Carrier
A United Technologies Company

Carrier Corporation
Facilities & Maintenance Services
Carrier Parkway
PO Box 4808
Building TR-7
Syracuse, New York 13221

HAND DELIVERED

November 16, 2009

Sandra Lizlovs, P.E.
New York State Department of Environmental Conservation
Division of Water
615 Erie Blvd. West
Syracuse, NY 13204-2400

Re: **Modified SPDES Permit NY0001163**
Thompson Road Site, DEC #7-3126-00018/21
Town of Dewitt, Onondaga County

Dear Ms. Lizlovs:

Enclosed, please the following submittals:

- *Final Engineering Design Report – Treatment of PCBs in Storm Water,* prepared by Ensafe Inc. on behalf of Carrier Corporation (Carrier) pursuant to the SPDES Permit referenced above; and
- *Outfall 002 Drainage Basin Concept Plan,* supplementing our letter of November 9, 2009 and summarizing completed and planned investigations and actions to address PCB control concerns, as recently discussed with the Department of Environmental Conservation (DEC).

We are copying this transmittal to the additional DEC representatives identified below. But, please let us know if you are aware of others who should receive copies.

The overall project schedule necessitates a series of planning and construction activities over a relatively compressed period of time. So, we are hoping to get a time set on our calendars for a meeting to review these materials with DEC and discuss the options and next steps for confirming and overseeing these efforts. The 24th of November remains a viable date for Carrier or possibly the first week of December. We look forward to hearing from you in that regard.

If you have any questions or comments in the meantime, please feel free to contact me or our outside environmental counsel representing Carrier in this matter, Robert S. Melvin of Robinson & Cole LLP (at 860-275-8251).

Sincerely,

Nelson Wong

Nelson Wong, P.E., Manager
Environmental Programs, Syracuse

Enclosures

Copies (with enclosures) to:
Dare Adelugba – NYSDEC, Division of Water, Albany
Mary Jane Peachey – NYSDEC, Regional Engineer
Larry Rosenmann – NYSDEC, Division of Solid Waste and Hazardous Materials, Albany
Edith Di Francesco – Carrier, Environment, Health & Safety and Engineering Methods
Dionne Cooper – Carrier, Legal
Greg Lowe – Carrier, Syracuse
William Penn – UTC
Kathleen McFadden – UTC, Legal
Phil Coop – Ensafe
Bob Melvin – Robinson & Cole

FINAL ENGINEERING DESIGN REPORT
TREATMENT OF PCBs IN STORM WATER

CARRIER CORPORATION
THOMPSON ROAD FACILITY
SYRACUSE, NEW YORK

EnSafe Project Number
0888807394

Prepared for:

United Technologies Corporation
UTC Shared Remediation Services
United Technologies Building
One Financial Plaza
Hartford, Connecticut 06010

Prepared by:

ENSAFE

5724 Summer Trees Drive
Memphis, Tennessee 38134
(901) 372-7962
(800) 588-7962
www.ensafe.com

November 13, 2009

FINAL ENGINEERING DESIGN REPORT
TREATMENT OF PCBs IN STORM WATER

CARRIER CORPORATION
THOMPSON ROAD FACILITY
SYRACUSE, NEW YORK

EnSafe Project Number
0888807394

Prepared for:

United Technologies Corporation
UTC Shared Remediation Services
United Technologies Building
One Financial Plaza
Hartford, Connecticut 06010

Prepared by:

ENSAFE

5724 Summer Trees Drive
Memphis, Tennessee 38134
(901) 372-7962
(800) 588-7962
www.ensafe.com

November 13, 2009

Table of Contents

1.0 SITE HISTORY 1

2.0 DESIGN OBJECTIVES 3

3.0 SUMMARY OF PSWS AND PMP FINDINGS 5
- 3.1 PSWS Findings 5
- 3.2 PMP Findings to Date 8
- 3.3 Conclusions 11

4.0 PILOT STUDY 12

5.0 TREATMENT PROCESS DESIGN 17
- 5.1 Storm Water Pumping 17
  - 5.1.1 Pump Station PS-1 17
  - 5.1.2 Pump Station PS-2 17
- 5.2 PCB Treatment 18

Figures

Figure 1 Site Location Map 2
Figure 2 Storm Water Sampling Locations 6
Figure 3 Pilot Treatment System Schematic 13

