EXPERIMENTAL SETTLING AND SKIMMING CHAMBER FOR I 696 STORM SEWER

MATERIALS and TECHNOLOGY DIVISION

EXPERIMENTAL SETTLING AND SKIMMING CHAMBER FOR I 696 STORM SEWER

A category 2 project conducted in cooperation
with the U.S. Department of Transportation,
Federal Highway Administration

Research Laboratory Section
Materials and Technology Division
Research Project 73 G-200
Research Report R-1268

Lansing, November 1985

Purpose

This report provides information—including costs—on the construction, operation, and maintenance of the experimental settling and skimming chamber [I 50062-04642A, Federal Project I 696-8 (53) 233] for the storm sewer serving part of I 696. It will also close the evaluation project for the chamber. This report completes the requirements for FHWA Category 2, Experimental Work Plan No. 30.

Introduction

As part of the construction of I 696 a sewer was included to handle only runoff from that part of the freeway between I 75 and I 94. The sewer discharges directly into Lake St. Clair through an underwater outlet. The subject experimental settling and skimming chamber was inserted into the sewer downstream from the pumphouse at the foot of Elm St in the City of Roseville (Fig. 1). The function of this chamber was to prevent sediment and any spills of petroleum or other chemical products on I 696 from entering Lake St. Clair.

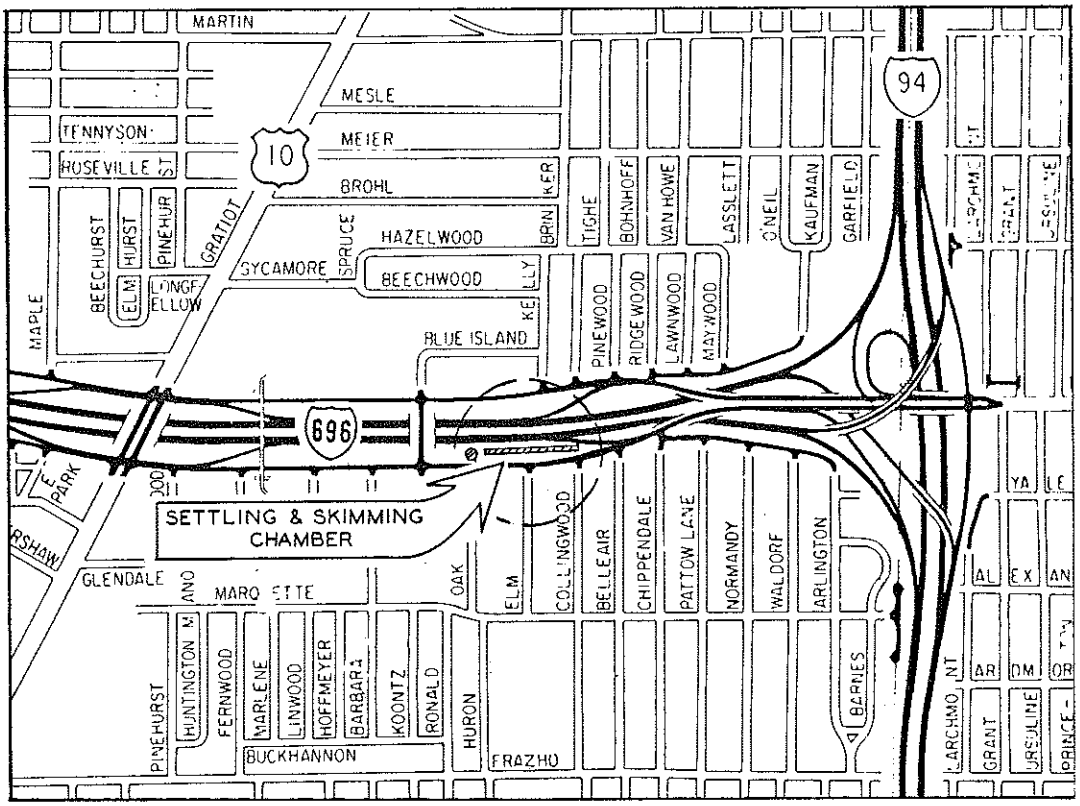

Figure 1. Location of settling and skimming chamber in the City of Roseville.

