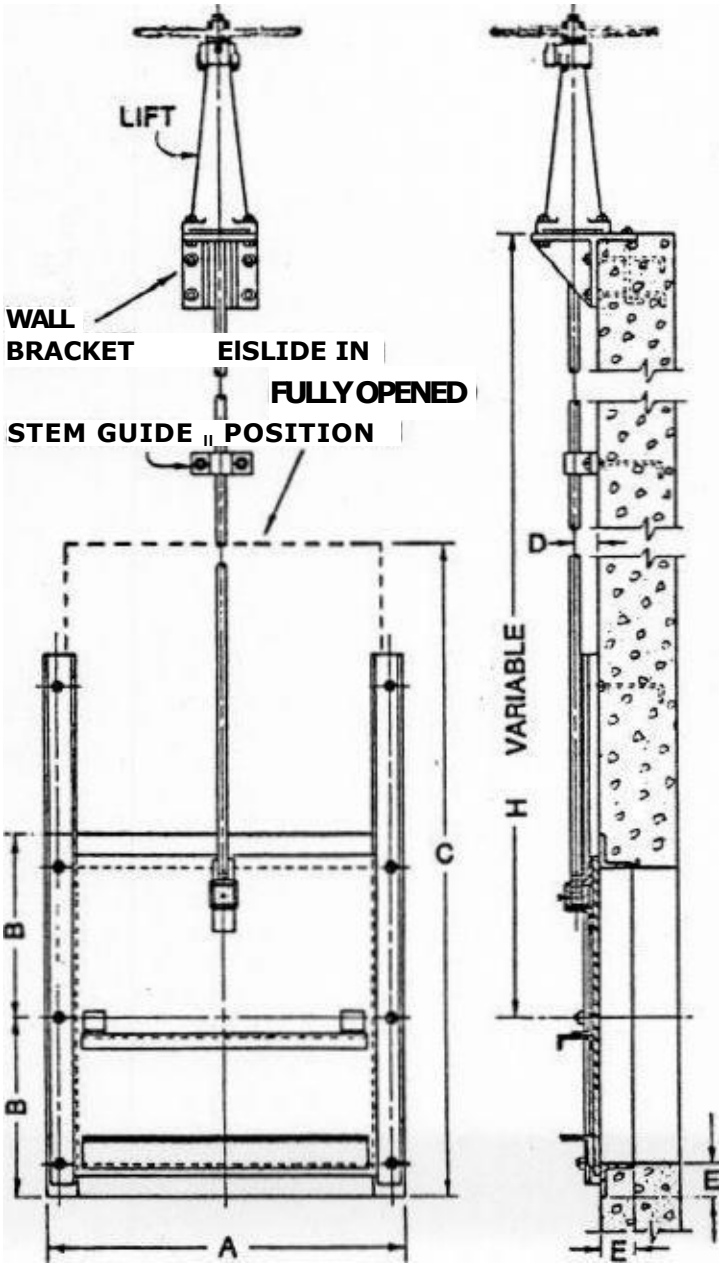
METRES TO FEET / METRES EN PIEDS

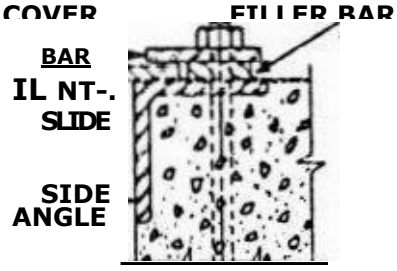
METRES	0	1	2	3	4	5	6	7	8	73	74	75	173	174	175	170	182	183
								FEET										
.0	0 0	33	8 6	9.8	13.1	16 4	19.7	23.0	26.2	239.5	2428	2461	567.8	570.9	574.1	5774	597.1	800.4
.1	0.3	36	6.9	102	13.5	16.7	20.0	23.3	266	239.8	243.1	2464	567.9	571.2	674.5	577.8	597.4	800.7
.2	0.7	39	7.2	10.5	138	17.1	20.3	23.6	28.9	240.2	243.4	2467	588.2	571.7	5748	5783	597.8	601.0
.3	1.0	4.3	7.5	10.8	34.1	17.4	20.7	24.0	27.2	240.5	243.8	2470	568.6	571.9	575.1	578.4	5981	601.4
.4	13	46	7.9	112	14.4	177	21.0	24.3	27.6	240.8	244.1	247.4	588.9	5722	5755	578.7	5984	601.7
.5	3.8	49	8 2	11.5	14.8	18.0	21.3	24.6	27.9	241.1	244.4	247.7	569.2	5725	5758	379.1	598.8	6020
.6	2.0	62	8.5	11.8	161	184	21.7	24.9	282	241.5	244.8	2480	569.6	5728	5761	579.4	599.1	6024
.7	2.3	56	8.9	12.1	15.4	lel	220	25.3	265	241.8	245.1	248.4	589.9	573.2	57114	579.7	599.4	
.8	28	59	92	125	15.7	19.0	223	25.6	28.9	242.1	245.4	2487	570.2	573.5	5768	580.1	5997	6,02,7
.9	3.0	62	9.5	12.8	161	19.4	226	25.9	29.2	2425	245.7	2490	,5705	573.8	577.1	580.4	.600.0	6033

FADIIICATED SLIDE GATES MODEL 10-00

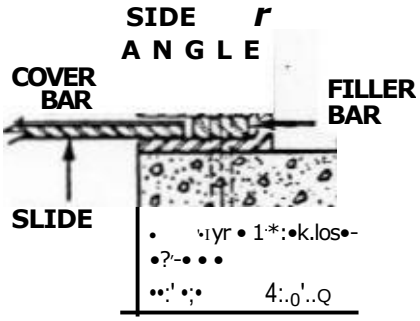
10-Foot Seating Heads
No Unseating Heads

- Square or Rectangular Opening
- Rising Stem
- Pedestal Lift
- Flat or Spigot Back
- No Wedges