Tables

Table 1 PMP Data (4 Quarters) 9

Appendices

Appendix A Summaries of Sampling Data Collected during PSWS
Appendix B Summary of Sampling Data Collected during Pilot Study
Appendix C Information on Major Pieces of Treatment Equipment

Exhibits

Exhibit I Engineering Design Drawings

1.0 SITE HISTORY

The Carrier Thompson Road Facility (Carrier) is located in the northeast portion of Syracuse, New York, approximately one-half mile south of the New York State Thruway (Figure 1 — Site Location Map). The facility is bordered by Sanders Creek to the north, Thompson Road with developed and undeveloped commercial land to the west, Kinne Street with residential areas to the east, and residential and commercial areas to the south. The property slopes slightly north toward Sanders Creek. The facility property covers approximately 175 acres and a large majority of the site is either paved or covered by manufacturing and office buildings.

The facility was purchased in the 1950s by Carrier. The Carrier Syracuse facility produces or has produced a variety of products associated with the heating, ventilation, air conditioning (HVAC) industry for home and commercial applications over the years. Operations include or have included the manufacture and assembly of various components associated with HVAC units.

Carrier is currently working with the New York State Department of Environmental Conservation (NYSDEC) to evaluate polychlorinated biphenyls (PCBs) in storm water effluent under terms of the State Pollution Discharge Elimination System (SPDES) permit issued to Carrier as a modification on September 14, 2007, from NYSDEC, Division of Environmental Permits, Region 7. Specifically, Carrier has developed and implemented a ***PCB Storm Water Quality Study (PSWS)*** which includes data from 12 months of monitoring PCB concentrations in storm water discharges from Outfalls 001, 002, and 01A. The monitoring period began mid-November 2007 and was completed mid-October 2008. A report on that study was submitted to the NYSDEC in November 2008. For convenience, a summary is included in Section 3.1 of this report. To address another permit requirement, implementation of the **Pollutant Minimization Program (PMP)** commenced in late October 2008. Four of the quarterly monitoring events have been completed, and a summary of the results is included in Section 3.2.

As required in the Schedule of Compliance in the permit, Carrier is to submit an approvable report, signed and stamped by a professional engineer licensed to practice in the State of New York, for the design and construction of a treatment system designed to assure that the discharge from Outfall 01A achieves compliance with the PCB effluent limitation and discharge goal listed in their modified permit. As granted by NYSDEC in response to a request by Carrier, this report is to be submitted to NYSDEC by November 16, 2009. The previous Revision 1 of this document provided a 50% progress report as requested by NYSDEC during a July 16, 2009, meeting with Carrier, and updated the previous Revision 0 that was submitted to NYSDEC on that date. This document and its attachments serve as the approvable design report.

