

As shown from Pleasant Street crosswalk



EXHIBIT 1 - WELCOME TO THE DARTMOUTH INCLINED PLANE AT THE SHUBENACADIE CANAL GREENWAY

INTERPRETIVE METHOD:

- Large Main Entrance Sign with a branded sign component at the top section
- Two interpretive panels on either side of the lower section of the structure (Side A and Side B)
- Located at the Prince Albert Road Entrance to the Shubenacadie Canal Greenway site

INTERPRETIVE THEME(S):

A "Welcome Message" (on Side A) and a "Site Overview" (on Side B).

CONTENT OUTLINE:

Side A

Side A will convey the overall welcome message on a large interpretive panel facing the road. The site upon which you are now standing is called the Dartmouth Inclined Plane. The Shubenacadie Canal Waterway and Marine Railway was an important and innovative section of the one of the largest and most ambitious feats of engineering ever undertaken in Nova Scotia, until the coming of the railway in the 1870s. The Shubenacadie Canal Waterway stretched an impressive 114 km across Nova Scotia's interior and carried goods and people between Halifax Harbour / Downtown Dartmouth and the Bay of Fundy between 1856 and 1871. All movement on the waterway was powered by water and machinery working together. Sadly, this engineering wonder became obsolete when the government built the new Railway. Although the Shubenacadie Canal and Marine Railway was a dream never fully realized, it changed the face of Dartmouth in terms of its people, culture, architecture, and the recreational opportunities we enjoy today.

Side B

Side B will also have an angled panel and will communicate that to visitors the Shubie basics i.e.: canal, lock, inclined plane, and marine railway and how they all worked. Icons, images and illustrations will accompany the text.

- What is a Canal?
- What is a Lock and How does it work?
- What is an Inclined Plane?
- What is a Marine Railway?
- Explore More! Visit the Fairbanks Centre

DESIGN COSTS

\$3,000 + HST

FABRICATION / INSTALL COSTS

\$18,000 + HST



EXHIBIT 2 - PEOPLE AND THE SHUBENACADIE WATERWAY

INTERPETIVE METHOD:

One (1) angled free-standing interpretive panel. Supports reflect design of Flume Headrace.

INTERPRETIVE THEME(S):

People used the waterway as a main water highway thousands of years before the canal, its locks, or inclined planes were built.

CONTENT OUTLINE:

The Ice Age

The end of the last Ice Age over 12,000 years ago, and the retreat of a glacier that covered much of Nova Scotia, helped carve out the Shubenacadie watershed of river, streams and lakes that we know today.

The Mi'kmaq

The Mi'kmaq used the Shubenacadie Waterway as a main highway from summer camps along the shores and islands of Halifax to winter camps in Nova Scotia's wooded interior for at least four thousand years. They traveled in birch bark canoes.

Early European Settlement

- Early Europeans such as the French and Acadians settled along the river with the help of the Mi'kmaq
- Sainte-Anne Mission and Ville de Hébert

British Founding of Halifax

- British Founding of Halifax in 1749
- Growth of commerce and merchants
- Early interest in building a canal on the Shubenacadie River

DESIGN COSTS

\$2,500 + HST

FABRICATION / INSTALL COSTS

\$6,000 + HST



EXHIBIT 5 - THE DARTMOUTH INCLINED PLANE: AT-A-GLANCE

INTERPETIVE METHOD:

One (1) large interpretive panel, mounted to exterior rear, west side the flume house.

INTERPRETIVE THEME(S):

The basic structure of the Dartmouth Inclined Plane is pretty much a straight line running from Halifax Harbour and all the way to the head of Sullivan's Pond. This large graphic panel will show a plan view and cross section (from the harbor to Sullivan's) of the inclined plane as it would have been in the 1860s. Visitors will clearly see the straight line of the incline plane from the harbor to Sullivan's Pond. The section view will reveal that the marine railway carried barges approximately 3000' from point A to point B. It will also be interesting to see that Sullivan's Pond is 55' above the Harbour. This panel will obviously introduce the flume house and the power it needed to generate. Include distances, elevations, and fixed features or landmarks to give perspective of where they are in relation to the inclined plane, including a "you are here" icon. To provide a larger perspective of the inclined plane in relation to where it is on the 114 km Shubenacadie Canal Waterway, a smaller inset map will show a map of the rest of the canal waterway from Lake Banook, to Maitland area. Also the inclined plane at Portobello, near Waverley should be indicated. Explore More! Visit the Fairbanks Centre will also be presented as a call to action.

CONTENT OUTLINE:

- The Dartmouth Inclined Plane is the starting point of the entire 114 km Shubenacadie Canal Waterway.
- It runs almost a straight line between Dartmouth Cove, where King's Wharf is today, and the entrance to Sullivan's Duck Pond.
- A "You are Here" Icon shows where you are situated along the inclined plane and how far are you from: Sullivan's Pond, King's Wharf, The Alderney Centre and Mill River
- Look up and down the inclined plane. What can you see?

