A Simple Solution to Product Recovery

CN Yard in Smithers, British Columbia

Prepared by:
CANADIAN NATIONAL RAILWAY COMPANY
KEYSTONE ENVIRONMENTAL LTD.

Introduction

- Section 1 - Background
- Section 2 - Site Description
- Section 3 - 1997 to 2000 Product Recovery
- Section 4 - 2001 to 2003 Recovery Approach
- Section 5 - Benefits

Background

Steam Era (1913-1959)

- Area HQ for GTP
- Bunker C fueling of steam locomotives
- 12 stall roundhouse for locomotive servicing

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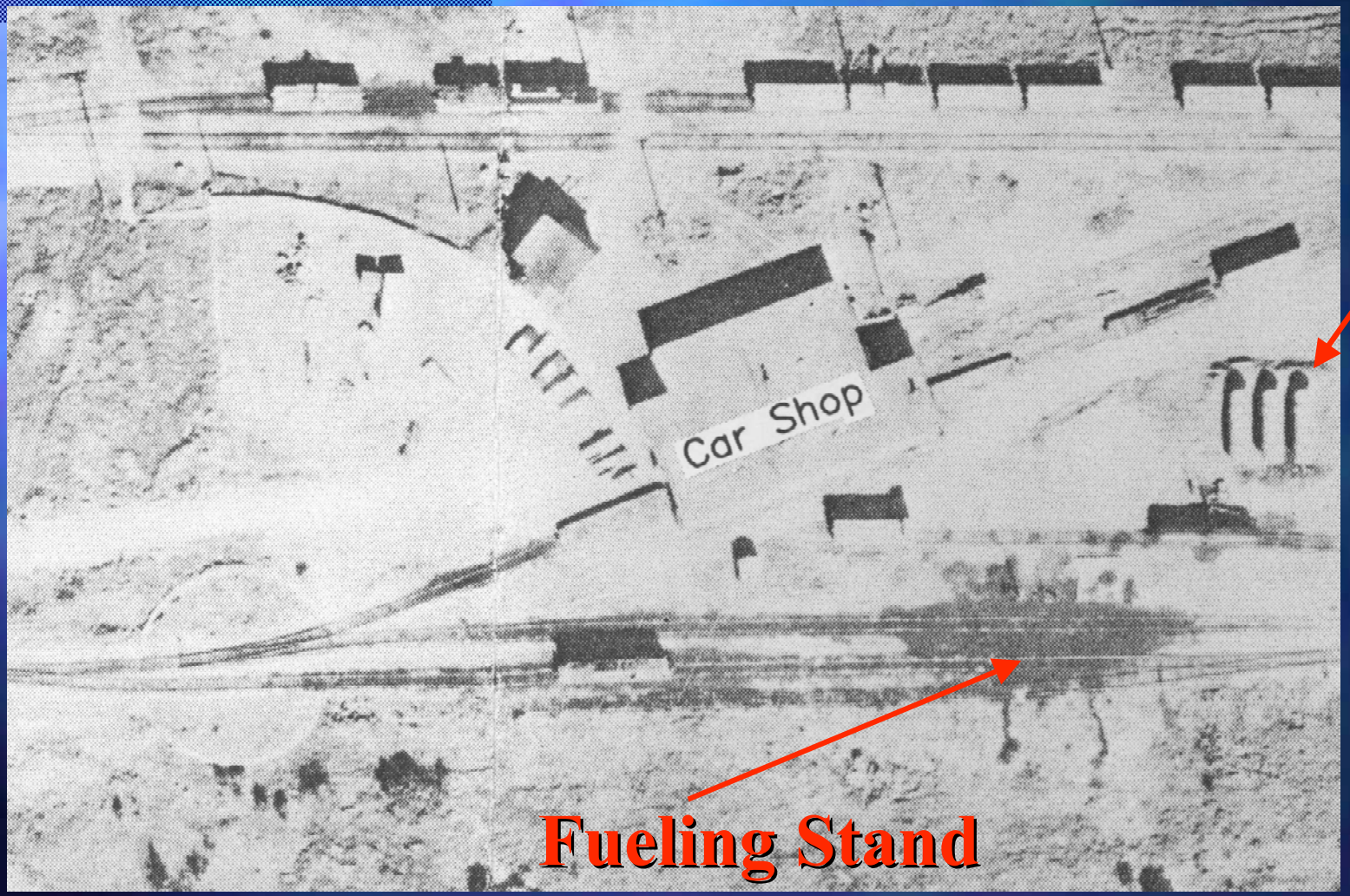
Fueling Stand (1996)