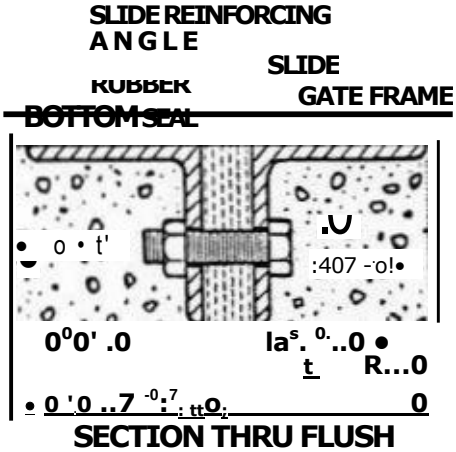




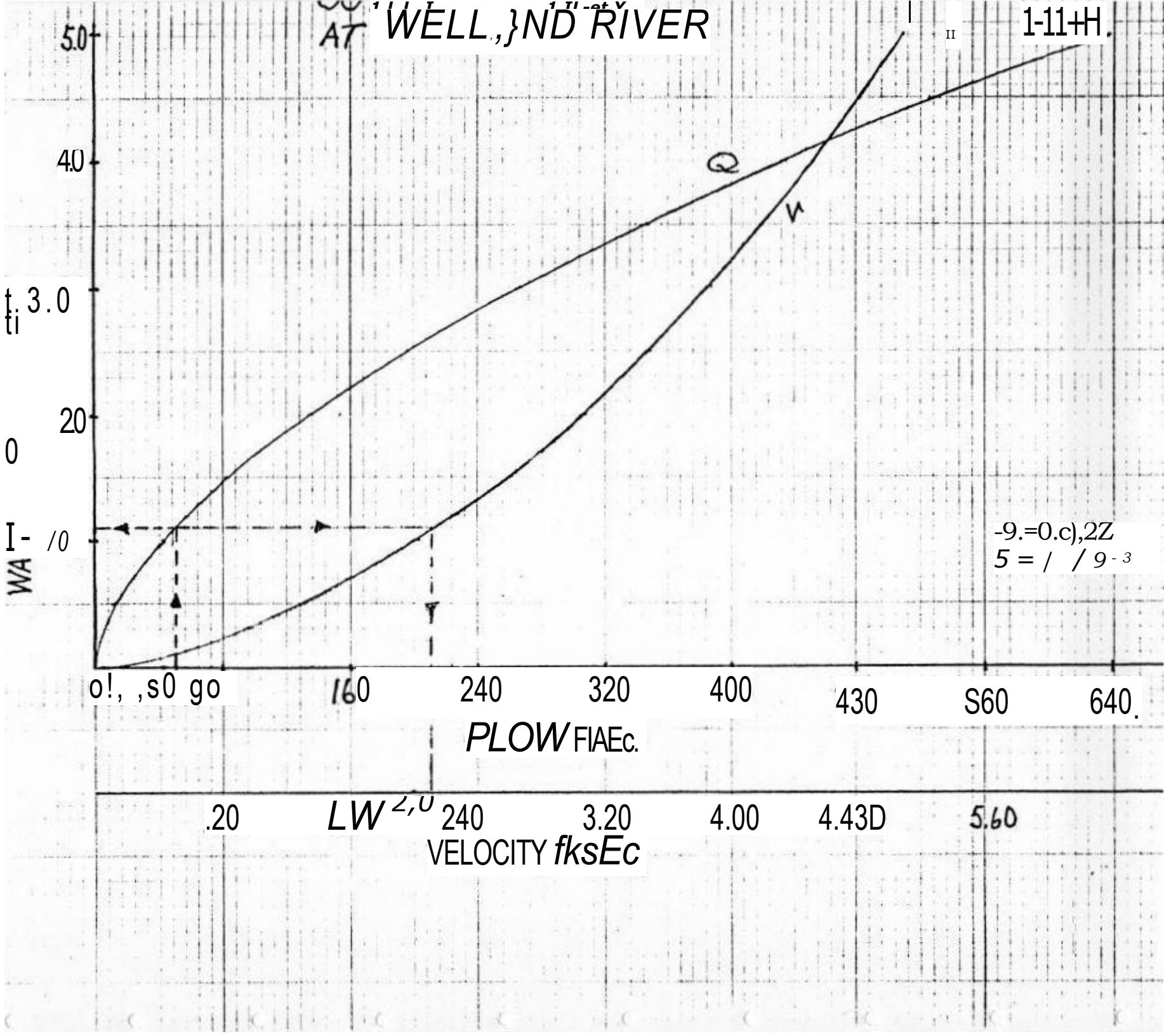
SPIGOT BACK FRAME



FLAT BACK FRAME



SECTION THRU FLUSH BOTTOM OPENING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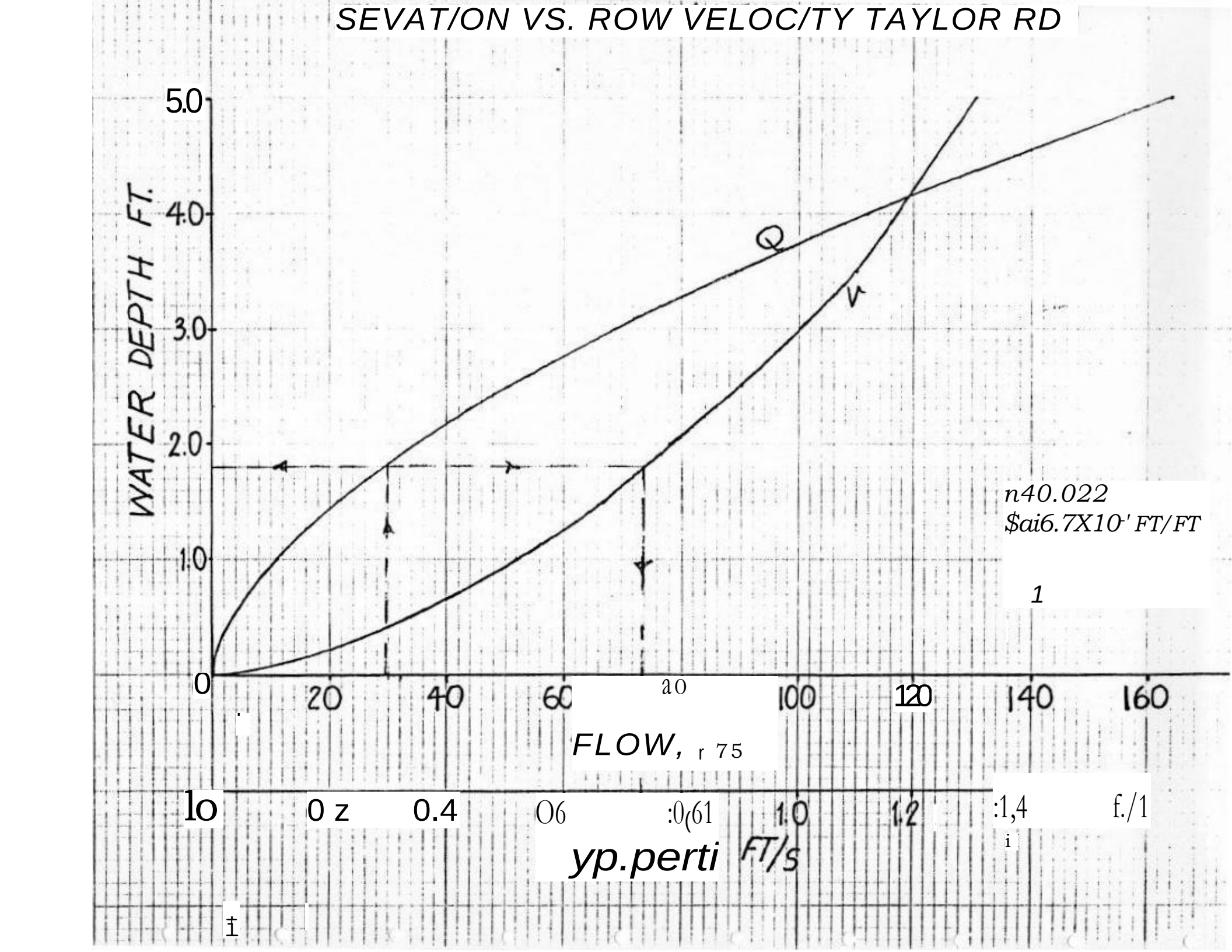
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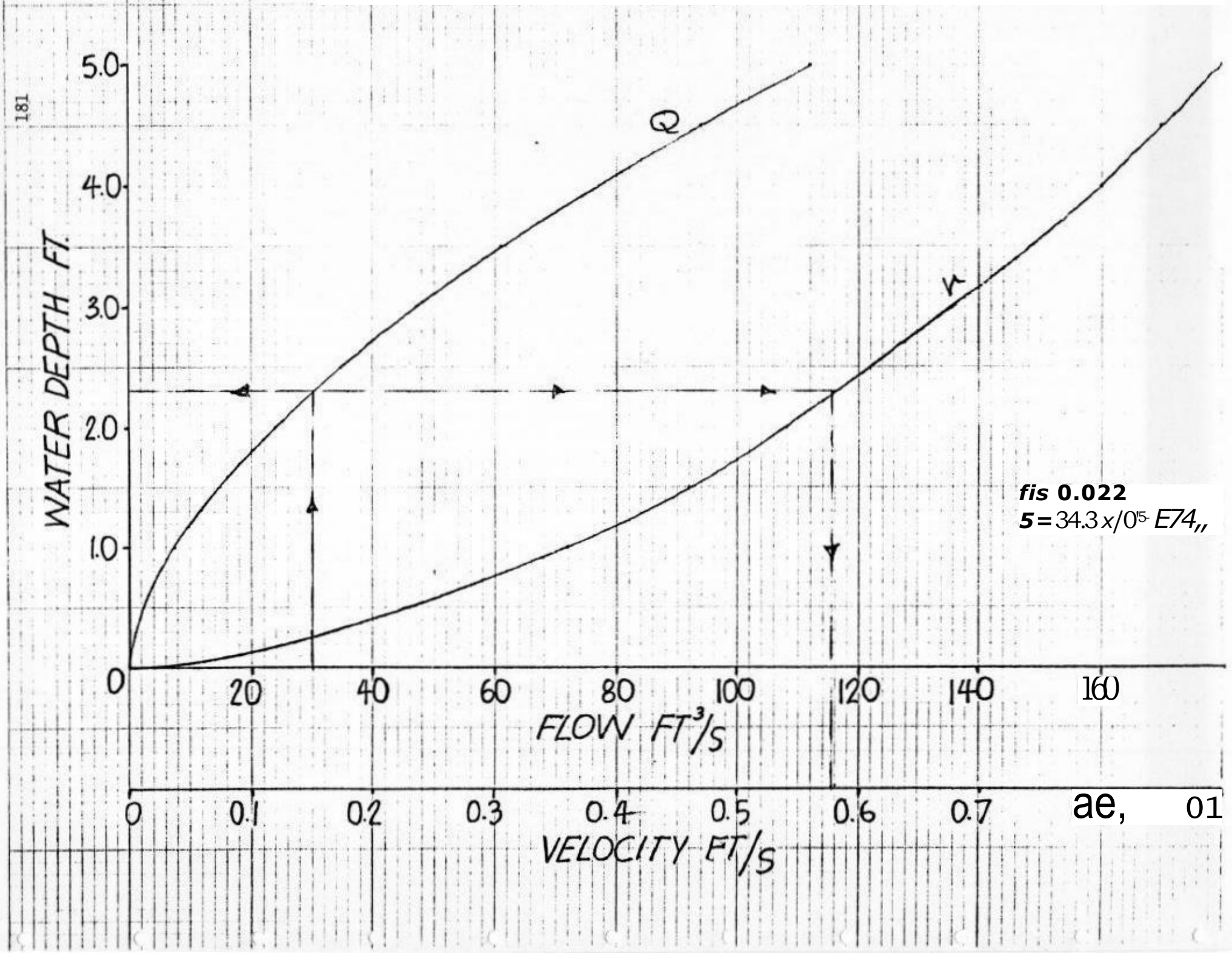