The following items will be featured and explained in detail:

Marine Boat Cradle

- Built out of wood, the marine cradle was transported up and down the inclined plane on wheels riding on iron rails and hauled by a cable which it was attached
- In order to help with loading and unloading the boats, the rails extended down into the bottom of the canal at both ends of the plane.

Cable and Pulley System

- Think of a big clothesline that ran from Sullivan's Duck Pond, through the flume house, and all the way down into Halifax Harbour.
- The two-inch diameter wrought iron cable formed a loop traveling on idler pulleys from the cable winding drum in the flume house to sheave wheels located under and above water.
- Traverse pulleys got larger in size going up the inclined plane, and smaller in size as they went down the plane.
- As the cable drum turned, it pulled the cable and moved the marine cradle, hauling the canal boats up and down the inclined plane.



One (1) large interpretive panel, mounted to exterior rear, west side the flume house.

Sheave Wheels

- A 12-foot groove or sheave wheel was laid / anchored horizontally underwater to an anchor cable / pulley system at both ends of the inclined plane
- Interpretive reproductions are located at Alderney Centre and Sullivan's
- One of the horizontal pulleys is rumored to be buried in Shubie Park

Flume House

- An Archaeological dig uncovered the stone foundation of the flume house. Underneath, in the chamber, is the reaction turbine that powered the plane.

Flume Headrace

- An 8' x 5' wooden trough extended from the Flume House to Sullivan's Pond. It was supported by heavy timbers.

Penstock Shaft

- Water from flume headrace dropped into this metal and wooden valve which activated the turbine.

Turbine (Reaction Turbine)

- This huge turbine that once powered the plane, almost completely filled the chamber.
- The pressure created made water to surge out the four nozzles to activate a shaft that turned the large cable winding drum.
- There's supposedly only four reaction turbines in the world, and one of them is here, under the flume house in the turbine chamber below.

Cable Winding Drum

- This large drum was located in flume house on the ground floor. It turned the cable back and forth to haul vessels as heavy as 100 tons, up and down the inclined plane.

Tub Valve

- A worker, called a plane tender, pulled a lever from the second floor of the Flume House to let water from Sullivan's Pond surge into the flume house from the flume headrace.

Tail Race and Wall

- This is located directly down the hill from the flume house, the stone-lined tail race ran parallel with the inclined plane.
- It carried the water from turbine chamber returning it to the stream and subsequently, Halifax Harbour.