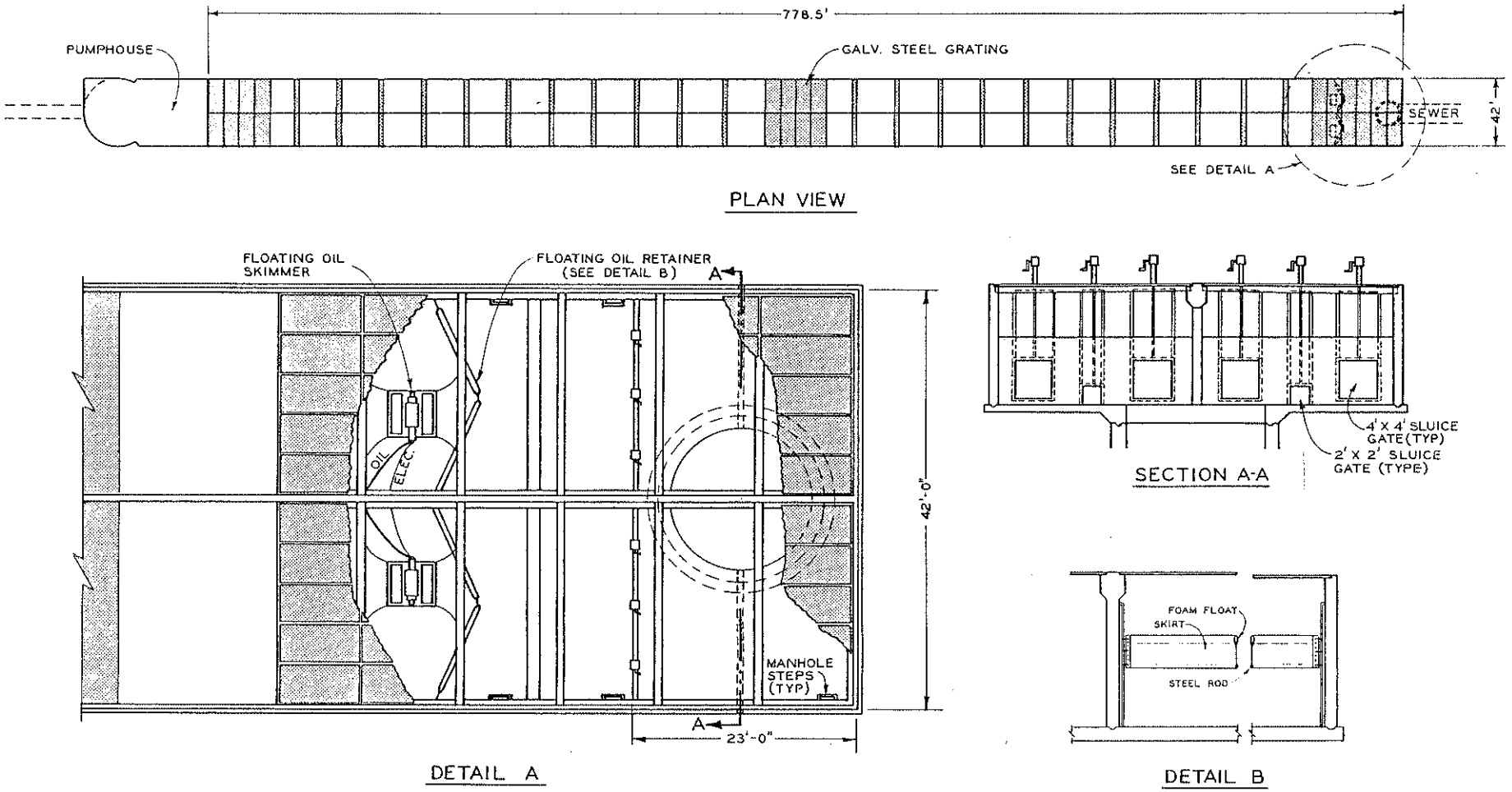

Figure 2. Physical layout of settling and skimming chamber.

Research Project 73 G-200 was approved in December 1973 to evaluate the performance of the settling and skimming chamber, and to record costs of operation and maintenance. Construction of the chamber was completed in 1975. Due to problems in sewer construction the pumphouse and the settling chamber did not receive the expected quantity of runoff water from I 696 until 1979. Thus, the evaluation project which was originally set to end in 1981 was extended to October 1, 1984.

The following sections give details of the chamber's physical layout, and the costs of construction, operation, and maintenance, including sediment removal and cleanup of one gasoline spill.