Background

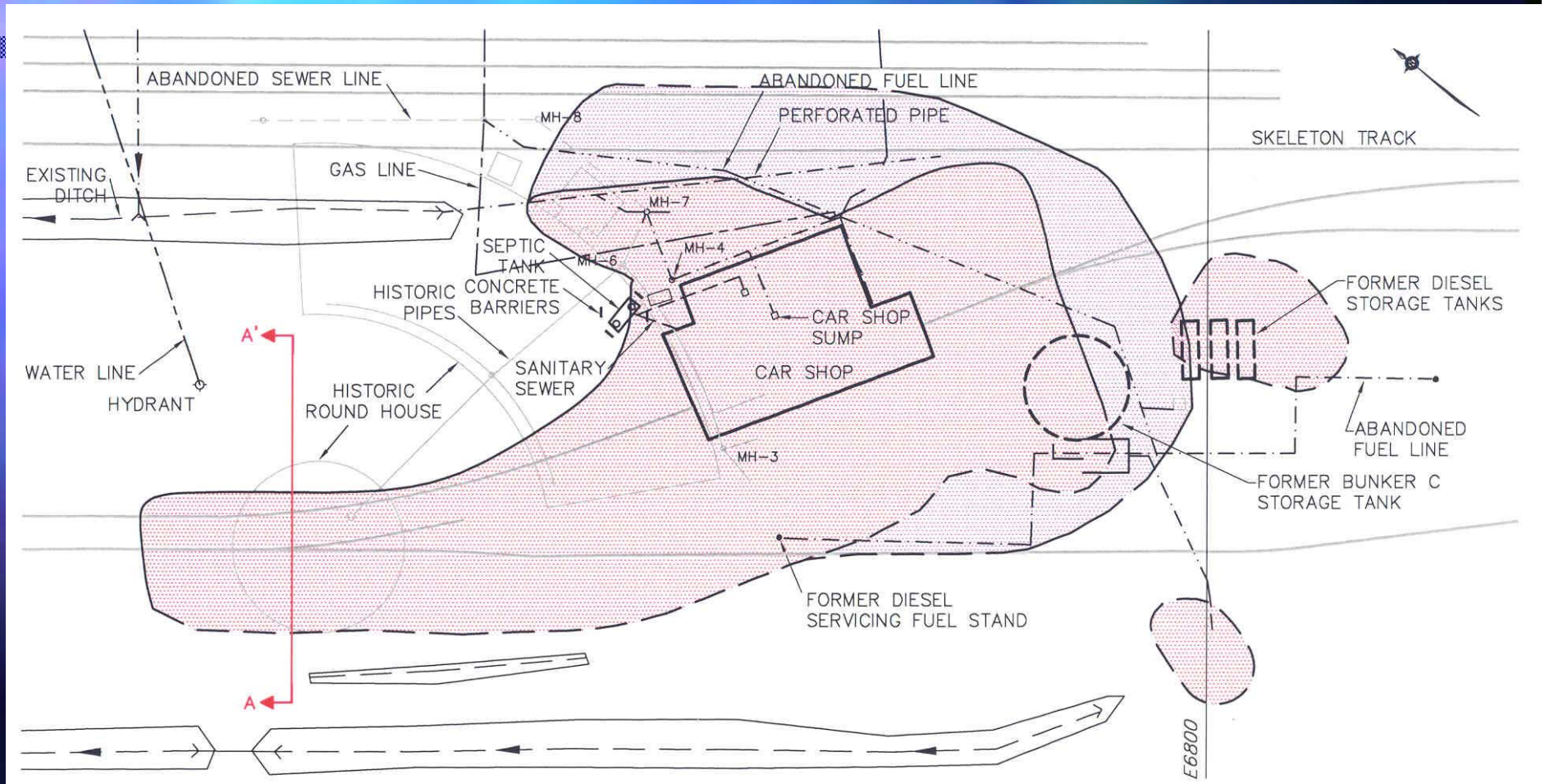
Dieselization (1955 - Present)

- Diesel fueling without containment until 1990.
- Fueling facility removed 1997
- Product plume of Bunker C and Diesel composition
- Area of plume 9000m^2

Air Photograph (1974)



Free product Plume



Site Description

Geology:

Three Distinct layers:

1. Upper sand and gravel fill
2. Middle clay confining layer
   - varies in thickness and elevation
   - undulating clay layer
3. Lower sand unit
   - confined by upper clay layer
   - artesian type aquifer