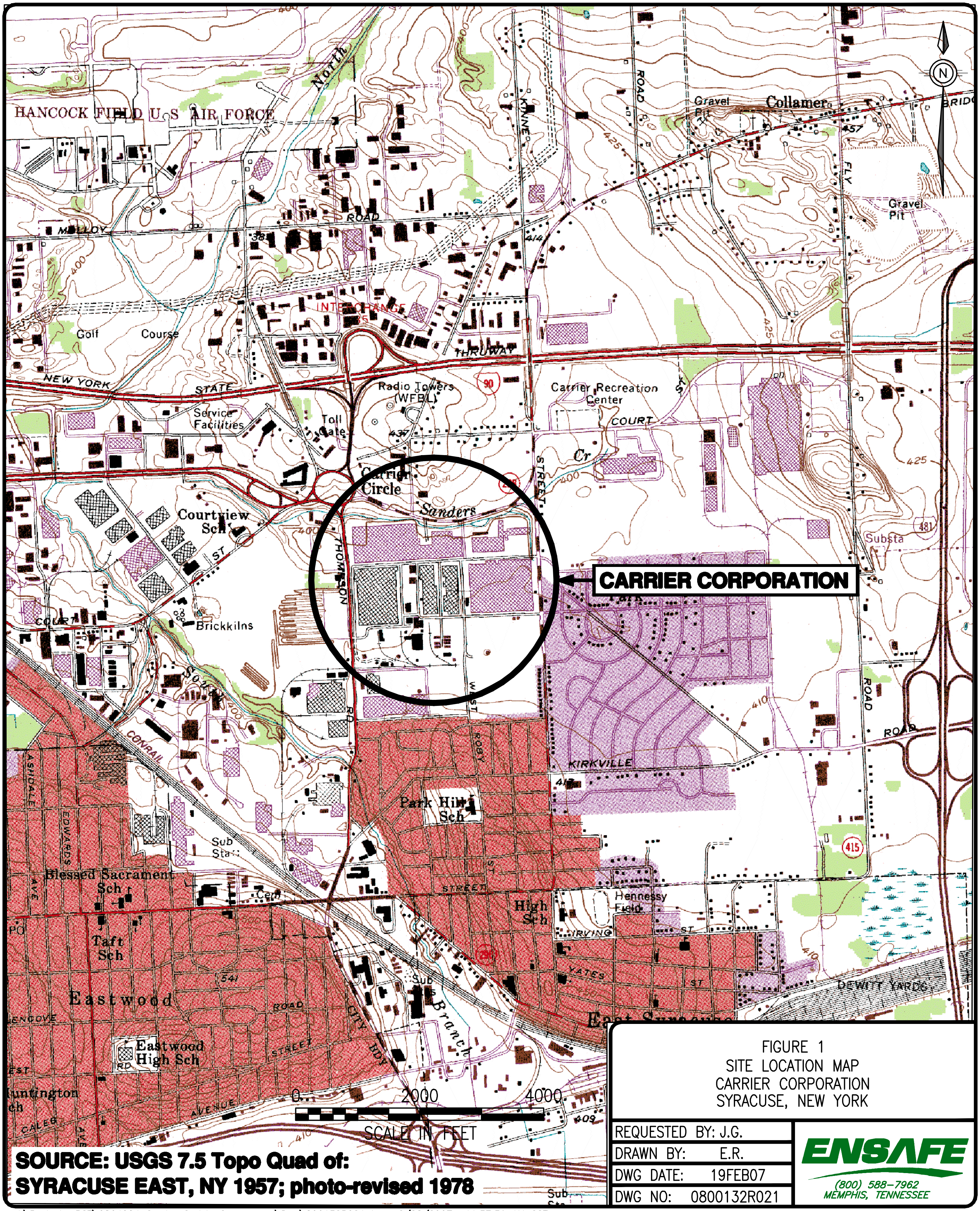


FIGURE 1
SITE LOCATION MAP
CARRIER CORPORATION
SYRACUSE, NEW YORK

REQUESTED BY:	J.G.
DRAWN BY:	E.R.
DWG DATE:	19FEB07
DWG NO:	0800132R021

ENSAFE
(800) 588-7962
MEMPHIS, TENNESSEE

SOURCE: USGS 7.5 Topo Quad of: SYRACUSE EAST, NY 1957; photo-revised 1978

I:\Projects-BST\0804084 Carrier Carlyle Compressor\Dwg\800132R021.dwg 2/28/2007 11:37:39 AM CST

2.0 DESIGN OBJECTIVES

With respect to PCBs specifically, the design objectives, as dictated by the current permit, are:

- To control the discharge of PCBs from Outfall 01A to below the permit limits, namely 0.3 micrograms/liter (µg/L) for each of the Aroclors 1242, 1248, 1254 and 1260.

- To control the discharge of PCBs from Outfall 01A so as to avoid triggering the requirement of permit Footnote 1.b, specifically that if the concentration of any Aroclor is above the permit-specified minimum detection limit (MDL) of 0.065 µg/L for three consecutive samples, the permittee must evaluate the treatment system and identify the cause of the detectable PCBs in the discharge.

- For the discharge from Outfall 01A, to implement the maximum feasible treatment technology for treatment of PCBs (permit Footnote 1.d.)

Based on the information to date, Carrier proposes to achieve these objectives (i.e., compliance with the current SPDES permit) by implementing the following measures:

- Routing the storm water pumped from Pump Station 2 (PS-2), which serves the drainage basin where PCB-contaminated storm water predominantly originates, through a 600-gallons per minute (gpm), multi-stage, PCB-removal system. The proposed treatment system is described in Section 5.2.

- Following treatment for PCB removal, the storm water pumped from PS-2 will be routed to the air stripping towers for trichloroethene (TCE) removal prior to discharge via Outfall 01A.

- The storm water pumping rate from Pump Station 1 (PS-1) will be maintained at its current maximum of 440 gpm. This storm water will NOT be treated for PCBs because PSWS and PMP sampling data show the occurrence of any Aroclor greater than 0.065 µg/L is rare and the maximum concentration is on the order of 0.1 µg/L.