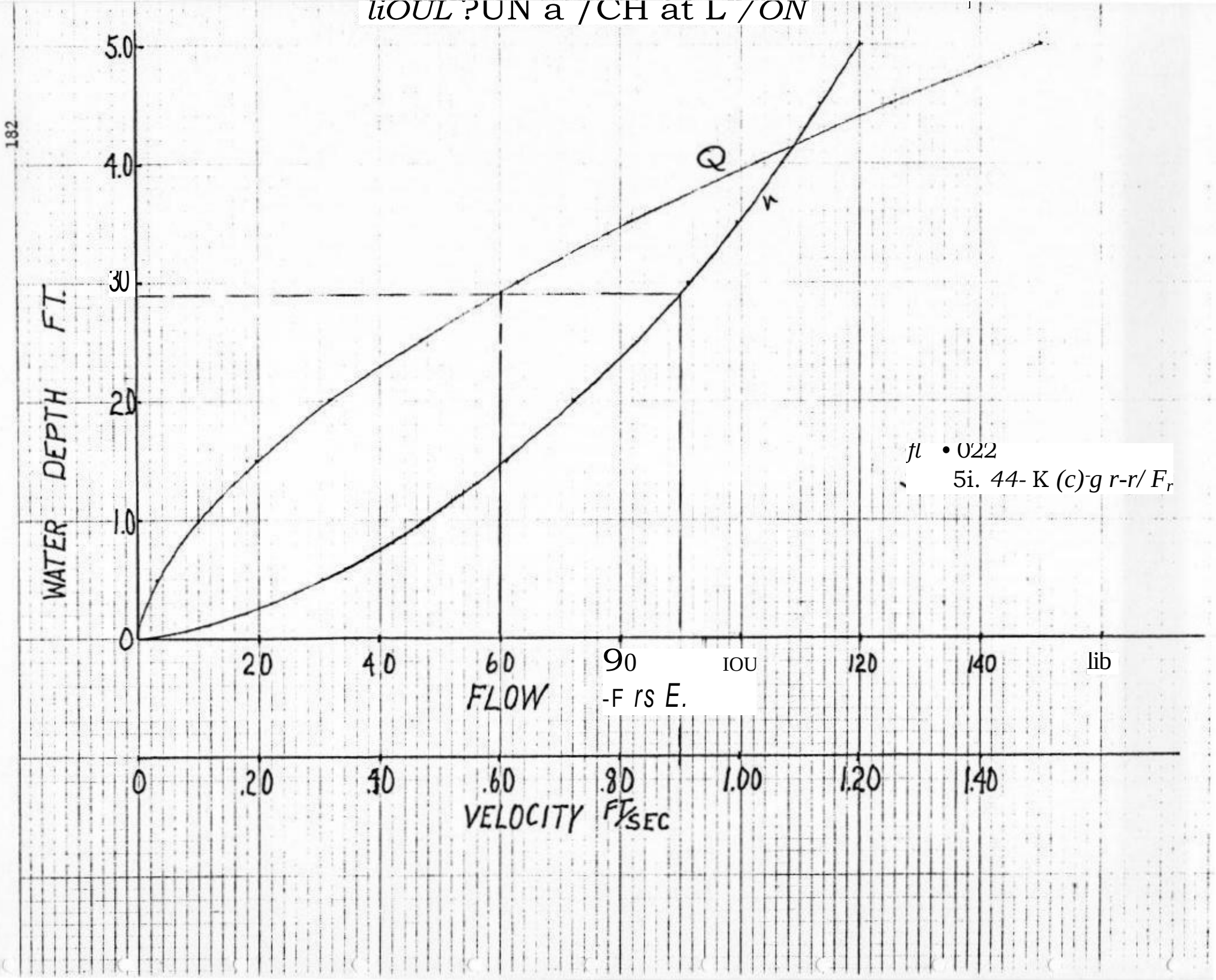
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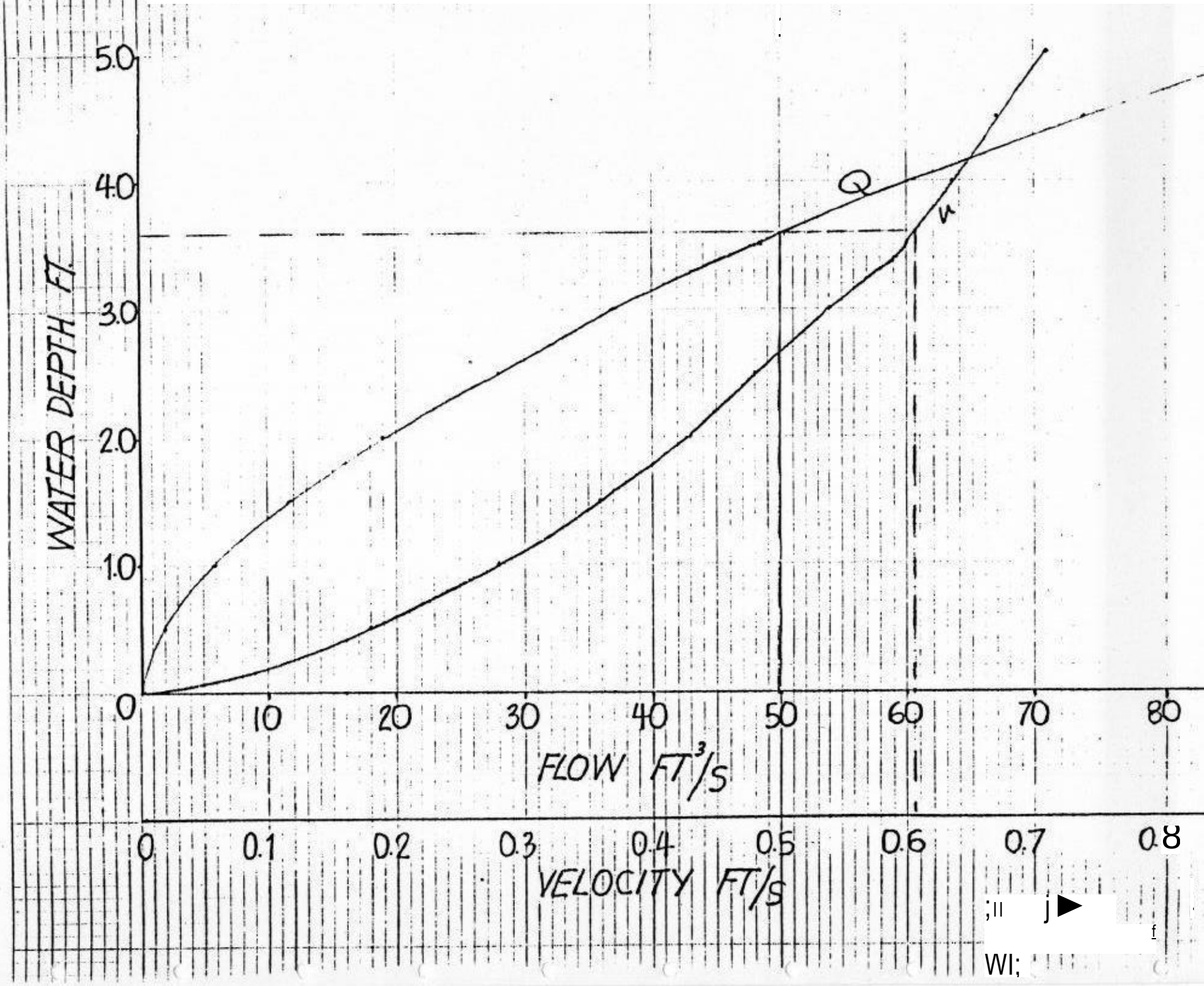
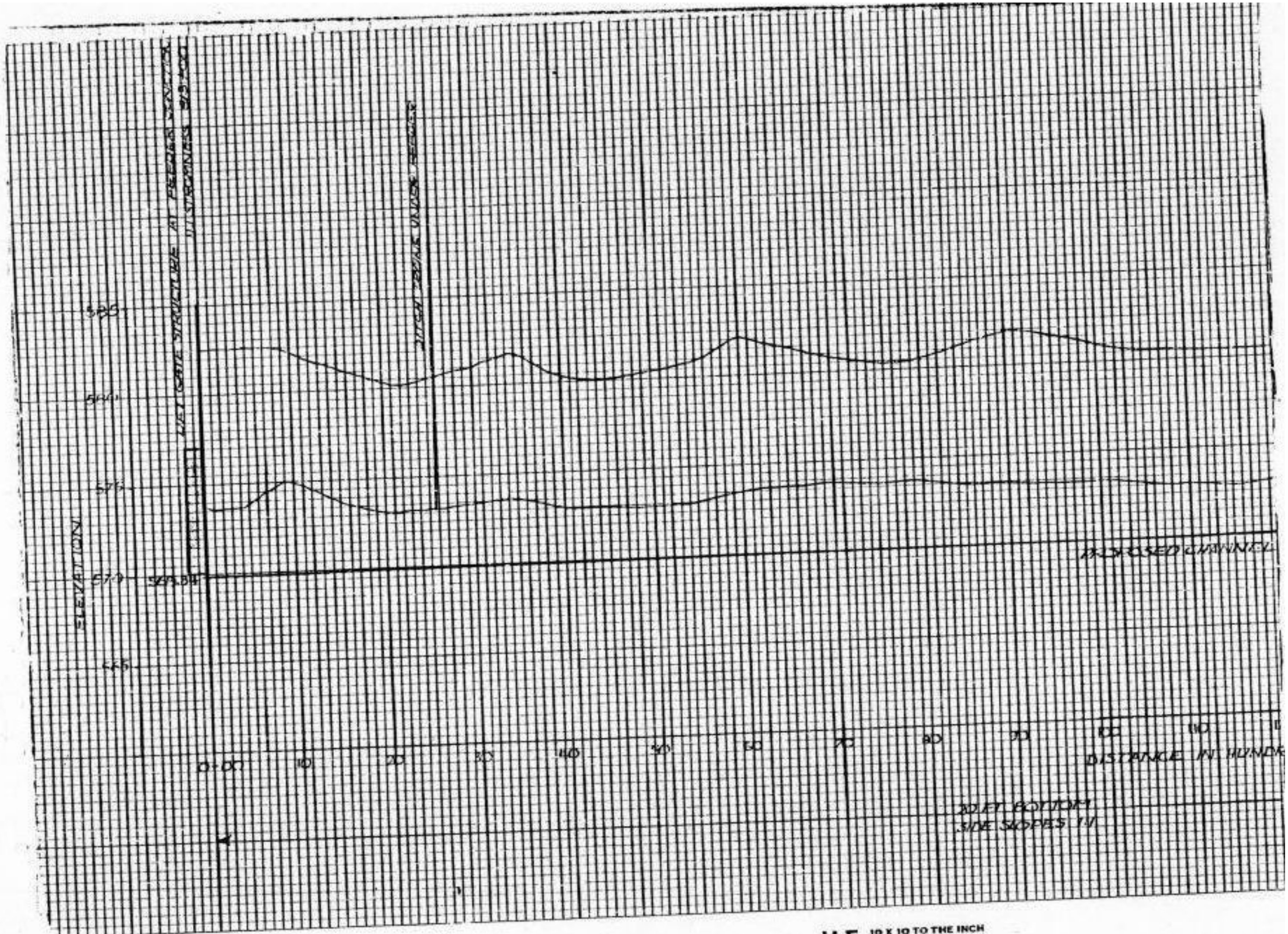
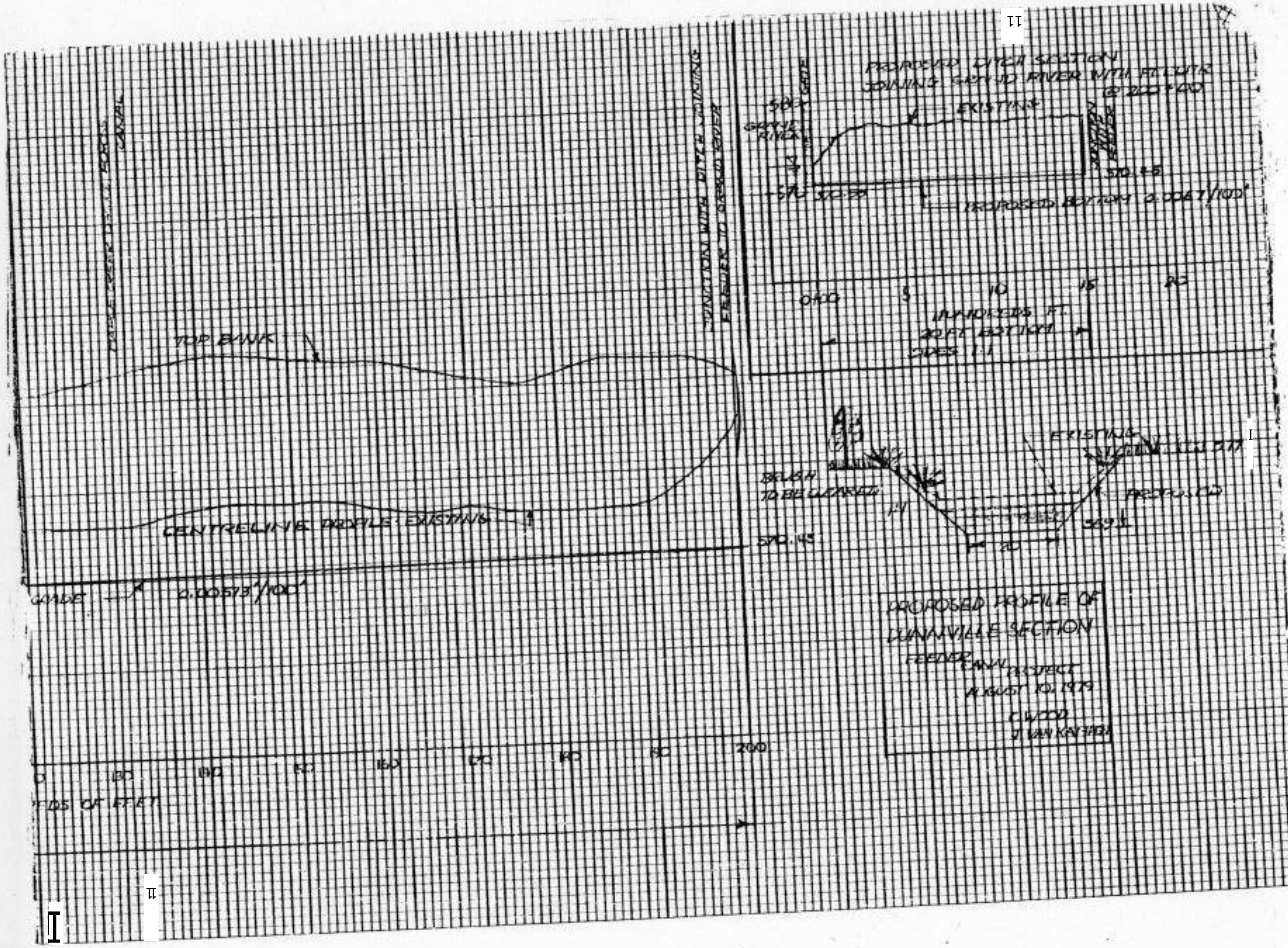
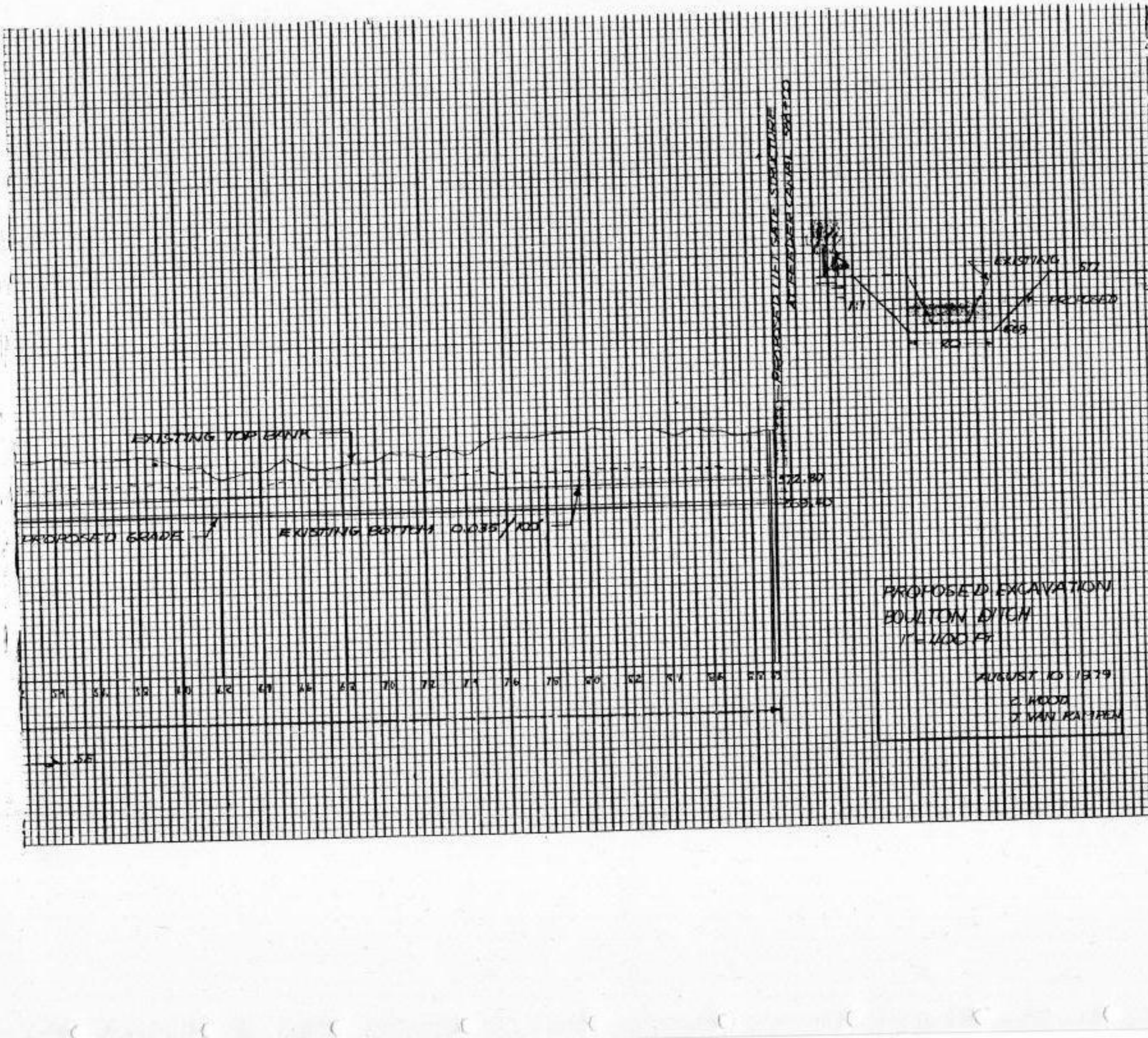
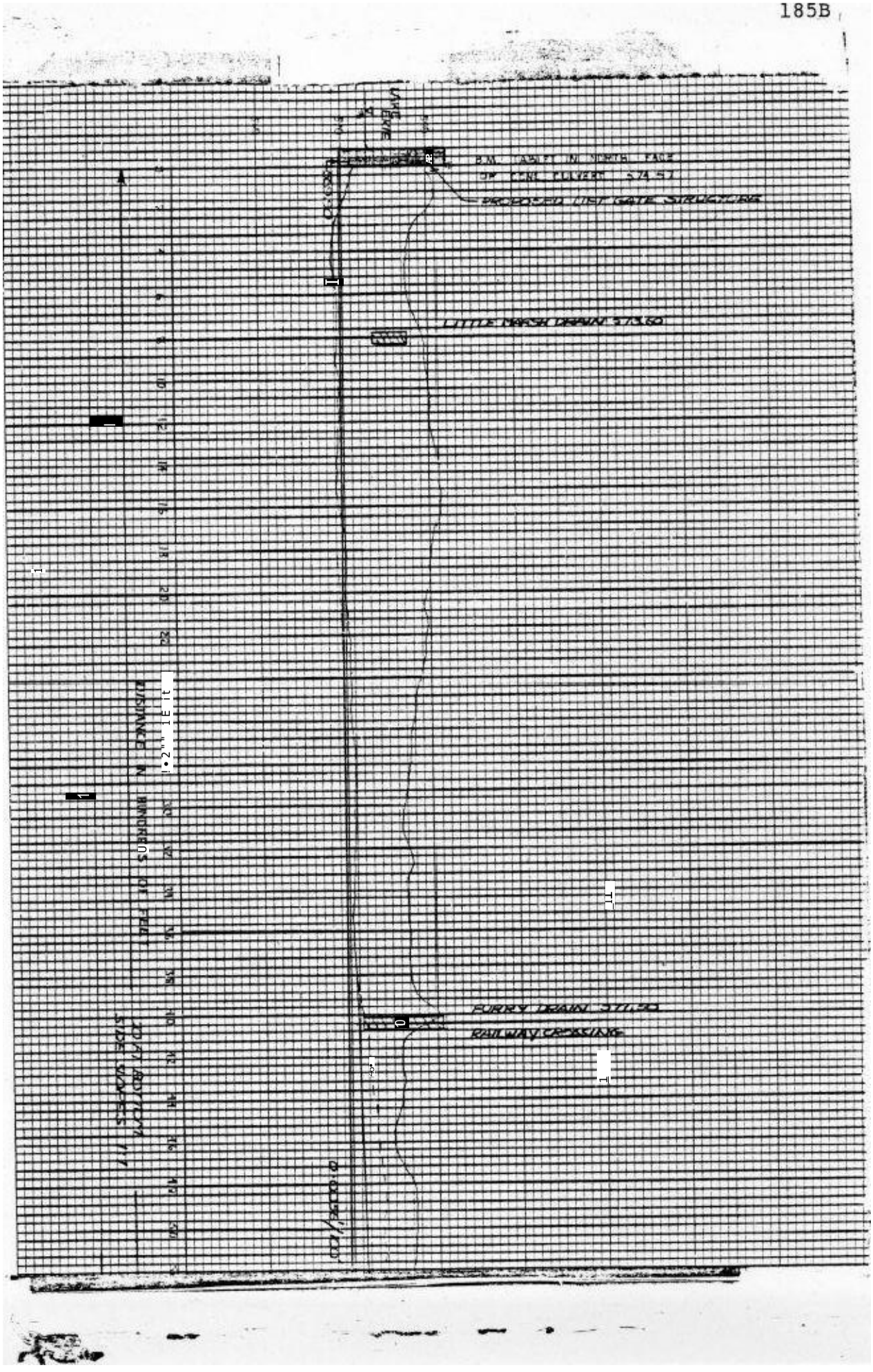