DESIGN COSTS

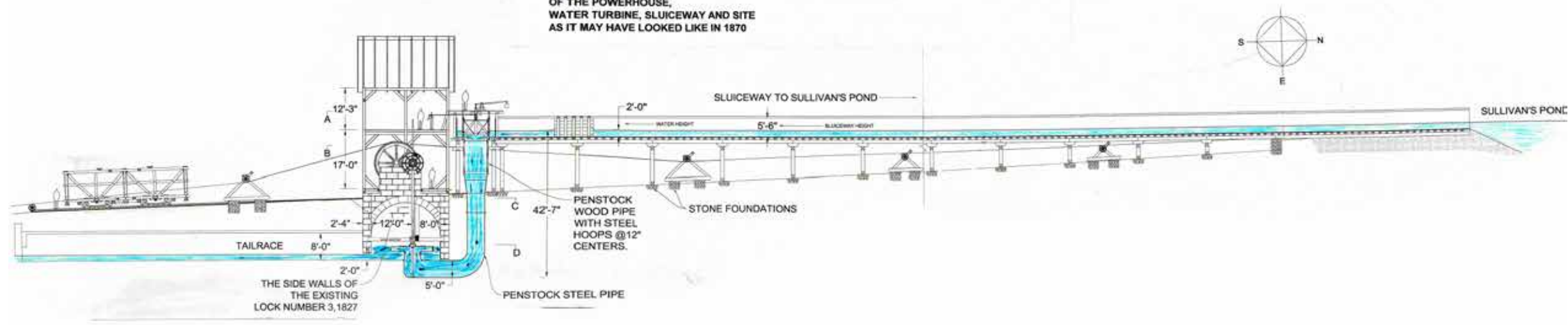
\$9,500 + HST

FABRICATION / INSTALL COSTS

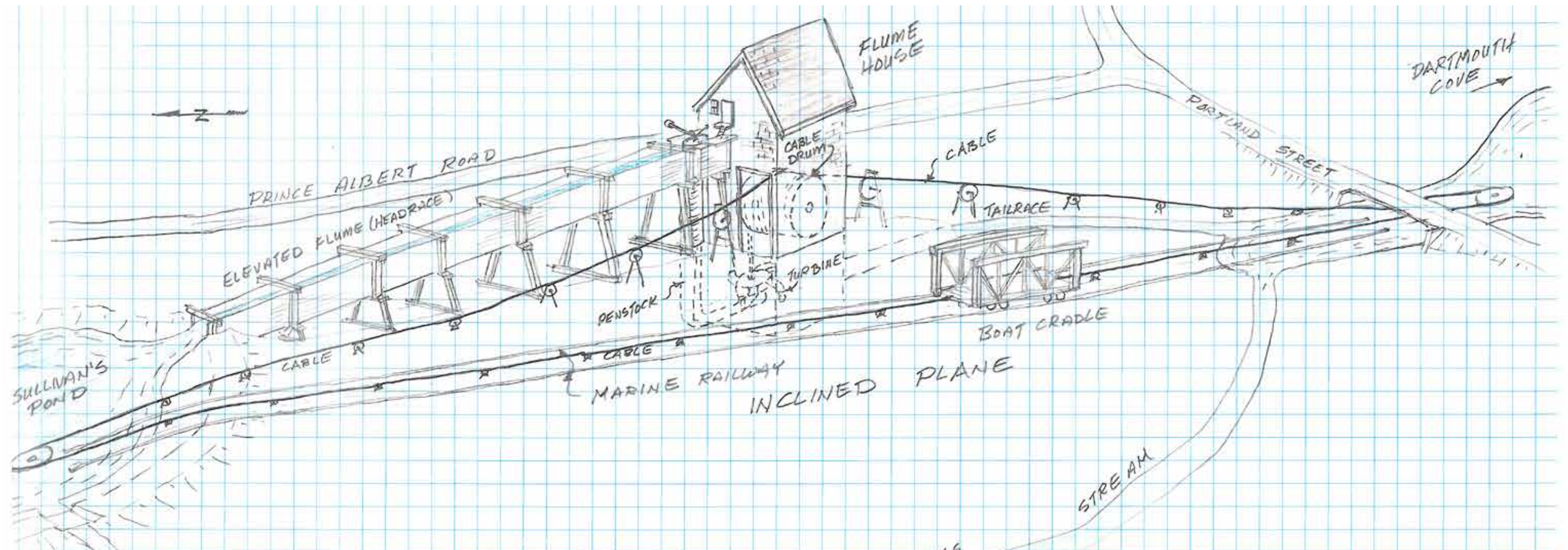
\$4,500 + HST

**MARINE RAILWAY BETWEEN DARTMOUTH COVE TO SULLIVAN'S POND
SHUBENACADIE CANAL COMPANY**

INTERPRETATION DRAWINGS
OF THE POWERHOUSE,
WATER TURBINE, SLUICeway AND SITE
AS IT MAY HAVE LOOKED LIKE IN 1870



The panel will feature an illustration of the Dartmouth Inclined Plane, from Dartmouth Cove to Sullivan's Pond, as it would have looked in the 1860s. Buildings, structures and open water will be shown in the style of the Morris Canal full colour illustration. The artwork will be inspired from both the Morris Canal Drawings and Figure1: Inclined Plane Perspective from Doug Brownrigg. The huge drawing will really demonstrate the sheer scale of the project and how it worked. It must have been a sight to behold.



THE INCLINED PLANE

To help the canal climb over the New Jersey Highlands on its way from Phillipsburg to Jersey City, the Morris Canal & Banking Company developed inclined planes to raise and lower its canal boats up to 100 feet at a time. Built in the 1830s and redesigned in the 1850s, these huge machines were up to 1,400 feet long and capable of moving boats loaded with 70 tons of cargo from one canal level to the next. The canal used 23 of these inclined planes and 23 lift locks to overcome an elevation change of almost 1,700 feet, an unbroken world record. After years of service, the canal was abandoned in 1923 and much of its infrastructure was dismantled. However, at Inclined Plane 9 West the plane tender's house, turbine chamber and tailrace tunnel are still in place making this site one of the best remaining examples of these engineering marvels.

1 The Power House

The stone foundation of the power house is still intact with its opening covered with iron bars. You can see the reaction turbine that once powered the plane still in place in the chamber below. Nearby are assembled pieces of the penstock and parts of the machinery. Across the driveway is the plane itself marked by a double row of sleeper stones. A modern reconstruction shows how the plane rails were supported on heavy wooden timbers that provided a flexible cushion between the rail and the sleeper stones.

2 The Tailrace

Downhill from the power house is the iron arch that frames the end of the tailrace tunnel. Here, used water from the turbine chamber and water from the bypass flume joined to flow down the tailrace channel and into the lower level of the canal at the bottom of the plane. When tours are being offered, it is possible to walk up the tailrace tunnel and into the turbine chamber. The