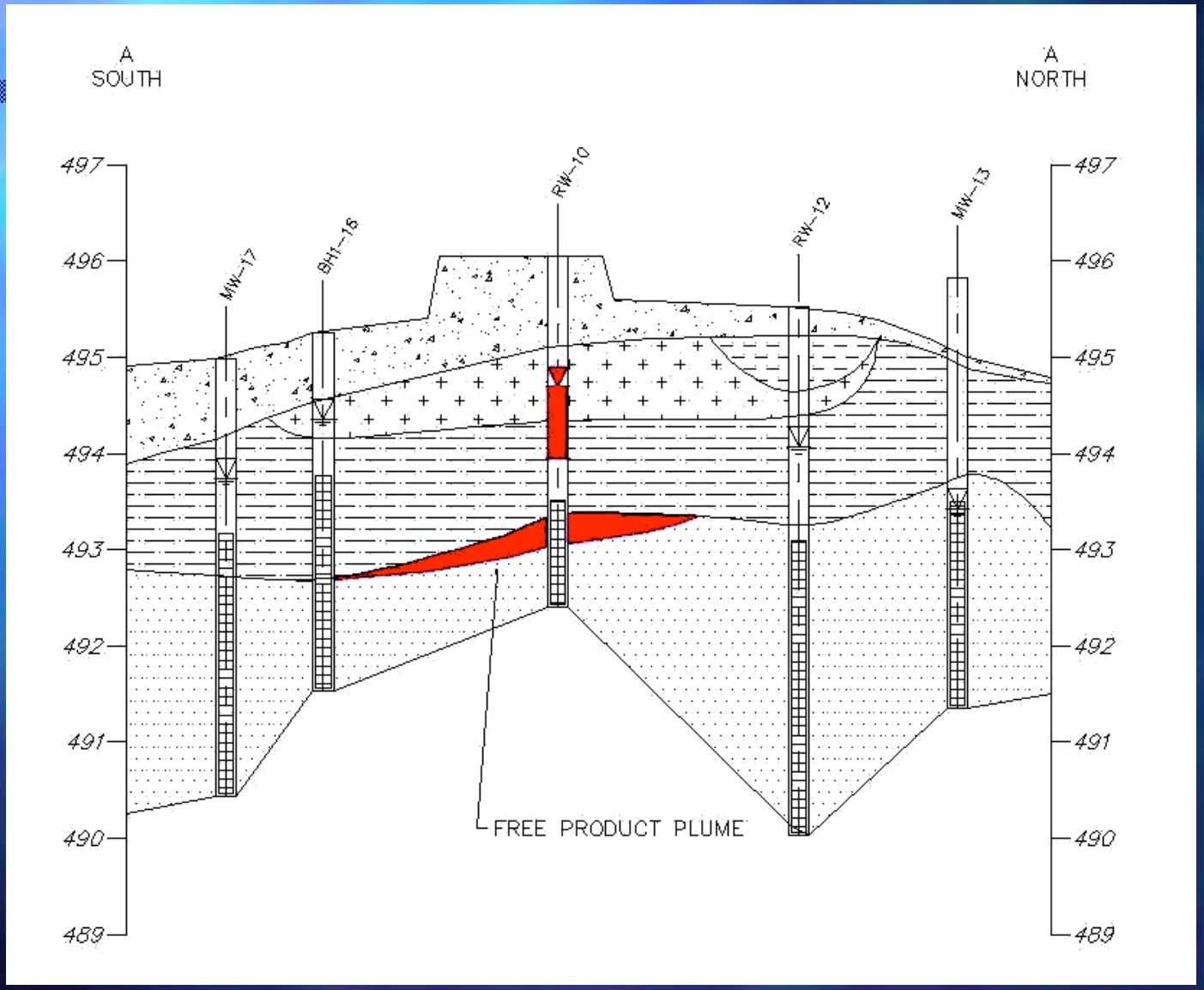
Site Description

Product Migration:

- Transported from surface through breaks within clay.
- Occurred during seasonal groundwater fluctuations.
- Forced upwards hydraulically by artesian aquifer.

Cross Section (Visual)

Site Cross Section (Schematic)