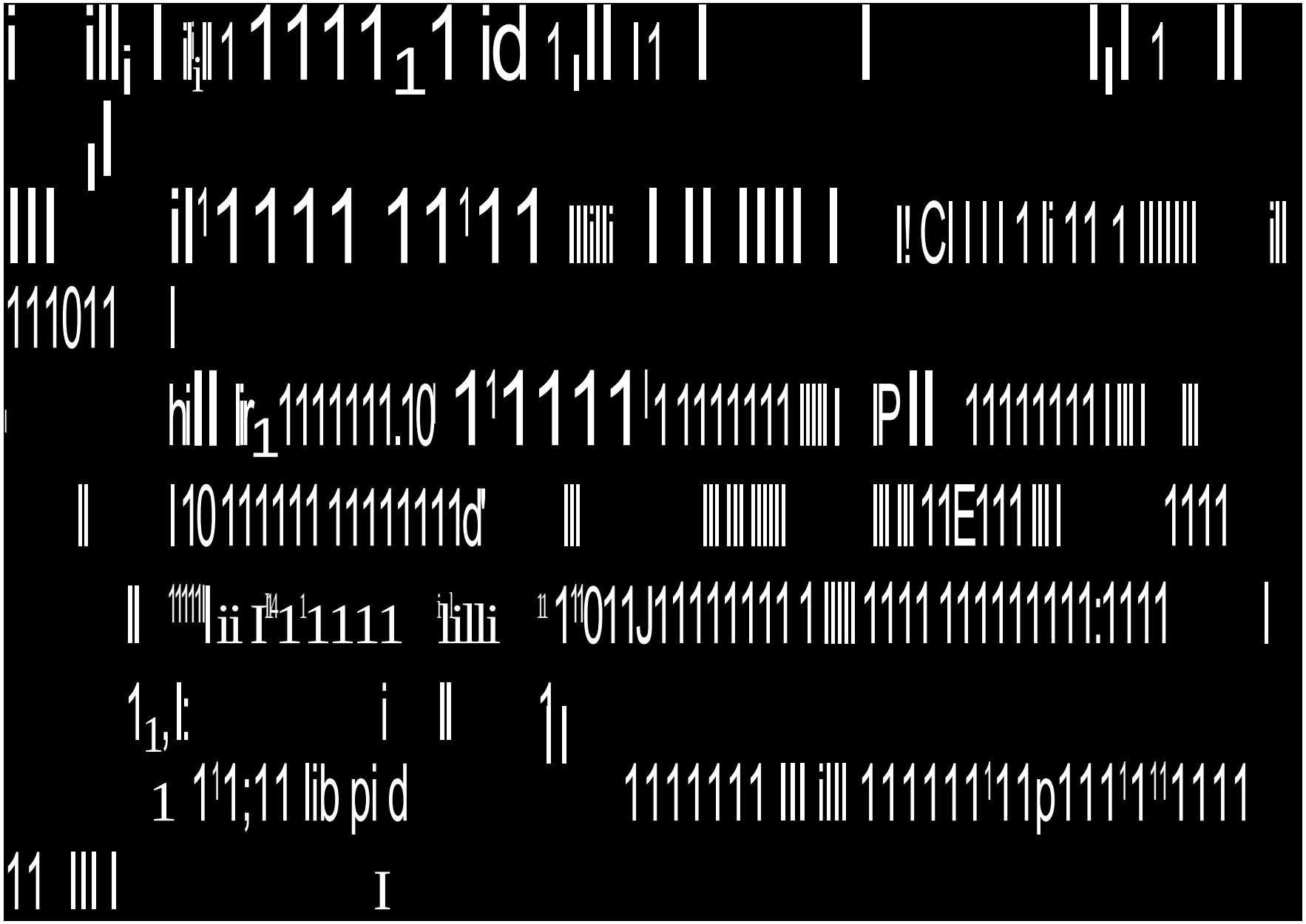


K+E 10 X 10 TO THE INCH
KEUFFEL & ESSER CO.

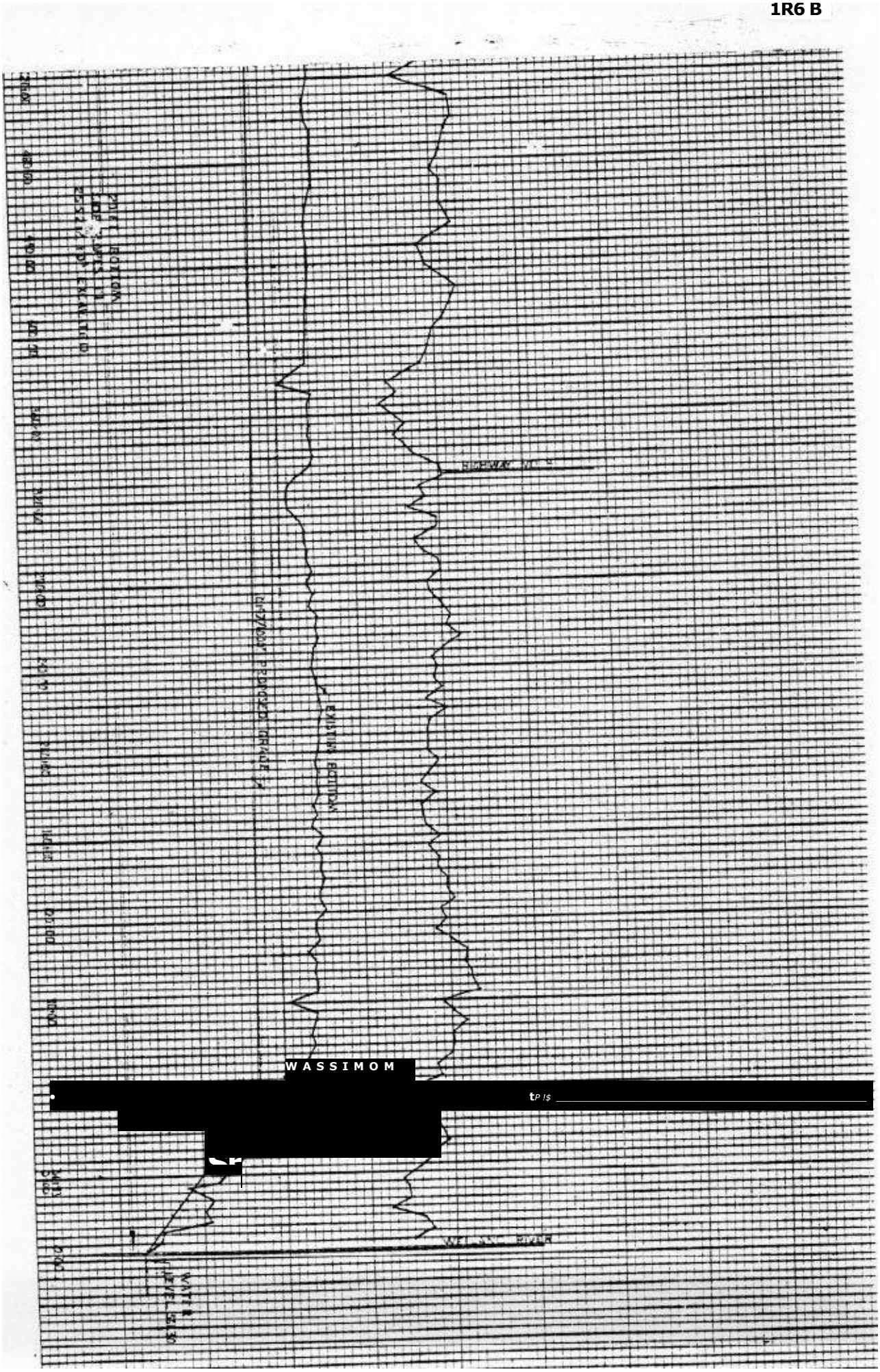

PROPOSED DITCH SECTION
JOINING GRAND RIVER WITH FEEDER
@ 200+00
EXISTING
PROPOSED BOTTOM 0.0047'/100'
570.45
5
10
15
20
0+00
20 FT BOTTOM
SIDES 1:1
EXISTING
PROPOSED
BRUSH
TO BE CLEARED
1:1
570.45
20
PROPOSED PROFILE OF
DUNNVILLE SECTION
FEEDER CANAL PROJECT
AUGUST 10, 1979
TOP BANK
CENTRELINE PROFILE · EXISTING
GRADE
0.00573'/100'
200
CANAL


EXISTING TOP BANK
PROPOSED GRADE
EXISTING BOTTOM 0.035'/100'
572.80
569.40
EXISTING
PROPOSED
PROPOSED EXCAVATION
BOULTON DITCH
1"=400 FT
AUGUST 10 1979
E. HOOD
J. VAN KAMPEN

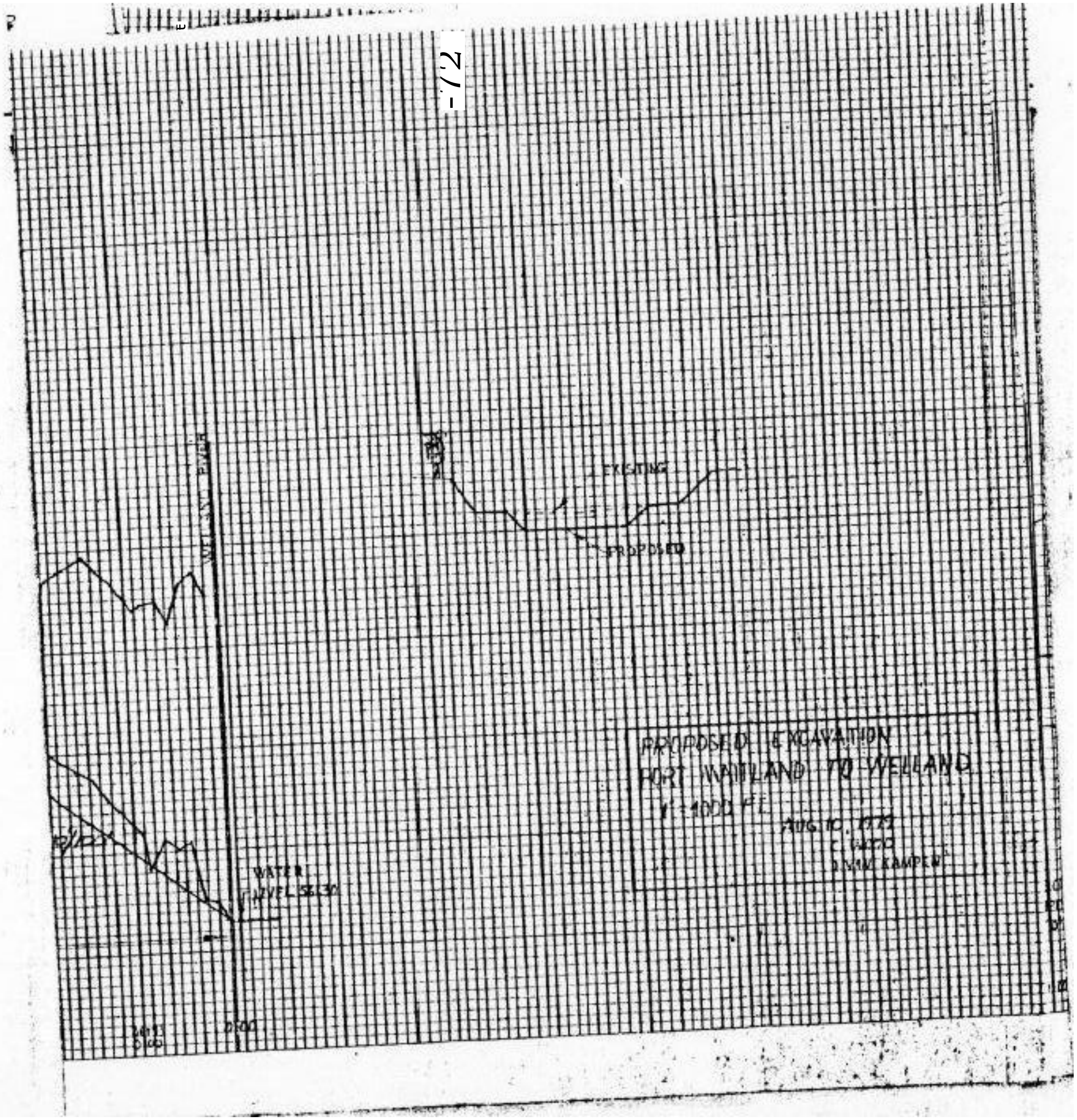

B.M. TABLET IN NORTH FACE OF CONC. CULVERT 574.57
PROPOSED CUT GATE STRUCTURE
LITTLE MARSH DRAIN 573.60
FURRY DRAIN 571.20
RAILWAY CROSSING
DISTANCE IN HUNDREDS OF FEET
RAILWAY CROSS SECTIONS
1" = 2'-0"



1R6 B



-72


EXISTING
PROPOSED
WATER LEVEL
PROPOSED EXCAVATION
PORT WELLAND TO WELLAND
1" = 1000 FT.
AUG. 10,

APPENDIX TWO

Recreation Inventory of Trails

Forty-one trails are recorded in the Niagara Peninsula, only five of which are located in Dunnville and Wainfleet. These are as follows:

Three are located in Dunnville.

1. Rock Point Provincial Park
   – hiking and snowmobile trails
   – two miles long

2. C Bar C
   – horseback riding, cross-country skiing and, snowshoe trails
   – four to five acres

3. Larry's Hideaway
   – bicycling and hiking trails
   - seventy-five acres

Two are located in Wainfleet.