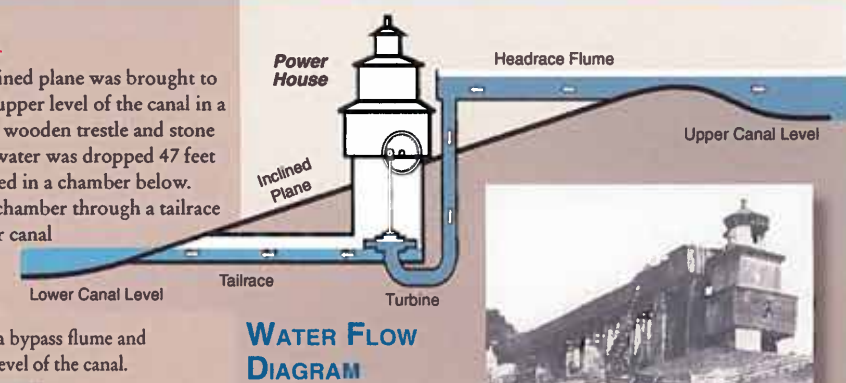
huge reaction turbine that once powered the plane almost completely fills the room. When the plane tender opened the tub valve above, the pressure of thousands of tons of water would send the head of the turbine spinning at about 60 revolutions per minute. Water from the turbine's four nozzles would fill the chamber and send a river surging down the tailrace tunnel.

3 The Plane Summit

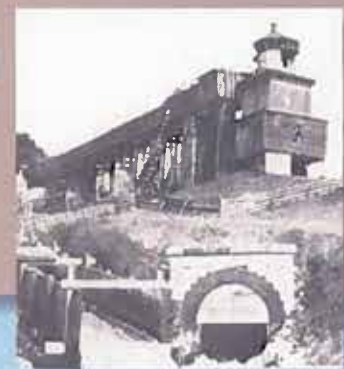
At the top of the plane the summit acted as a dam to contain the water in the upper level of the canal and divert it into the headrace flume. A double set of tracks came up the plane, over the summit and back down into the water. The 90-foot-long canal boats and cradle cars were built in two hinged sections that could flex as they crossed the summit of the plane. Plane 9 West's double set of tracks and two cradle cars, allowed boats to go up and down the plane at the same time.

THE WATER

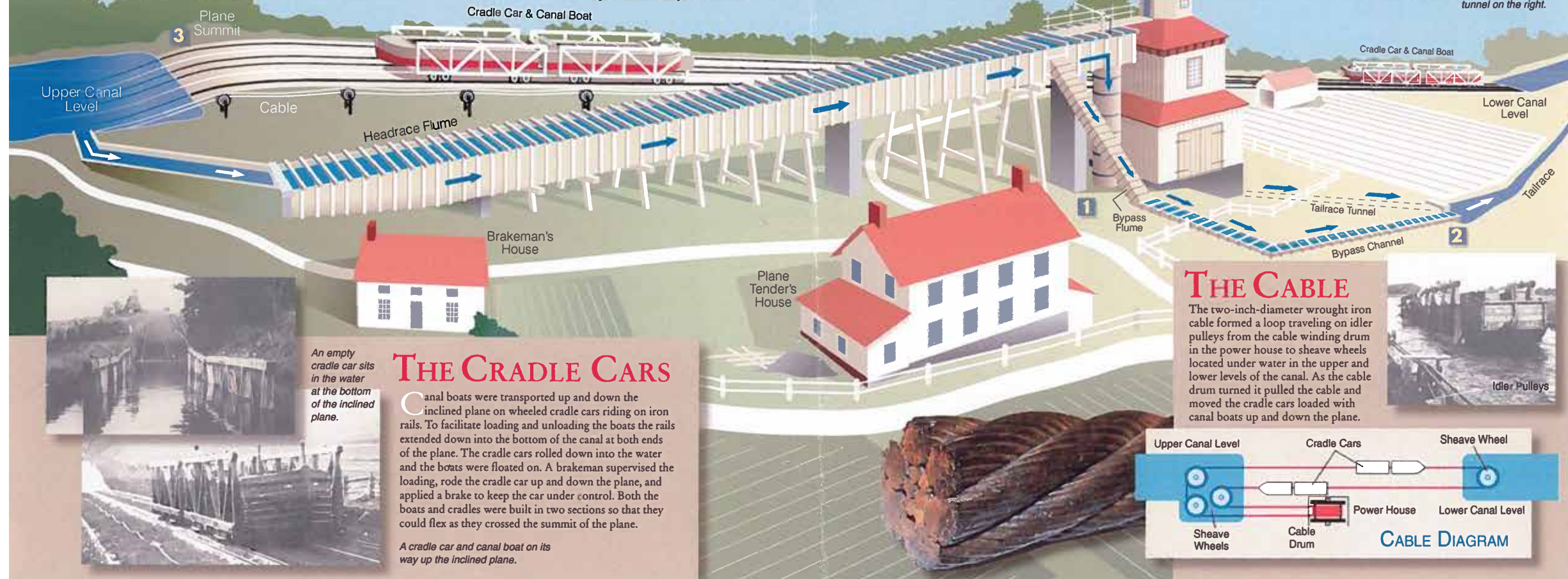
The water to power the inclined plane was brought to the powerhouse from the upper level of the canal in a headrace flume supported on a wooden trestle and stone piers. At the power house the water was dropped 47 feet to turn a reaction turbine located in a chamber below. Used water exited the turbine chamber through a tailrace tunnel and flows into the lower canal level to be used to power the next inclined plane. When the inclined plane was not in operation, water was routed through a bypass flume and channeled directly to the lower level of the canal.