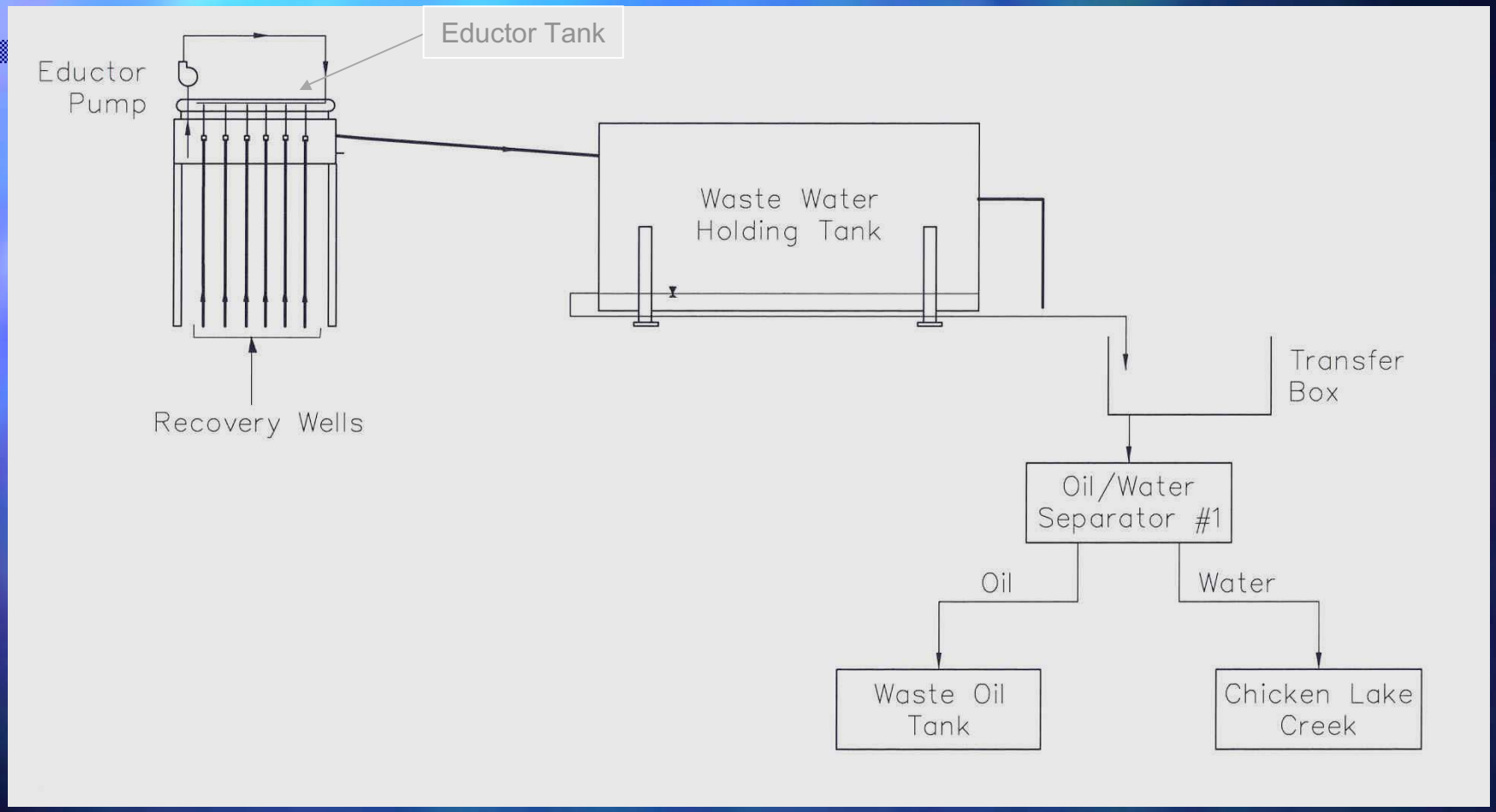


1997 to 2000 Product Recovery

Liquid Recovery System:

- Hydrocarbon skimmers installed in each well (19).
- Low vacuum induced on eductor to draw in product and groundwater from skimmers.
- Fluid sent through holding tank, transfer box, oil water separator
- Oil recovered for off site recycling
- Groundwater discharge to drainage ditches

System Schematic



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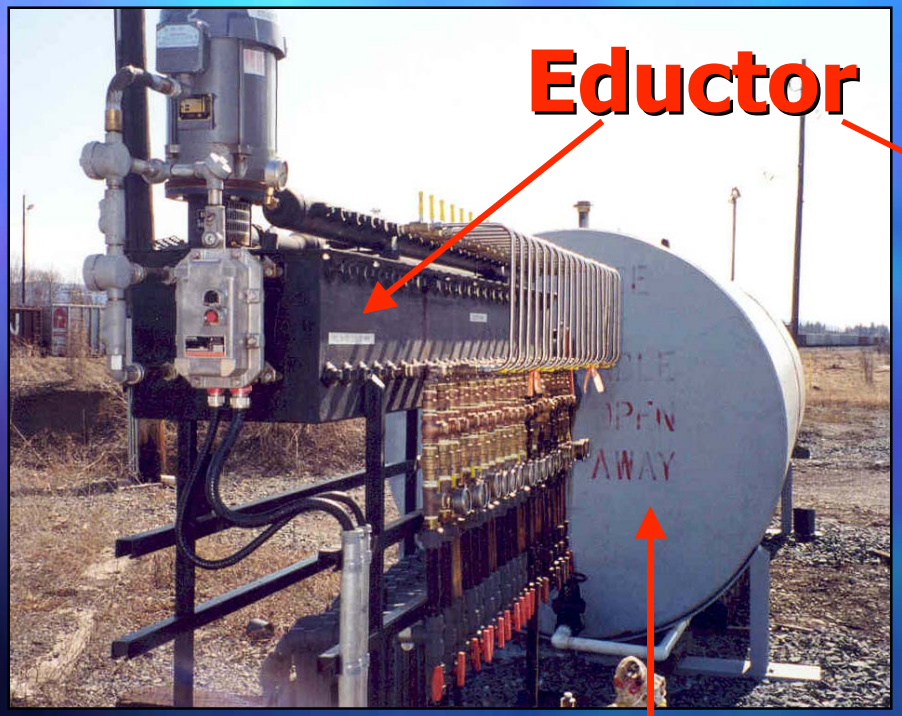
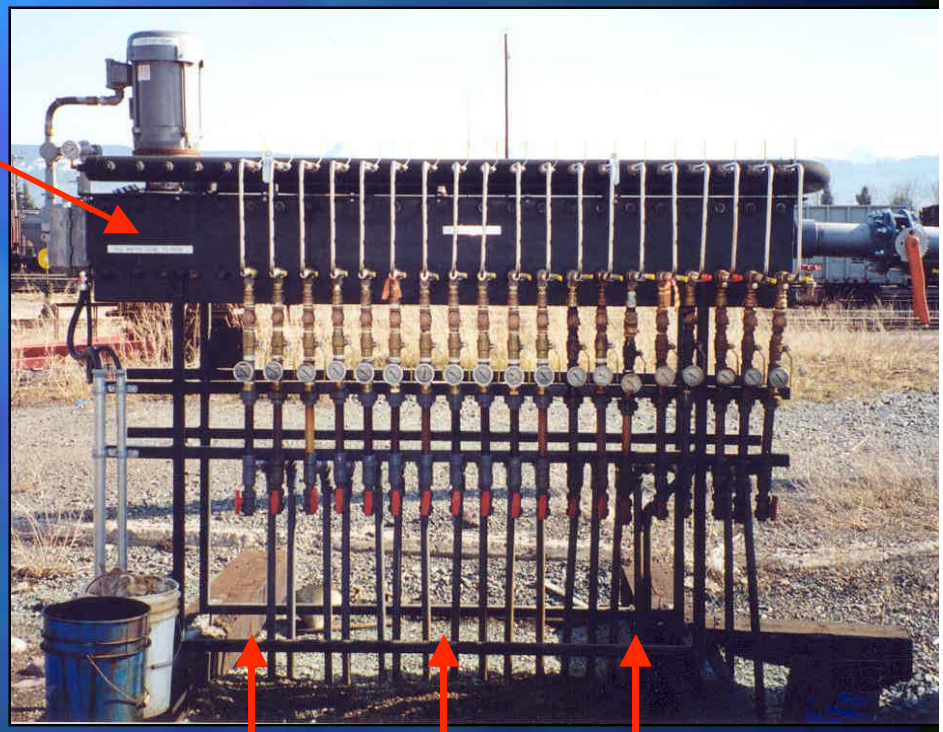
1997 to 2000 Product Recovery