4. Long Beach
   hiking trails

5. Morgan's Point Community Park
   – hiking and snowmobile trails

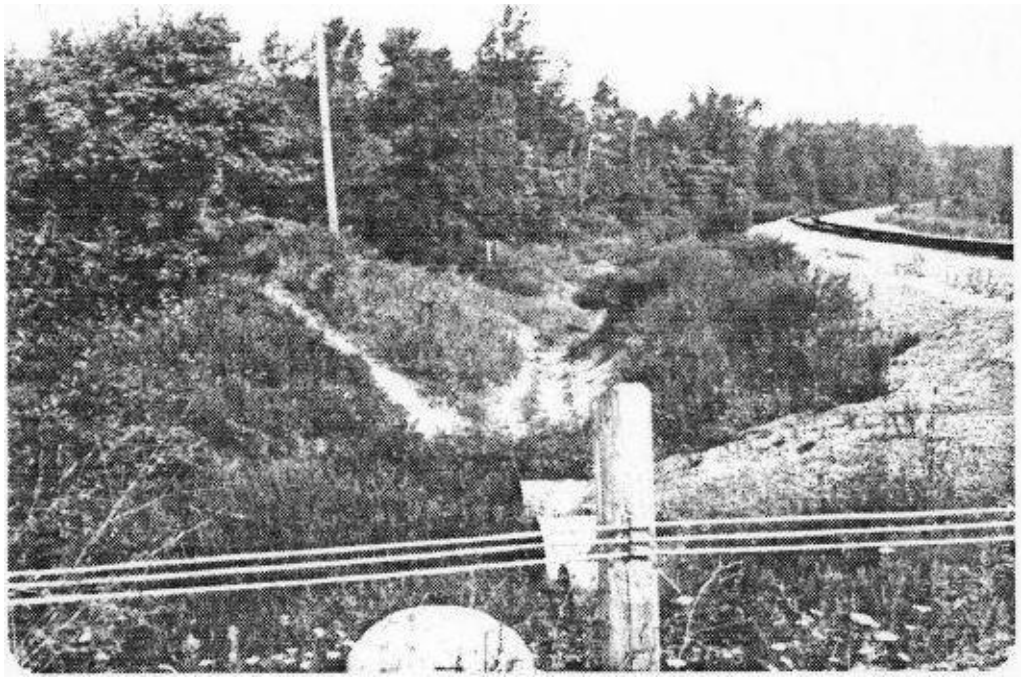
Costs Relating To Picnic Sites

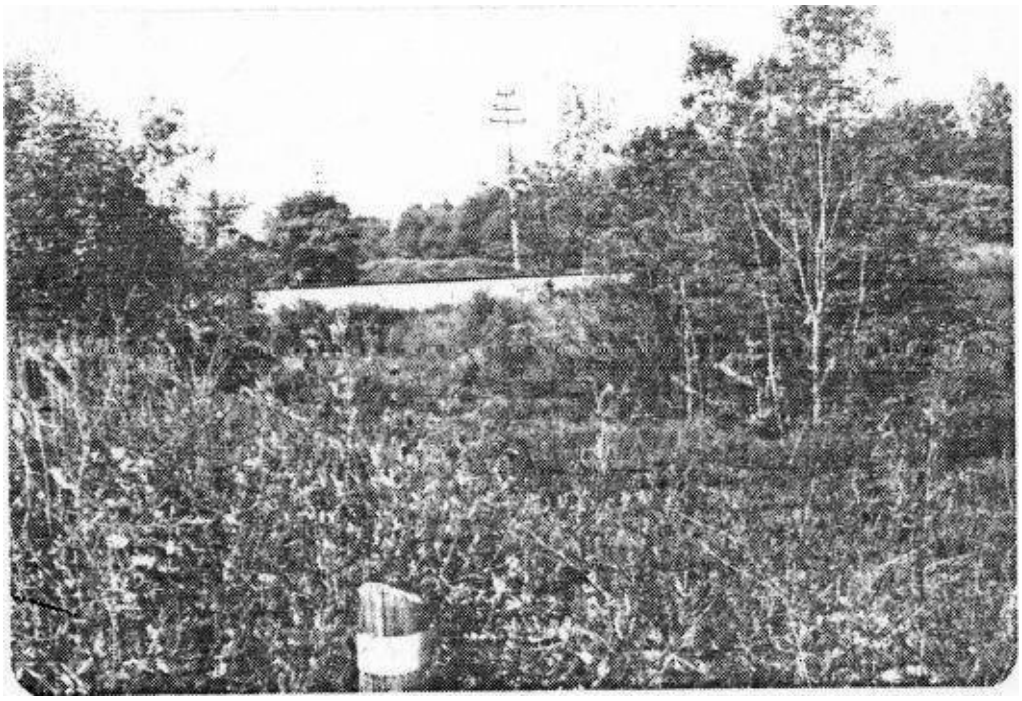
Equipment

Picnic Tables	Costs
Benches	$60 per table
Garbage Cans	$90 per bench
Clear brush and levelling (labour included)	$ 1.50 per can
Grassing an area	$100 per acre
Sodding an area	$400 per acre
Signs	$ 0.07 Per square foot
	$20 per mile
	$20 per intersection

(1977 figures)

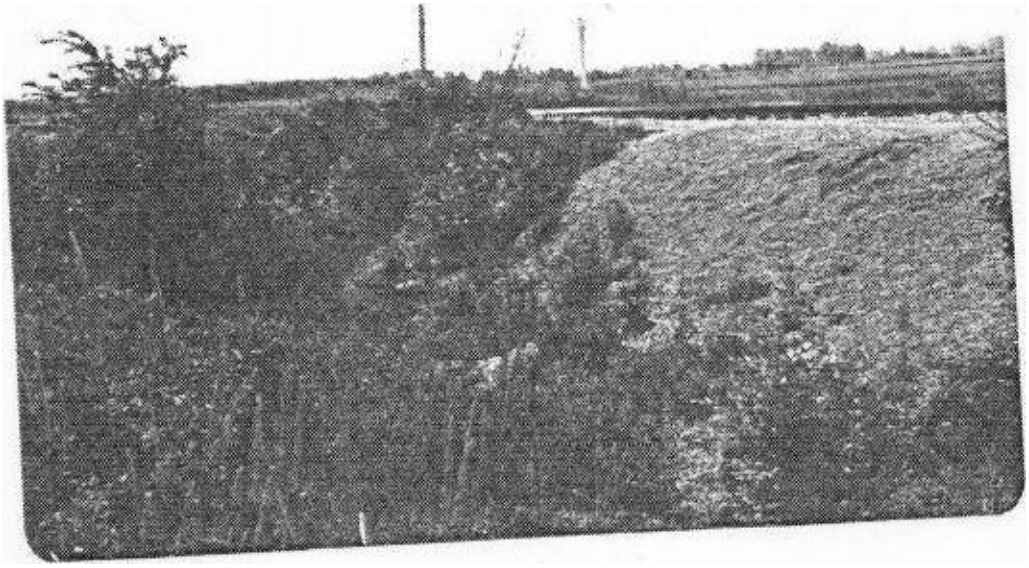
(Source: Alternative Use for Abandoned Railway Rights-of-Way in Regional Niagara, 1977.)

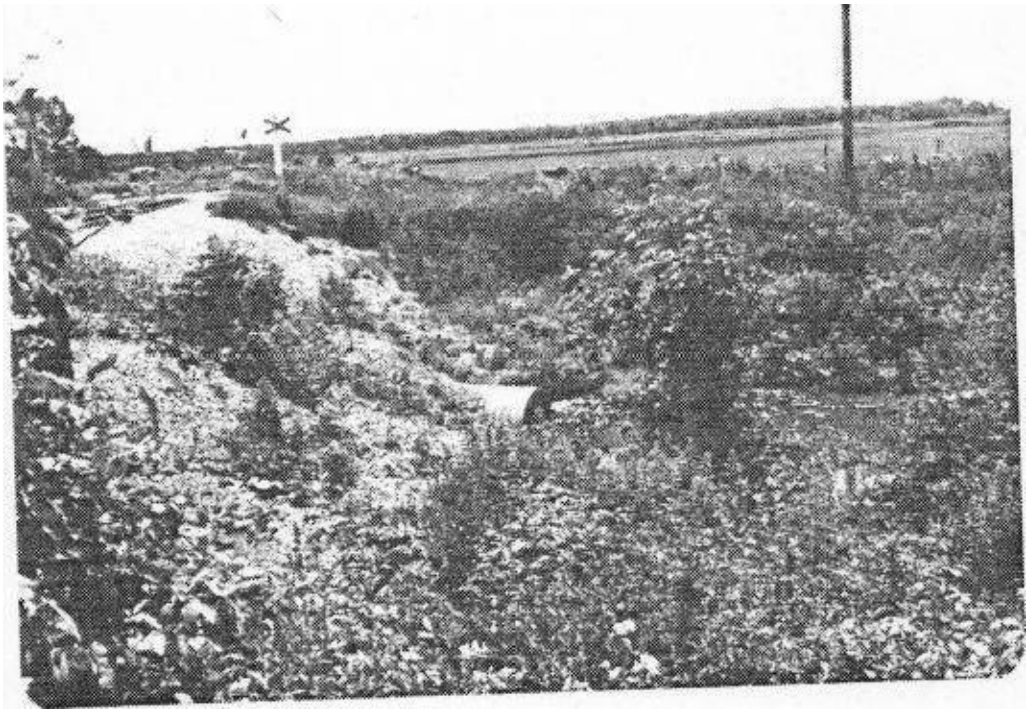




Railroad crossing between Welland and Wainfleet.

This infill of the Feeder is only one of many. Its location near a railroad crossing makes it suitable as an access point to the other side of the channel for the proposed bicycle/walking/cross-country skiing trail.





Railroad crossing between Wainfleet and Stromness.

WATER TEST RESULTS ALONG THE FEEDER CANAL

Location	Date	CODs (ppm)	Total Solids (ppm)	Suspended Solids (PPm)	Turbidity in Silica Units	Coliform Count per 100 ml
Brown Tap Drain	May/61	2.0	312	12	9	1020
	Apr/64	33.0	378	44		1000
At Regional Road 23	May/61	6.0	290	40	43	20

Niagara Peninsula Conservation Authority

PRESENT WATER TEST RESULTS ALONG THE FEEDER CANAL

Temperature	32 C
pH (at lab0 (at lab)	7.8
Nitrate	0.5 mg/L
Phosphorous (reactive)	0.06 mg/L
Alkalinity	160 mg/L CaCo3
Hardness	400 mg/L CaCo3
Sulphate	150 mg/L
Clloride	165 mg/L (Cl)
Turbidity	50 F.T.U.
Colour	180 units

WATER TEST RESULTS - GRAND RIVER AT THE DUNNVILLE BRIDGE

Date	Total Coliform MF/100 ml	Fecal Coliform MF/100	Water Temp. Degree C	Dissolved O_2 MG/L
Feb.14/78	210	4.L	.5°C	11.0
May 23/78	210	4.L	19.0°C	15.8
July 10/78	200	128	23.0°C	8.3
Sept.6/78	180	12.0	16.5	9.9
Nov.22/78	100	30.0	4.0	11.0

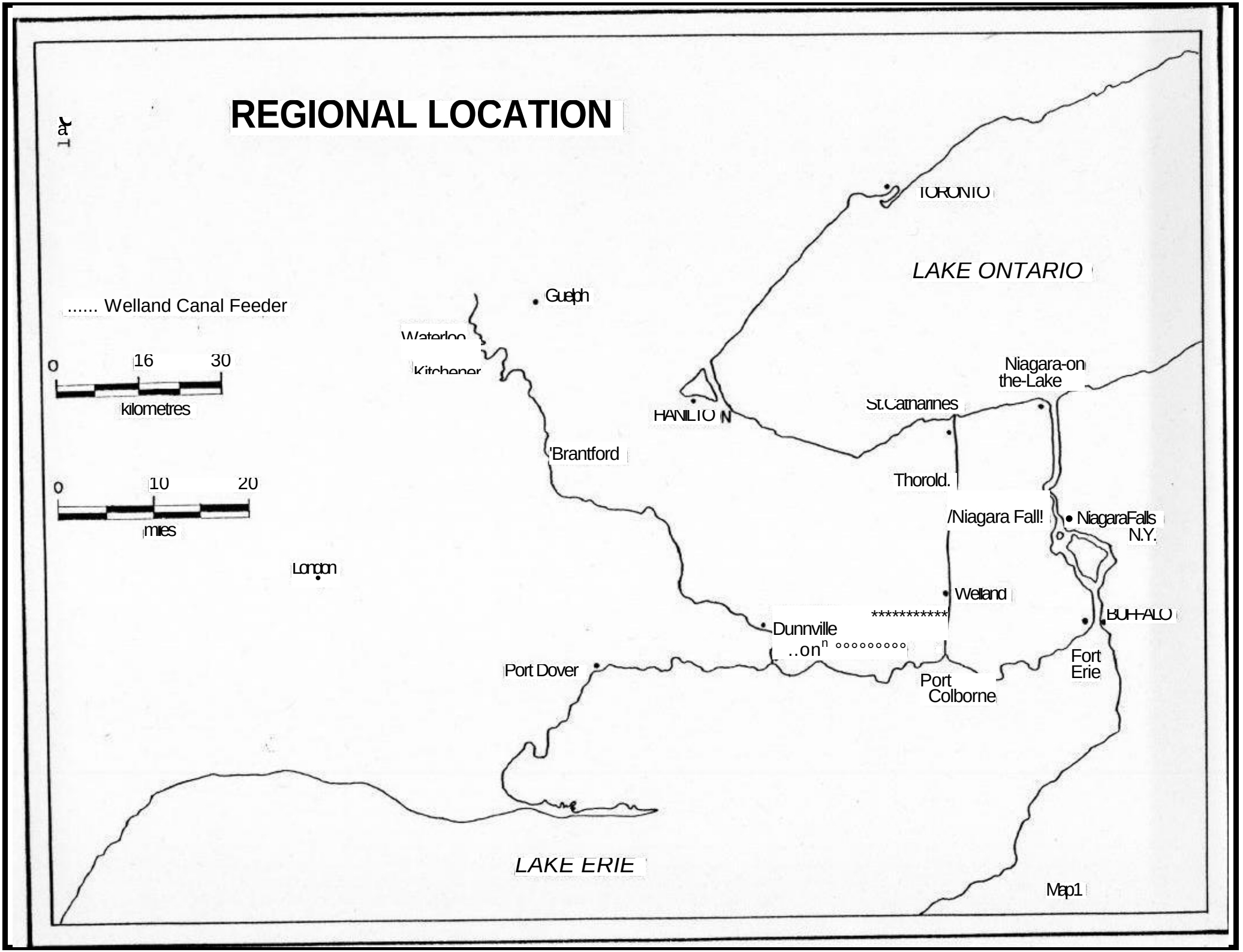
BOD MG/L	Total P MG/L	Filtered Ammonia MG/L	Total Kjeldahl MG/L	Filtered NO_2 MG/L	Filtered NO_3 MG/L
0.8	0.055	0.372	0.81	0.021	2.66
2.2	0.110	0.126	0.920	0.053	1.430
10.0G	0.190	0.184	1.26	0.025	0.165
2.2	0.105	0.152	0.470		
1.0	0.081	0.106	0.740	0.029	2.130