The headrace flume, measuring eight feet wide by five feet deep, brought water from the upper level of the canal to the power house.



The Plane 9 West power house is seen above, while below water flows from the bypass trough on the left and the tailrace tunnel on the right.



An empty cradle car sits in the water at the bottom of the inclined plane.

THE CRADLE CARS

Canal boats were transported up and down the inclined plane on wheeled cradle cars riding on iron rails. To facilitate loading and unloading the boats the rails extended down into the bottom of the canal at both ends of the plane. The cradle cars rolled down into the water and the boats were floated on. A brakeman supervised the loading, rode the cradle car up and down the plane, and applied a brake to keep the car under control. Both the boats and cradles were built in two sections so that they could flex as they crossed the summit of the plane.

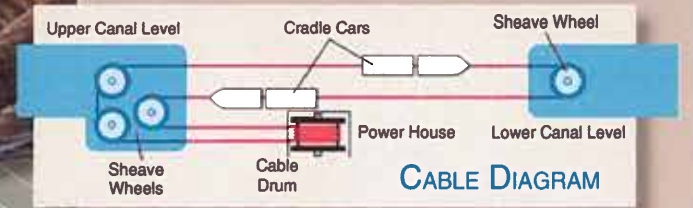
A cradle car and canal boat on its way up the inclined plane.

THE CABLE

The two-inch-diameter wrought iron cable formed a loop traveling on idler pulleys from the cable winding drum in the power house to sheave wheels located under water in the upper and lower levels of the canal. As the cable drum turned it pulled the cable and moved the cradle cars loaded with canal boats up and down the plane.



Idler Pulleys



9. THE FLUME HOUSE

INTERPRETIVE METHOD:

Interpretive text and illustrations applied to the interior glass, large south window of the flume house and visible from the exterior.

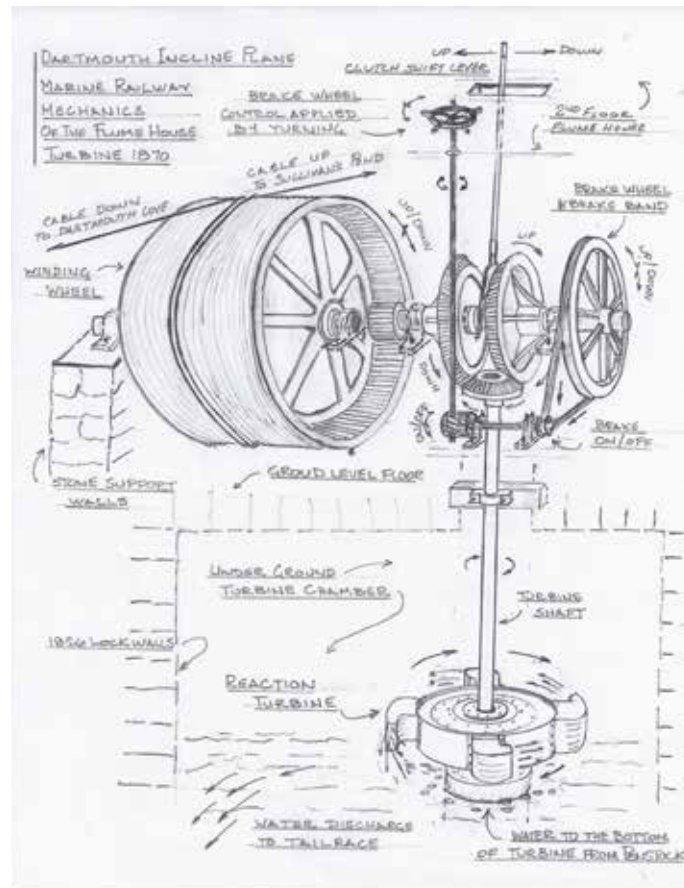
INTERPRETIVE THEME(S):

The flume house was the center of operations and power for the inclined plane. Our flume house is built directly on top of the turbine chamber and on top of the actual stone foundation of the original flume house that was here in the mid-nineteenth century. This flume house also sits directly on top of the original stone lock that was built here between 1826 and 1831. Look inside the flume house and you will see these stone walls.

CONTENT OUTLINE:

Interpretive overview / walkthrough of the structure, gears and inner workings

- Turbine Chamber / Turbine / Power shaft
- Cable Drum and gears (First Floor)
- The plane tender worked on the second floor where upon the breakman's signal he opened a tub valve that brought water from Sullivan's Pond down a trough like structure called the headrace flume
- Feature an illustration of the second floor / workings of the Flume House



DESIGN COSTS
\$9,500 + HST

FABRICATION / INSTALL COSTS
\$1,400 + HST



11. ROUND AND ROUND: THE TURBINE

INTERPRETIVE METHOD:

Interpretive text and illustrations applied to plexi-glass panels mounted to the flume headrace structure surrounding the Penstock (north elevation of Flume House). Visitors stand in front of the structure and can see how water would rush overhead from Sullivan's Pond, down into the penstock and flume house.