Carrier proposes to implement the following improvements at Outfall 002/PS-2 concurrently with those above:

- Constructing a weir structure at the 002 Outfall to raise the elevation at which overflows commence. This will increase the capture of PCB-contaminated storm water, which originates predominantly from the 002 drainage system, and reduce the frequency, magnitude and duration of overflows at Outfall 002. This will also minimize the incursion of creek water into the Carrier storm water system when backwater conditions occur in Sanders Creek. Carrier proposes to construct a weir box at the end of the 002 Outfall pipe that will raise the overflow elevation from its current 27.19 feet (site datum) to 32.10.

- Increasing the pumping capacity of PS-2 from 380 gpm to 600 gpm. In conjunction with the weir structure at Outfall 002, this will further increase the capture of PCB-contaminated storm water, without overloading the existing 01A treatment system (air stripping towers) for TCE removal, and without exceeding the permitted daily maximum 01A flow of 1.5 million gallons per day (MGD). (The 440-gpm maximum pumping rate from PS-1 plus the 600-gpm pumping rate from PS-2 yields a combined pumping rate of 1040 gpm, or 1.5 MGD when operated around the clock.)

Other measures under evaluation for future assessment and control of PCBs are discussed in a **Concept Plan**, which is being submitted as a separate document.

3.0 SUMMARY OF PSWS AND PMP FINDINGS

3.1 PSWS Findings

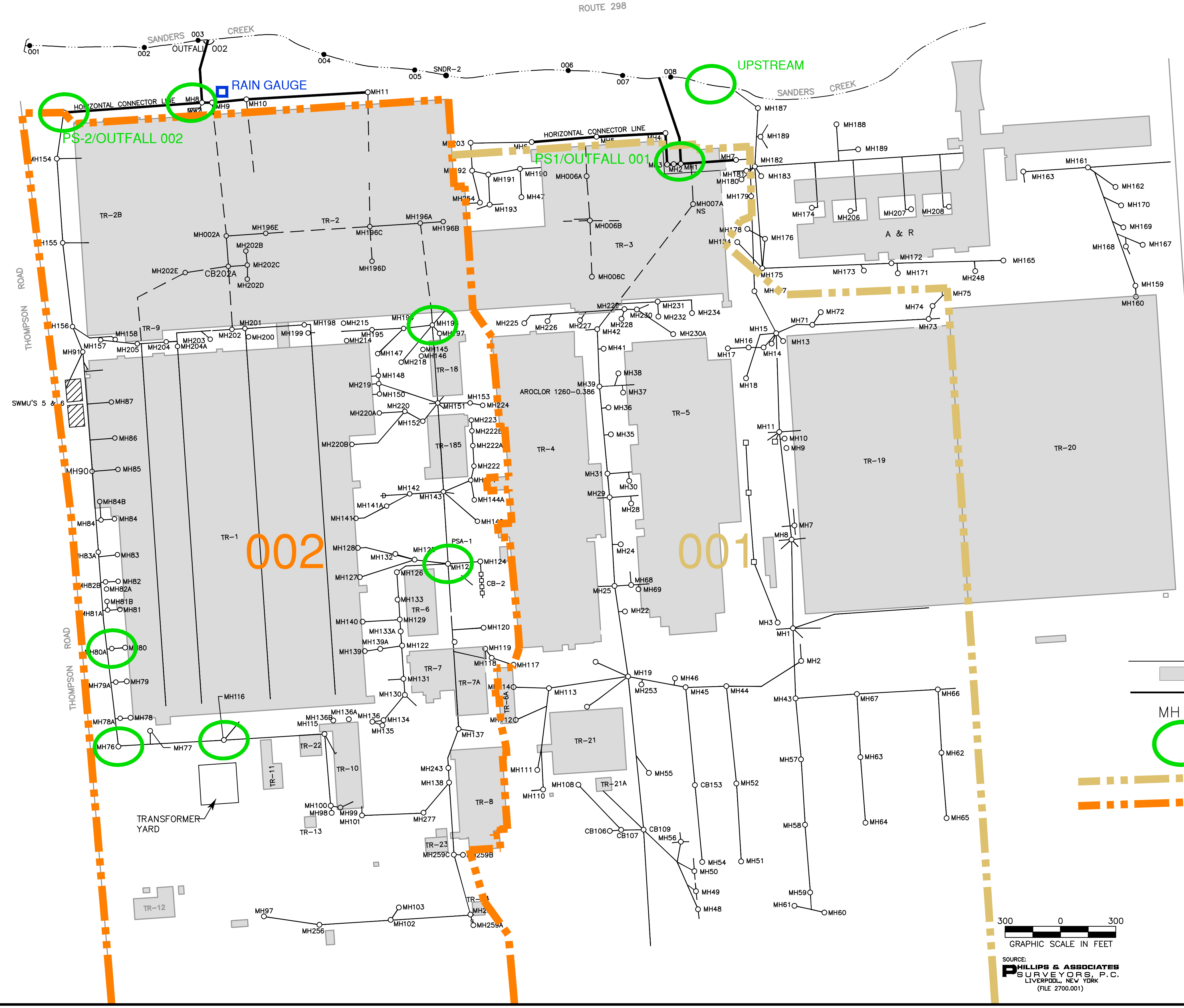
Storm water data was collected from November 2007 through October 2008 and included over 180 samples from Outfalls 01A, PS-1/Outfall 001, PS-2/Outfall 002, and Sanders Creek. The data collected included flow rates at the pump stations and outfalls and in Sanders Creek as well as specific chemical data on these flows and discharges. PCB analysis was performed on both unfiltered and filtered samples. The complete data from the PSWS study may be found in the ***PCB Storm Water Quality Study***, which was submitted to NYSDEC in November 2008. For context, a brief discussion is presented below and data summary tables are included in Appendix A. Figure 2 shows the 001 and 002 drainage basins and the locations where storm water samples have been collected.