Liquid Recovery System:





1997 to 2000 Product Recovery

System Deficiencies:

- Extreme heating of main product recovery system
- Formation of emulsions
  - elevated hydrocarbon concentration (TEH) in effluent.
- Low product recovery rates

1997 to 2000 Product Recovery

1999 Upgrades:

- Recycle line from holding tank to eductor tank
  - increase volume of water recirculated
  - reduce overall water temperature
- Oil skimmer installed in wastewater holding tank
- Cycle timer on pump to reduce introduction of air.
- Two new recovery wells

Eductor Product Recovery Rates

19971998199920001		(Litres)2650329523		

2001 to 2003 Recovery Approach

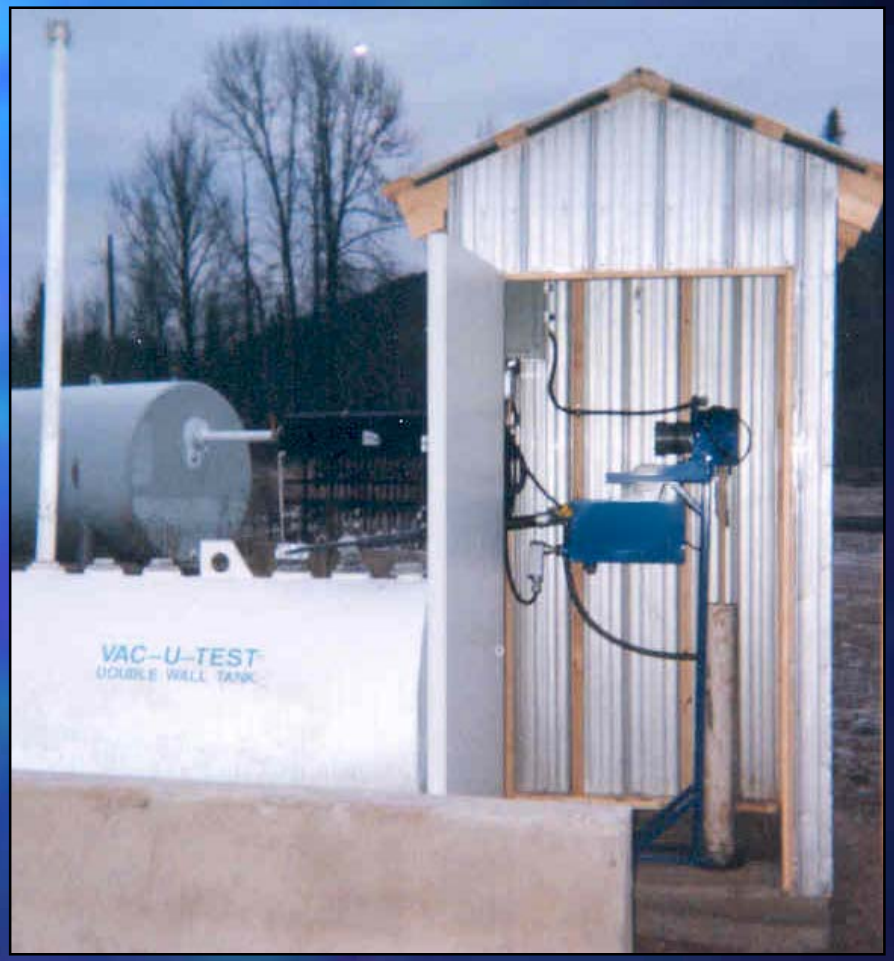
Objectives:

- Reduce the operation and maintenance costs
- Increase the product recovery
- Simplify operation and maintenance for operators