Total Solids MG/L	Suspended Solids-MG/L	Dissolved Solids-MG/L	Chloride MG/L	Sulphate MG/L	Reactive Silcate MG/L
516	2.5	513	38.5	113	3.90
443	33	410			
516	62	454	55		
	62		51		
494.0	12.0	484	45.5	130	1.20

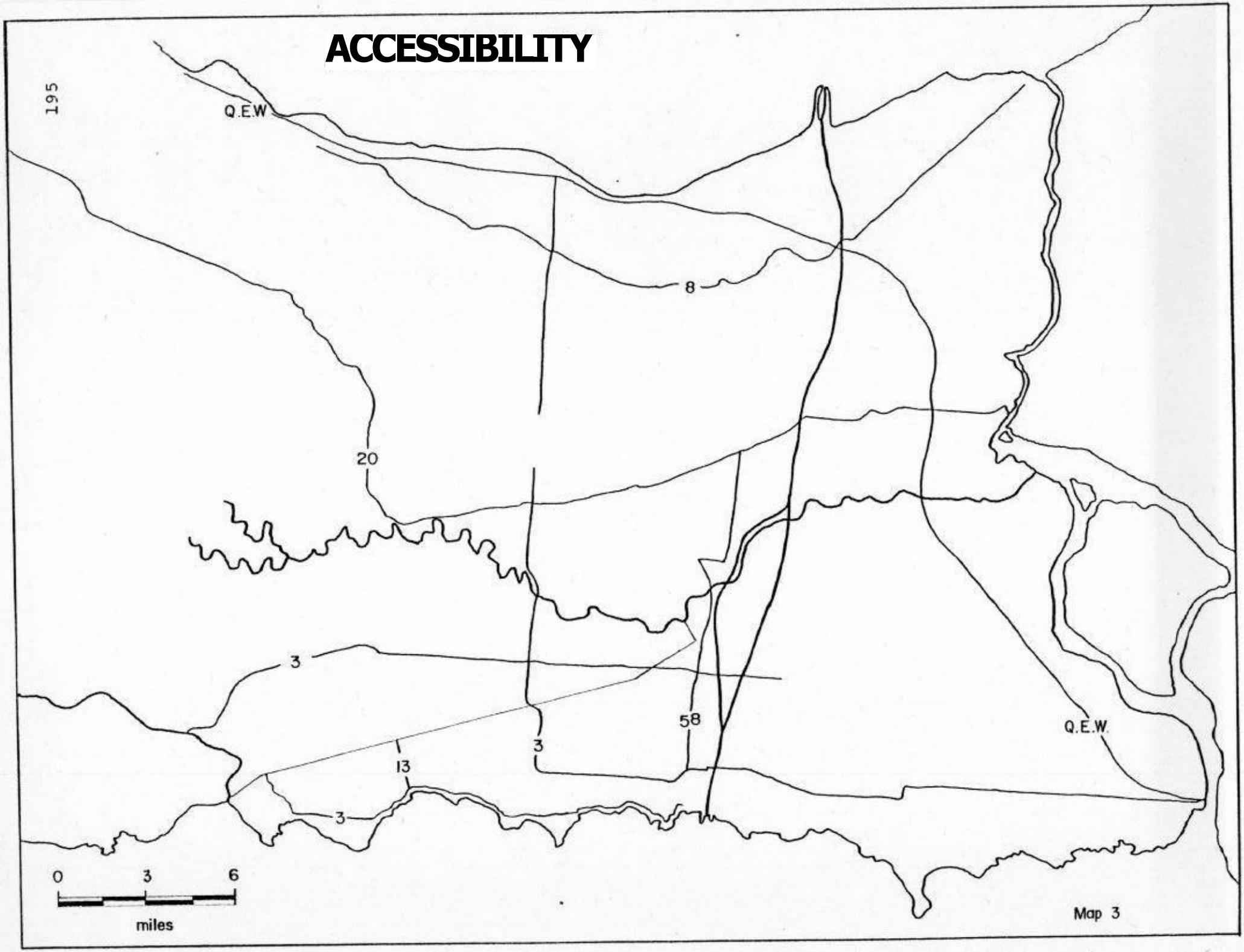
WATER TEST RESULTS - GRAND RIVER AT THE DUNNVILLE BRIDGE - continued

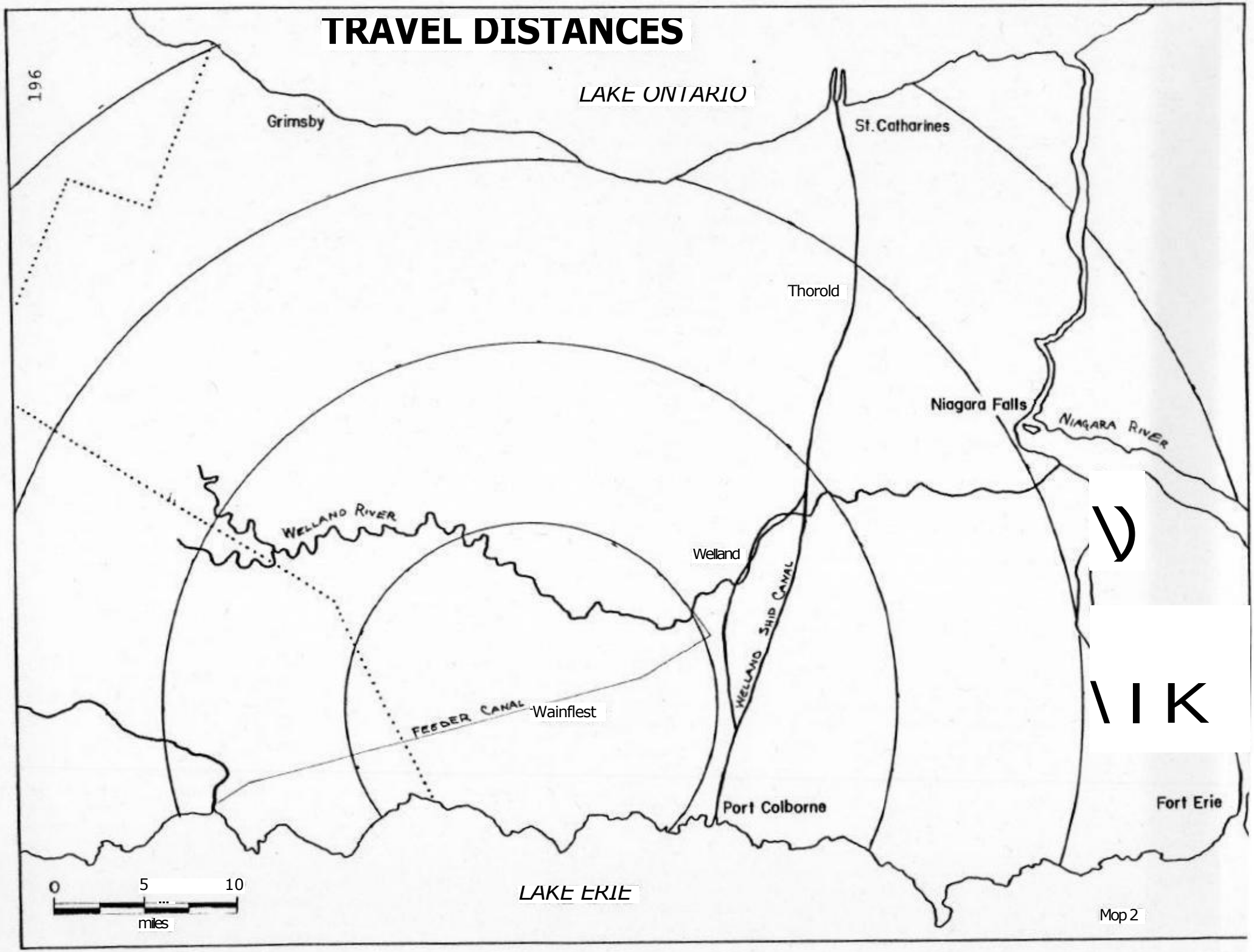
PH at Lab	Total Iron MG/L	Phenols UG/L	Organic CasC MG/L
7.88	0.24	1.0L	7.0
7.82	0.770	2.0	6.0

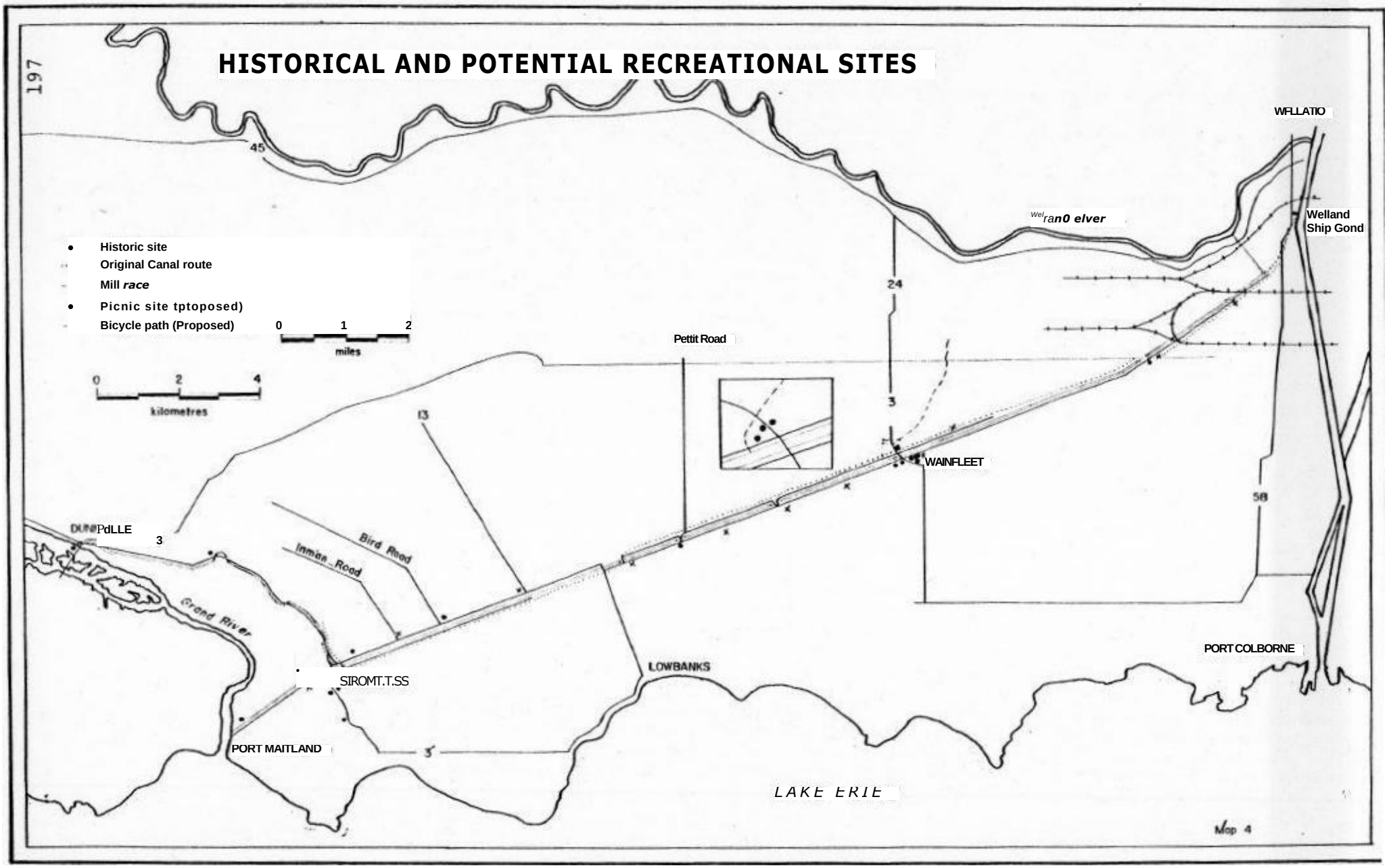
Ministry of the Environment


REGIONAL LOCATION
TORONTO
LAKE ONTARIO
Guelph
Waterloo
Kitchener
..... Welland Canal Feeder
0 16 30
kilometres
0 10 20
miles
HAMILTON
St.Catharines
Niagara-on the-Lake
'Brantford
Thorold.
/Niagara Fall!
NiagaraFalls N.Y.
London
Welland
BUFFALO
Dunnville
Port Dover
Port Colborne
Fort Erie
LAKE ERIE
Map1