Interactive Components

Feature a detailed illustration of the penstock and the turbine in action. Another illustration will show visitors that the 45' drop down into the ground would be nearly the same height (in terms of drop) as the adjacent condo building (is tall).

A small, interactive working water model of the turbine could be located on site for showing how fast the turbine rotated and how the water came out of each nozzle. This would require a hose and water source. Refer to the short video of the model at the Morris Canal.

INTERPRETIVE THEME(S):

After water from Sullivan's Pond rushed down the flume headrace and dropped 45 feet into the turbine chamber, the turbine went into action, creating forces great enough to haul marine the cradle car up and down the inclined plane. The turbine was also shared with the Starr Manufacturing Plant established in 1867. Look inside the flume house to see where the chamber and turbine are located.

CONTENT OUTLINE:

This column of surging water and the 45 foot drop into the penstock shaft, had a great enough force to activate the reaction turbine housed in the chamber directly below the flume house.

Tons of fast moving water from the penstock flooded the chamber and filled the turbine. There were four nozzles or jets positioned around the circumference of the turbine and water sprayed out of these jets, and against the walls of the chamber creating a rotational spin of 60 revolutions per minute! Think of a spinning lawn sprinkler, only much more powerful and faster.

The force from this powerful spin cycle moved the gear that ran up to the surface into a clutch. The clutch turned the cable drum that had thick cable wrapped around it, in the appropriate direction to move the canal boat up or down the inclined plane through a pulley system.

Tracks went into Sullivan's Pond, where the vessel was released from the cradle and sailed across the pond, and between two navigational beakers before approaching the lock at Lake Banook.



Did you know?

The turbine chamber was built inside an old lock from the incomplete canal construction of 1826. Two walls of this chamber are cut granite from the original canal system and lay directly under the flume house.

When the canal ceased operations in 1870, the Starr Manufacturing Plant (which had been on this site since 1867) expanded into the site and appropriated the inclined plane's turbine system to power the its machinery in its factory. Water power was converted through a series of gears and belts to the Starr factory on the surface.

This turbine found in this chamber is actually one that the Starr plant installed, replacing the original turbine the Dartmouth Inland Navigational Company had put in for the inclined plane. The Starr Plant relied on this turbine to power its plant before it changed over to electricity. This is one of only four reaction turbines known to exist in the World!