2001 to 2003 Recovery Approach

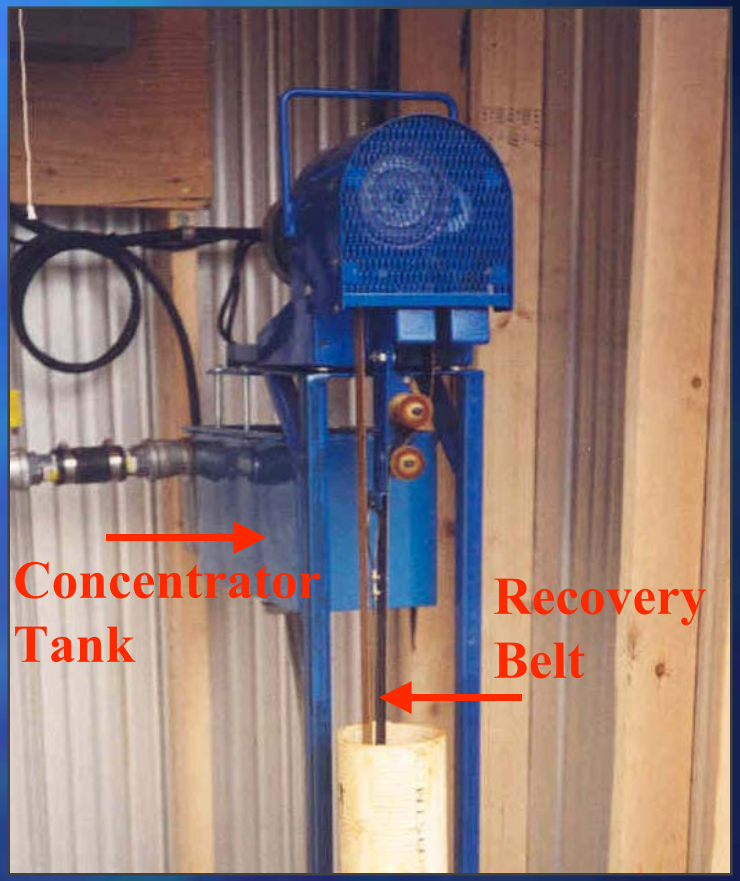
New Product Recovery System:

- Recovery well (100 mm)
- Product recovery skimmer
- Transfer pump
- Hydrocarbon tank
- Enclosure