ACCESSIBILITY



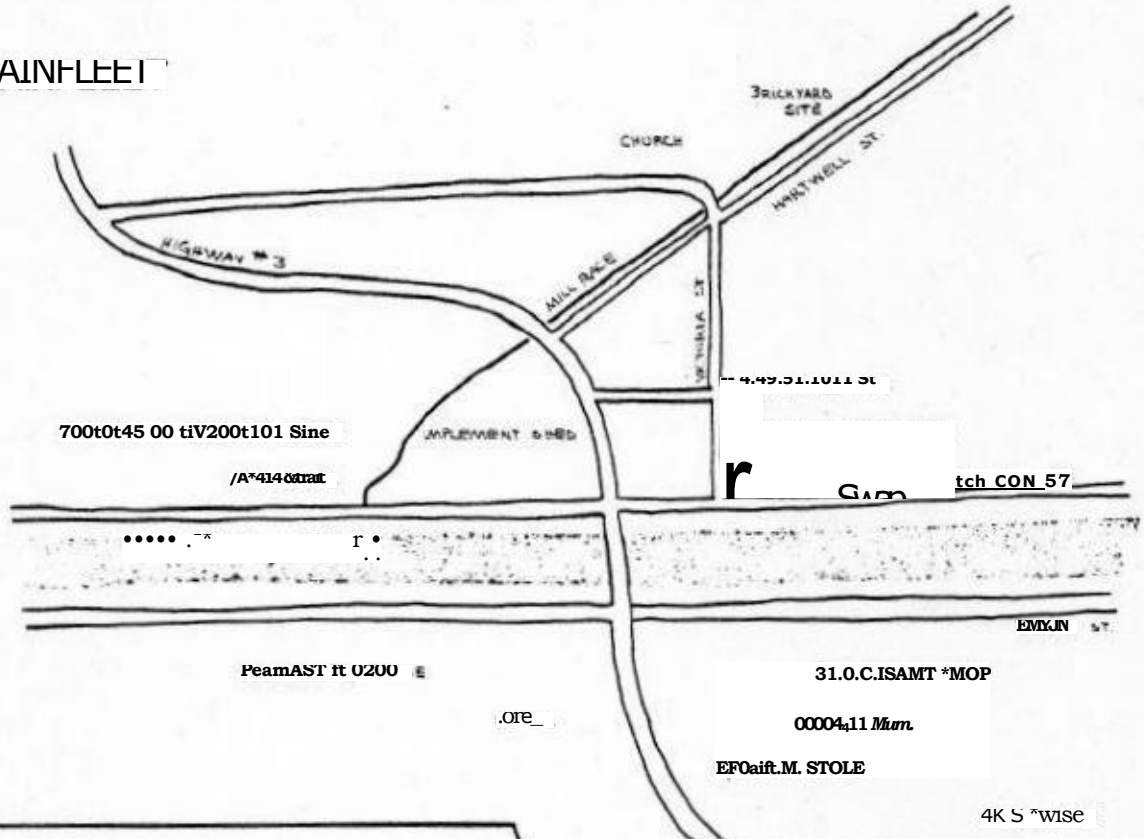

TRAVEL DISTANCES
196
LAKE ONTARIO
Grimsby
St. Catharines
Thorold
Niagara Falls
NIAGARA RIVER
WELLAND RIVER
Welland
WELLAND SHIP CANAL
FEEDER CANAL
Wainflest
Port Colborne
Fort Erie
LAKE ERIE
0
5
10
miles
Mop 2


HISTORICAL AND POTENTIAL RECREATIONAL SITES
197
WELLATIO
45
Welland
Ship Gond
24
Historic site
Original Canal route
Mill race
Picnic site tptoposed)
Bicycle path (Proposed)
0 1 2
miles
0 2 4
kilometres
Pettit Road
3
13
WAINFLEET
58
Bird Road
Grand River
LOWBANKS
PORT COLBORNE
SIROMT.T.SS
PORT MAITLAND
LAKE ERIE
Map 4