Description of Settling and Skimming Chamber

This concrete structure consists of twin parallel chambers each approximately 19.5 ft wide, 755 ft long, and 12 ft high as shown in Figure 2. The inlet is switchable so that the pumphouse output can be directed to only one chamber or both chambers. Most of the roof area is made up of repeating 28-ft units, each consisting of a 4-ft steel grating panel and 24 ft of 4-ft wide precast concrete panels. Large grating areas near the pumphouse and near the middle are 40 ft long and the exit end grating area is 60 ft long. These grated areas provide for ventilation and inspection, and are removed for access during cleanup and sediment removal. The 7-ft wall at the outlet end is fitted with manual sluice gates (Fig. 2). Each chamber is equipped with a 6 gal/hr capacity floating oil skimmer machine (Model BD-213M by Surface Separator Systems, Inc., Baltimore, Maryland) near the outlet wall. A floating oil barrier located between the skimmer machine and the end wall prevents oil or other floating matter from flowing over the wall into the exit sewer. Any liquid collected by the skimmers is conducted to an on-site 2,000-gal storage tank.

Routine Maintenance

The maintenance schedule for the skimmer chamber is for twice yearly inspection and operating procedure tests on the two mechanical skimmers, plus lubrication and operational checks of the gate mechanisms. Once a month, during a routine maintenance stop at the site, the entire length of the skimmer is briefly inspected.

Operational Procedures

One or more of the sluice gates on each side of the skimmer chamber outlet are normally open. The chamber fills and empties with automatic operation of the pumps. The sluice gate openings are slightly above the chamber floor, and the floating oil barriers also temporarily impede water flow to help collect sediment. If a petroleum spill occurs on the part of the freeway served by the chamber, maintenance personnel travel to the chamber site and take appropriate action to recover the spill. The pumps can be shut off to keep the spilled material in the pumphouse sump for recovery. If circumstances require, the exit gates of the skimmer

TABLE 1
SETTLING AND SKIMMING CHAMBER COSTS
(Rounded to nearest hundred dollars)

October 1975	
Construction completed	$ 745,500.00
1975 to 1979	
Not operational - inlet sewer not completed	----
October 1, 1979 to September 30, 1980	
Operation and maintenance*	800.00
Securing grates against vandals	1,000.00
Repair of gate mechanism	600.00
	2,400.00
October 1, 1980 to September 30, 1981	
Operation and maintenance*	900.00
Sediment removal	3,500.00
	4,400.00
October 1, 1981 to September 30, 1982	
Operation and maintenance*	1,000.00
October 1, 1982 to September 30, 1983	
Operation and Maintenance* (Spill recovery from pumphouse $4,800)	1,200.00
October 1, 1983 to September 30, 1984	
Operation and maintenance*	1,500.00

*These costs are estimated - the records did not always separate pumphouse and skimmer related costs.

would be closed and the spilled material pumped to the skimmer chamber. The spill could be directed to, and contained in, only one side of the skimmer while subsequent water is routed through the other side. Or, water and spill material could be pumped into both sides of the skimmer chamber. Water could flow out over the end wall, but the petroleum material would be retained by the floating barrier for recovery.

When sediment builds up to a significant degree, gratings are removed during a dry period so that a small front-end loader and personnel can be lowered into the chamber to remove sediment. Sediment was removed only once during this evaluation period, about 40 cu yd in 1980. This sediment probably resulted from settling and leakage problems that occurred during sewer construction.

There was only one petroleum product spill during the evaluation project; a gasoline tank truck overturned and caught fire in 1983. Most of the gasoline cargo burned; only 1,000 to 2,000 gal of a mixture of gasoline, diesel fuel from the tractor, and melted rubber from tires entered the sewer system. Maintenance personnel were alerted and waited at the pumphouse until the spill entered the sump. The petroleum mixture was removed from the sump to end the spill episode.

Table 1 lists costs for the skimmer chamber. The listed costs include labor, overhead, equipment, electric power, materials, and travel expense.

CONCLUSIONS AND RECOMMENDATIONS

Maintenance of the settling and skimming chamber has presented no great problems. Sediment removal has been needed only once in five years; the only petroleum product spill was recovered from the pumphouse.

No further construction of settling and skimming chambers is planned. Such facilities may provide solutions to problems at other locations.