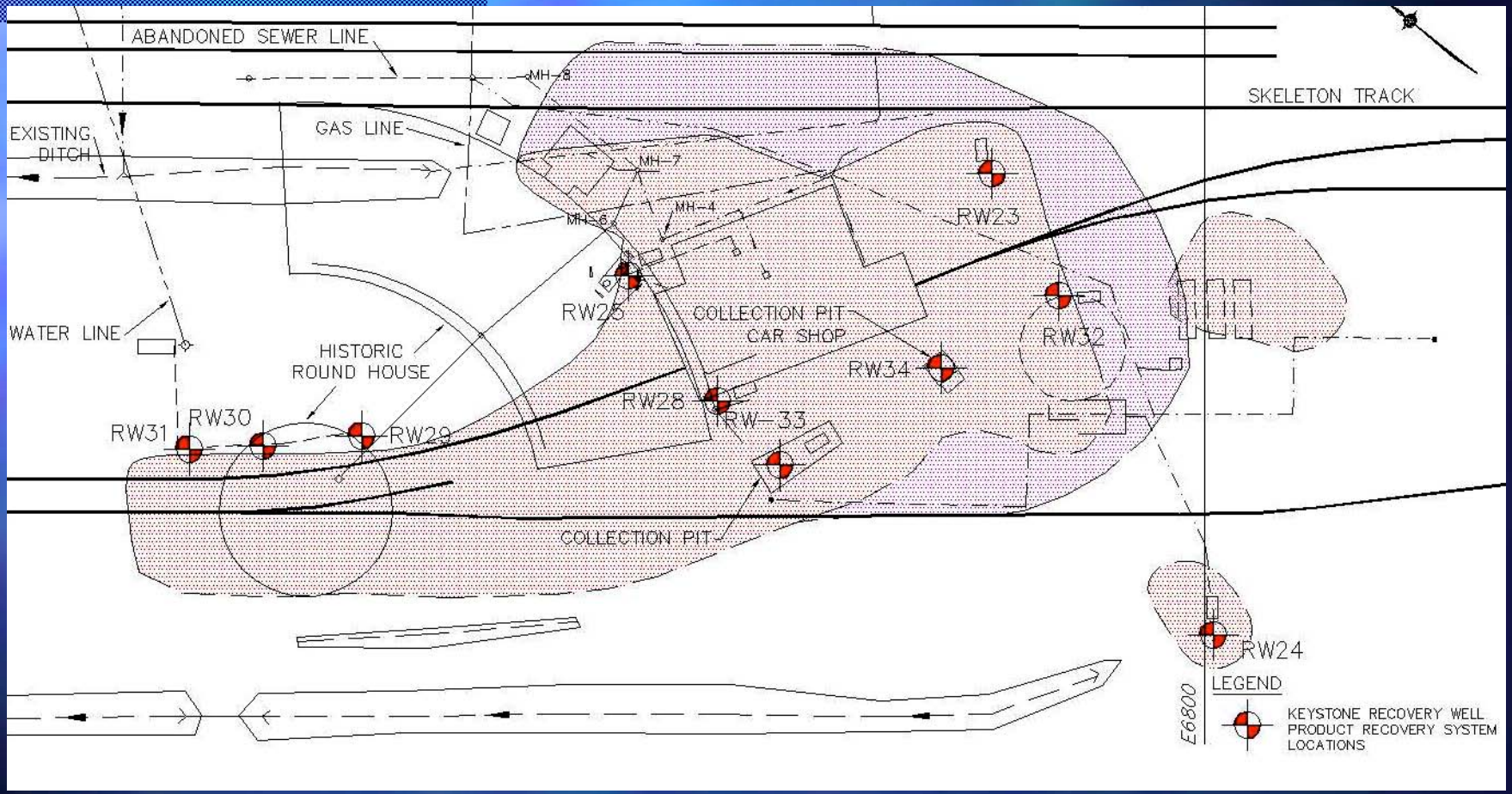


2001 to 2003 Recovery Approach

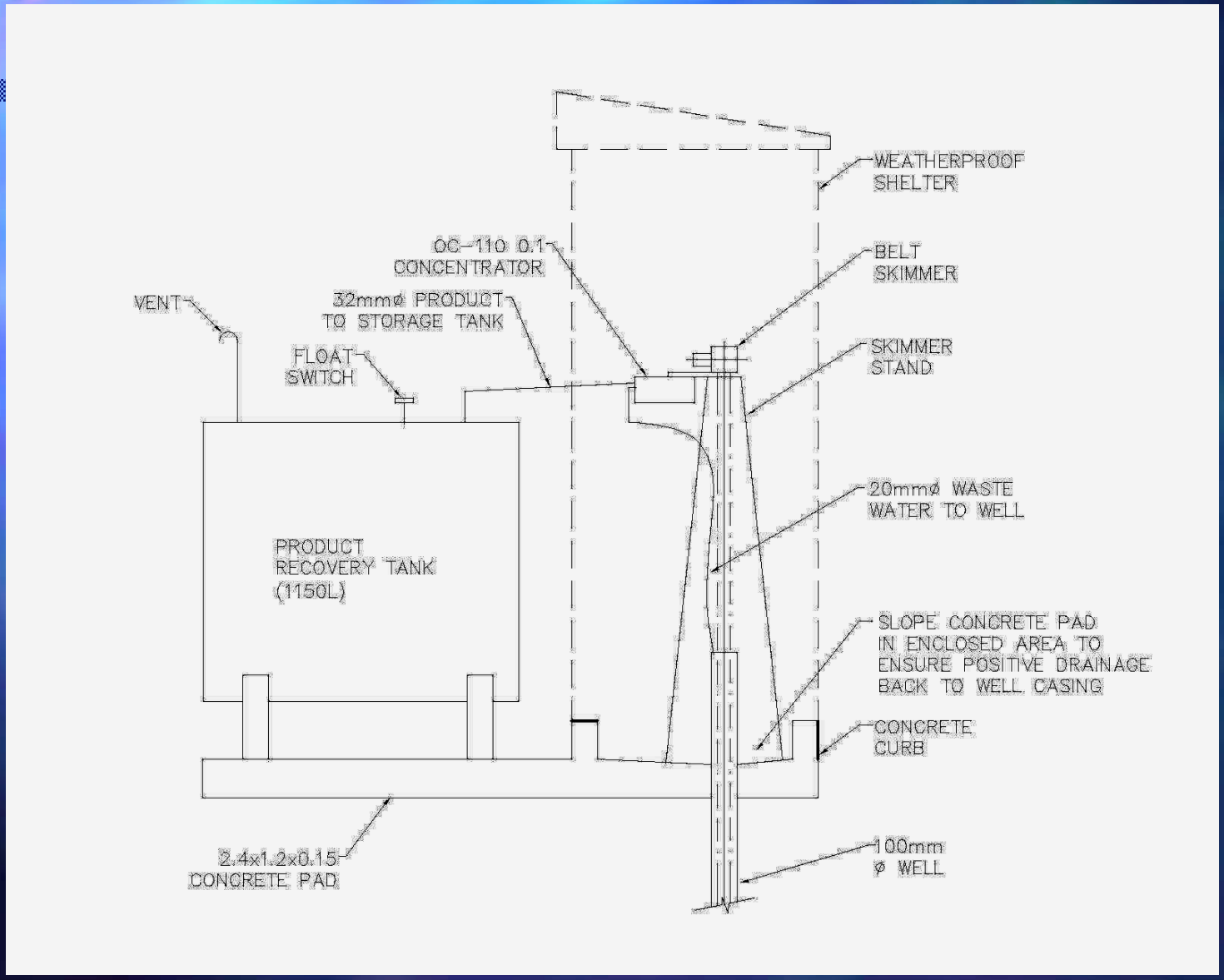
- Belt Skimmer
- Belt scraped by blades
- Product collected in AST
- Water returned to well



Recovery Well Layout



System Schematic



2001 Results

- 1500 Litres of product collected.
- Few mechanical difficulties.
- Low product migration into some wells.