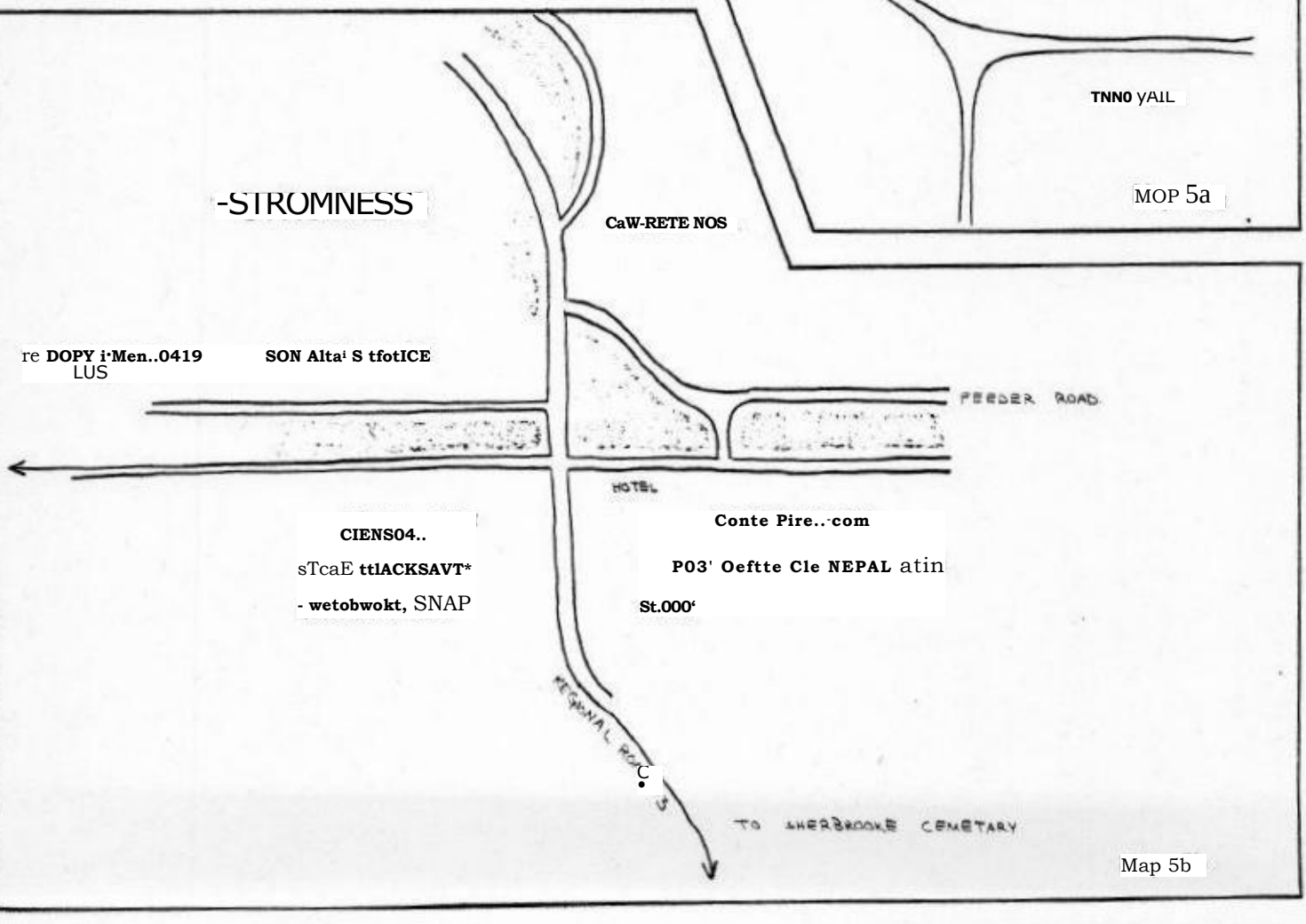
POTENTIAL HERITAGE CONSERVATION DISTRICTS

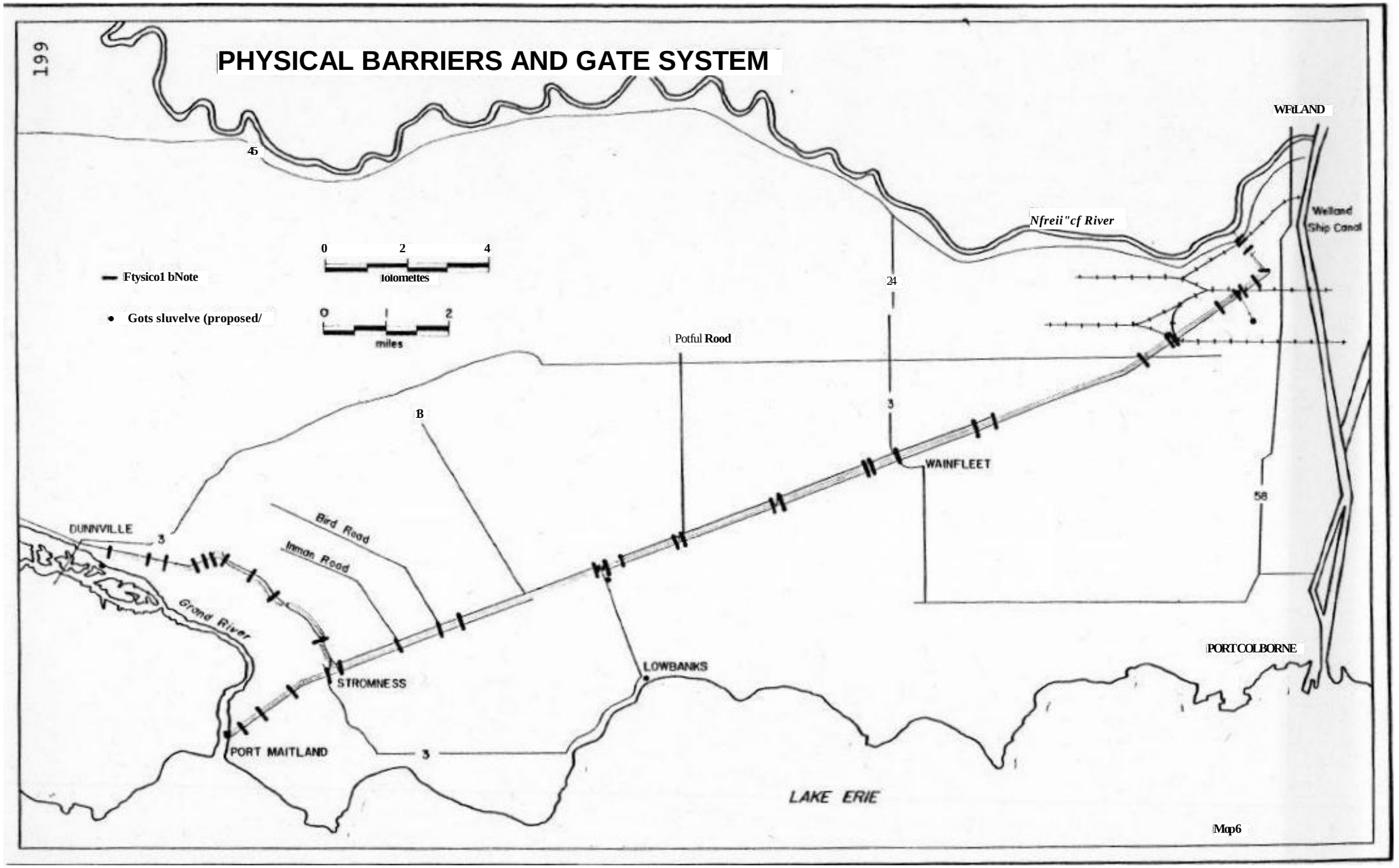
19R

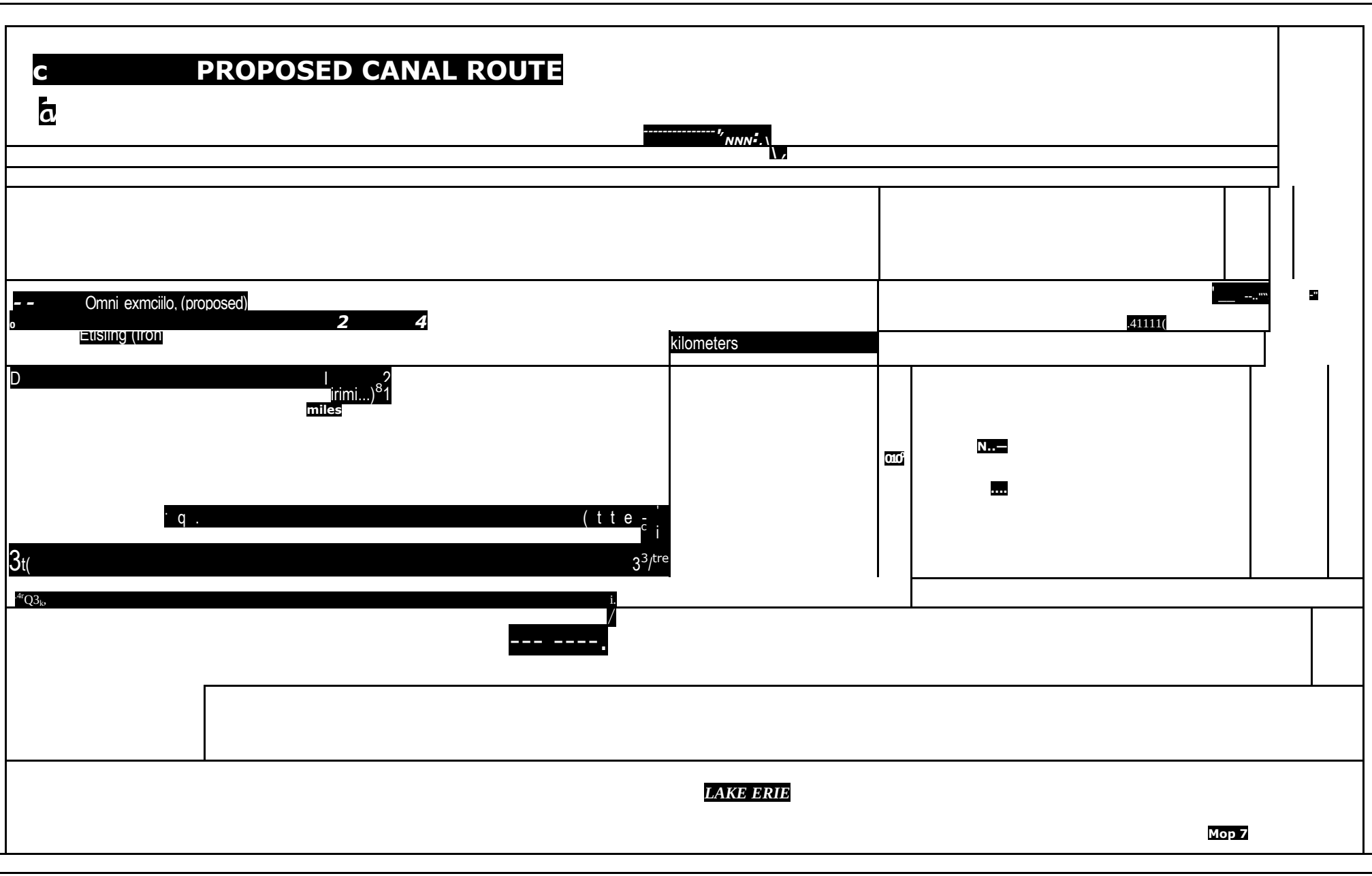
-WAINFLEET



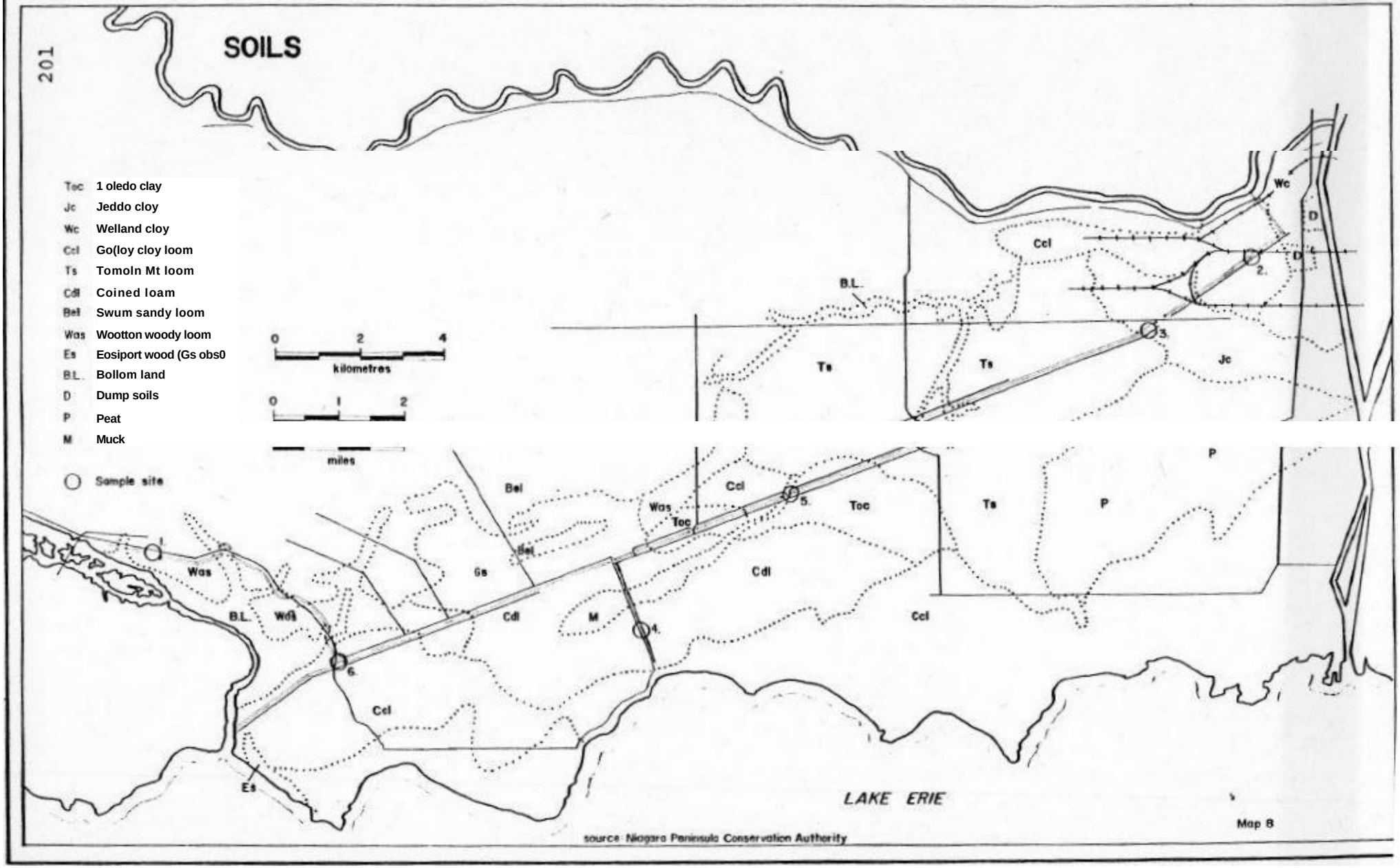
-STROMNESS




199
PHYSICAL BARRIERS AND GATE SYSTEM
WFtLAND
45
Nfreii"cf River
Welland
Ship Canal
0 2 4
Ftysico1 bNote
Gots sluvelve (proposed/
0 1 2
miles
24
Potful Rood
B
3
WAINFLEET
58
DUNNVILLE
3
Bird Road
Inman Road
Grand River
STROMNESS
LOWBANKS
PORT COLBORNE
PORT MAITLAND
3
LAKE ERIE
Mop6

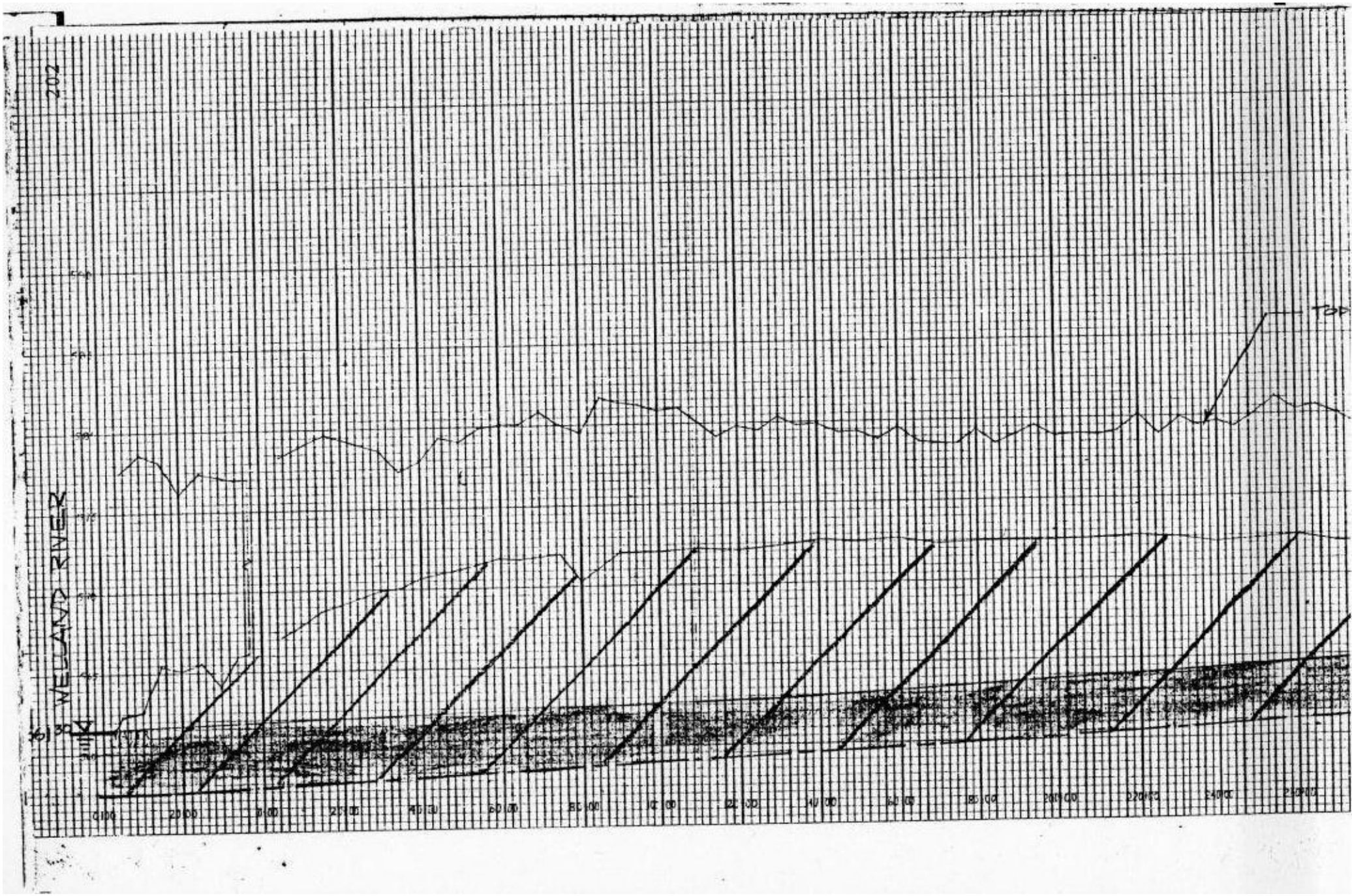

PROPOSED CANAL ROUTE
Omni exmciilo, (proposed)
Etisling (iron
kilometers
miles
LAKE ERIE
Mop 7

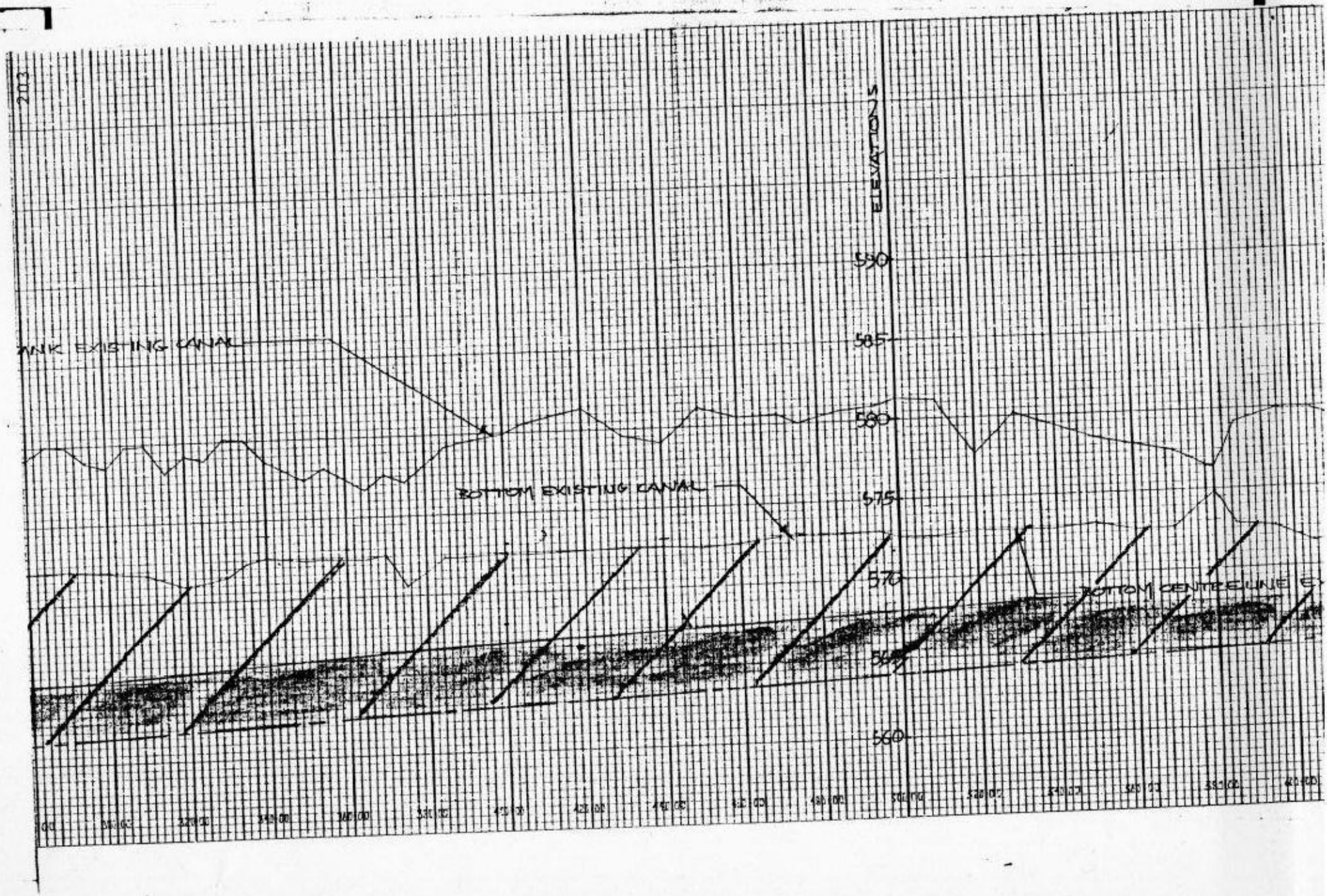
SOILS



source Niagara Peninsula Conservation Authority

Map 8


202
WELLAND RIVER
TOP


203
ELEVATIONS
590
585
580
575
570
560
TOP EXISTING CANAL
BOTTOM EXISTING CANAL
BOTTOM CENTRELINE