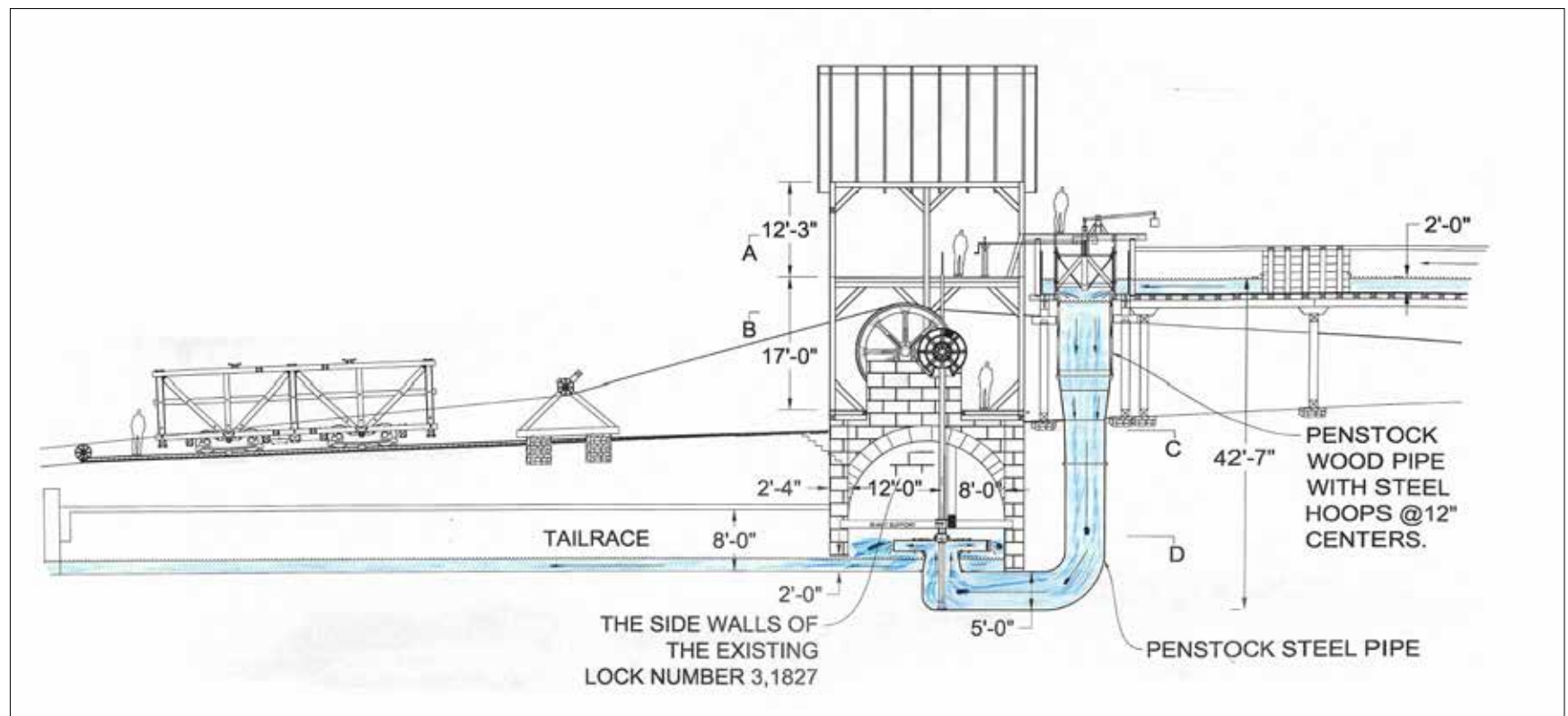
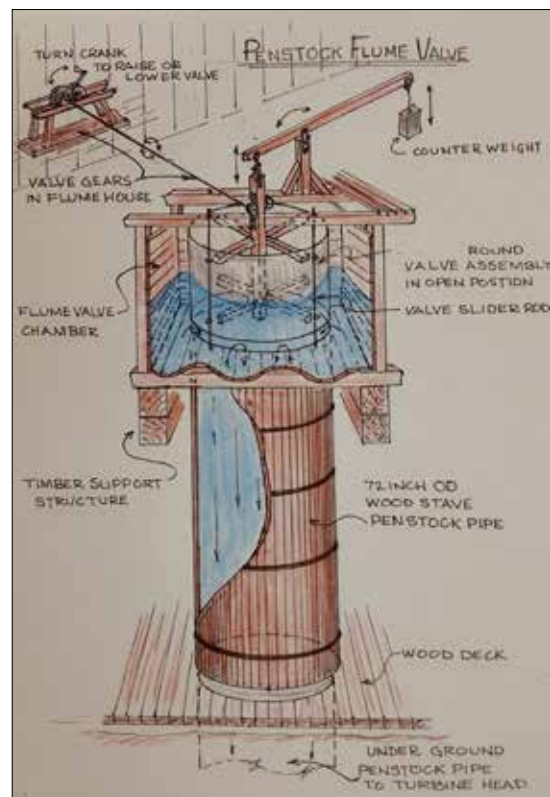
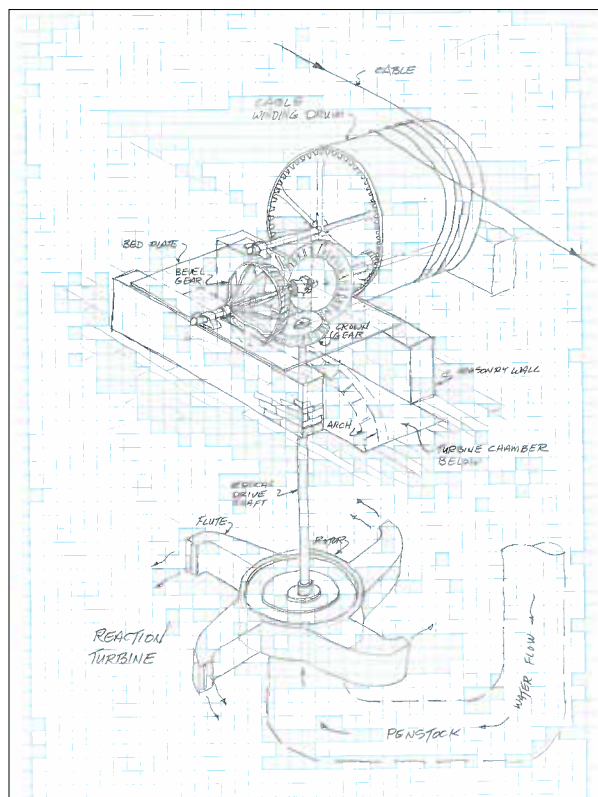


DESIGN COSTS
\$8,750 + HST

FABRICATION / INSTALL COSTS
\$6,400 + HST



Interpretive text and illustrations applied to plexi-glass panels mounted to the flume headrace structure surrounding the Penstock (north elevation of Flume House).



12. PULLING ITS WEIGHT: THE CABLE DRUM & PULLEY SYSTEM

INTERPETIVE METHOD:

Interpretive text and illustrations applied to the interior large glass north window of the flume house and visible from the exterior. Visitors can see all the gears working including the large cable drum.