2002 Results

- 7900 Litres of product collected
- Recovery well RW-25 - 3096 L
- Recovery well RW-28 - 2830 L
- Two infiltration trenches constructed
  - product recovery systems installed within the collection trenches

Rope Skimmer Product Recovery Rates

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	2001	2002	2003
Annual Product Recovery (Litres)	1550	7900	10000*
Average Product Recovery Rate (Litres per operating hour)	0.5	2.7	3.1

* Projected annual recovery

System Winterization

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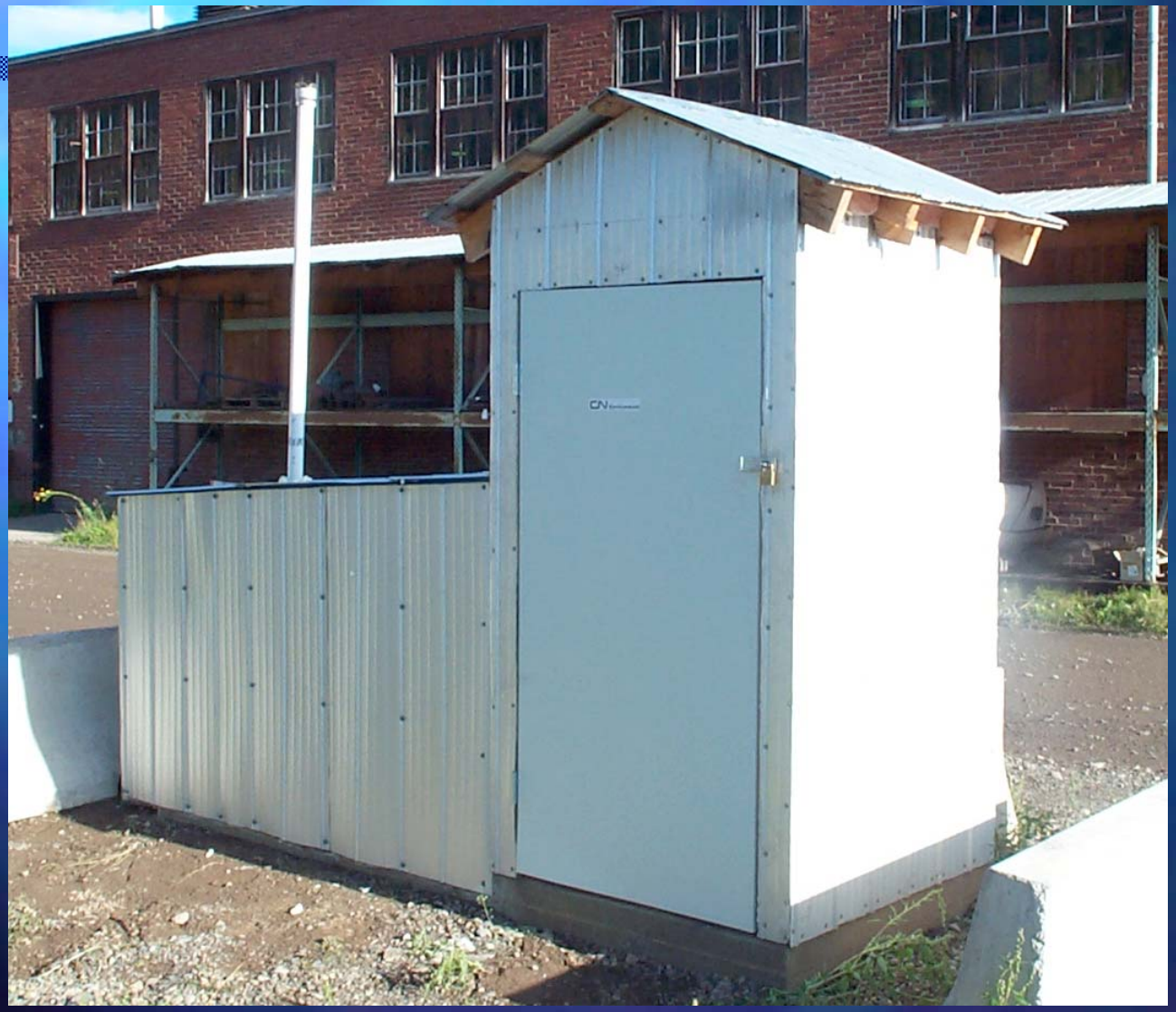

Cost Comparison

Eductor RecoverySystem	Rope SkimmerSystem	

Average Product Recovery Rate

	Eductor Recovery System	Rope Skimmer System
Annual Product Recovery (Litres)	2150[1]	10000[2]
Average Product Recovery Rate (Litres per operating hour)	1.4	2.1

[1] Assuming emulsified oil contains 50% water content

[2] Average results include projected annual recovery for 2003

Conclusions

Benefits of the "Simple" Solution:

- No emulsification and no discharge.
- Reduces potential impact on fish and fish habitat.
- Low maintenance, simple operation.
- Minimal local expertise required.
- Year round operation.

Acknowledgements

- Jack Stroet (CN operator) for his commitment and dedication in monitoring the system
- Highland Environmental for construction and assistance on upgrades
- Jason Christensen for managing and facilitating system operation