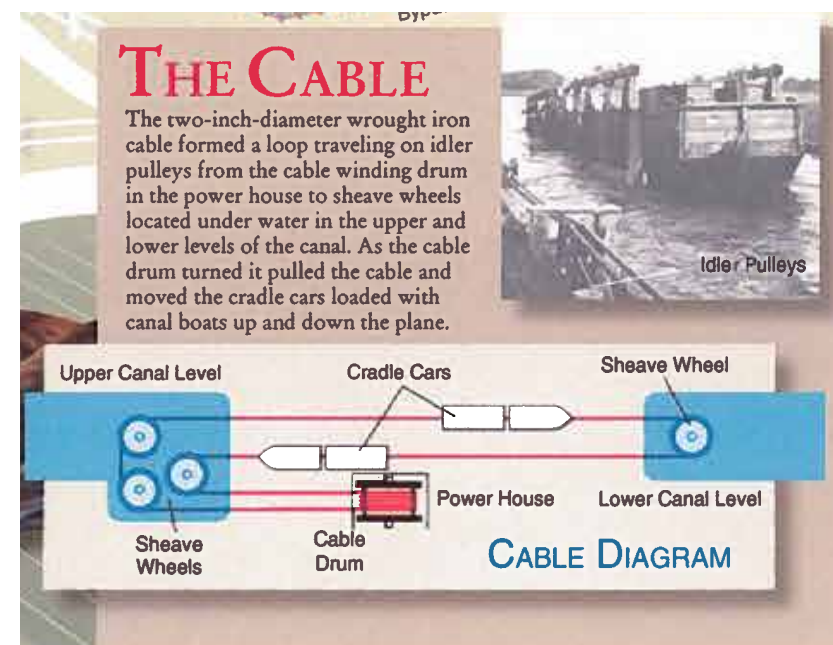
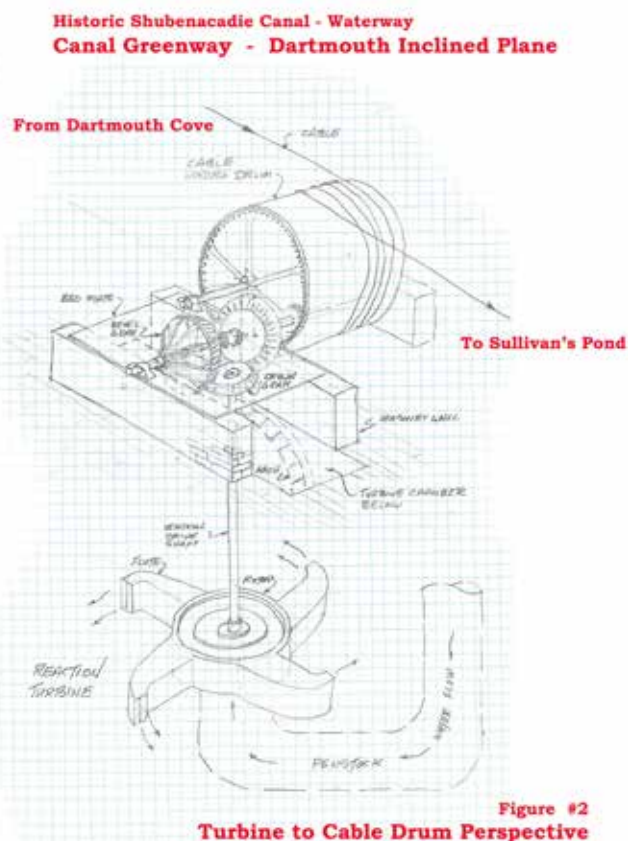
INTERPRETIVE THEME(S):

Powered by water from Sullivan's Pond rushing over the flume headrace and filling the turbine which activated the cable drum to turn the cable pulley system, was vital to the inclined plane. It moved the marine cradle car between 80 and 100 tons up and down the inclined plane.

CONTENT OUTLINE:

The two-inch diameter wrought iron cable formed a loop traveling on traverse pulleys from the cable winding drum in the flume house to the sheave wheels located under water in the lower and upper ends of the inclined plane. As the cable drum turned, it pulled the cable and moved the marine cradle car loaded with canal boats up and down the plane.

Note: Reference and use Cable Diagram from Morris Canal inset illustration.



Interpretive text and illustrations applied to the interior large glass north window of the flume house and visible from the exterior

DESIGN COSTS
\$6,000 + HST

FABRICATION / INSTALL COSTS
\$1,400 + HST

Exhibit Number	Exhibit Title	Design	Fabrication / Installation
1	Welcome / Gateways Entrance Sign	\$3,500.00	\$18,000.00
2	People / Waterway	\$3,000.00	\$6,000.00
5	The Inclined Plane	\$9,500.00	\$4,500.00
9	The Flume House	\$9,500.00	\$1,400.00
11	The Turbine	\$8,750.00	\$6,400.00
12	The Cable Drum / Pulley System	\$6,000.00	\$1,400.00
Copywriting	For All Exhibits	\$5,000.00	\$0.00
Shop Drawings	For All Exhibits	\$0.00	\$3,500.00
Design / Build Totals		\$45,250.00	\$41,200.00
Project Total		\$86,450.00	
Schedule:		Mar / April	April / May / June