Outfall 01A

Outfall 01A discharges the combined effluent from the two air stripping towers of the existing storm water treatment system, which receives flow from Pumping Station 1 (PS-1) and Pumping Station 2 (PS-2). In addition to surface runoff from storm events, the storm sewers tributary to the two pumping stations receive infiltration of shallow groundwater, which produces a low flow even during dry weather. From November 28, 2007, through October 22, 2008, a total of 85 million gallons was pumped to and treated in the 01A air stripping towers, with approximately 40 million gallons being pumped from PS-1 and 45 million gallons from PS-2.

Samples were obtained from Outfall 01A discharges on 35 days during the 12-month PSWS period. Samples were obtained from outfall discharges at various times during the discharge events. Additionally, some samples represented grab samples and others represented composite samples, and still others represented monthly grab samples required by the permit and reported in monthly discharge monitoring reports.

- Thirty-four (34) grab samples, distributed over 29 of the 35 days, were collected. In 5 of the grab samples collected on 5 separate days, Aroclor 1260 was detected above the permit quantification level (PQL) of 0.30 µg/L per Aroclor. No other Aroclors were detected above the PQL. A total of 37 composite samples, representing periods from 3 to 24 hours, were collected on 26 days. None of these composite samples yielded an Aroclor above the PQL.



LEGEND

	BUILDING
	STORM SEWER AND SIZE
MH O	MANHOLE
	SAMPLING LOCATIONS
	DRAINAGE BASIN 001 BOUNDARY
	DRAINAGE BASIN 002 BOUNDARY

FIGURE 2
STORMWATER SAMPLING LOCATIONS
CARRIER FACILITY THOMPSON ROAD
SYRACUSE, NEW YORK

REQUESTED BY: M.H.
DRAWN BY: E.R.
DWG DATE: 14JUL09
DWG NO: 5771 R001

ENSAFE
(800) 588-7962
MEMPHIS, TENNESSEE

I:\2009 Projects-BST\5771 Syracuse, NY\5771 R001.dwg 07/14/2009 13:54:37 PM CST

- Among the grab samples, another 9 samples representing parts of 7 days showed PCB concentrations above the MDL of 0.065 µg/L per Aroclor but less than the PQL. Aroclor 1260 was found in this range in 8 of the 9 grab samples and Aroclor 1254 was found in 2 of them. In 37 composite samples Aroclor 1254 was reported in this range in only two samples (on 2 of 26 days); Aroclor 1260 was found in this range in only one composite sample.

PS-1/Outfall 001

At this location 41 composite samples and 23 grab samples were obtained on 30 days, 22 of which were days when the outfall experienced overflow conditions.

- Of the 8 days that were sampled during non-overflow conditions, none exceeded the PQL of 0.30 µg/L per Aroclor and only one exceeded the MDL of 0.065 µg/L per Aroclor. (Aroclor 1254 was found at 0.074 µg/l in a composite sample on December 4, 2007.) All flows during these conditions are pumped to the treatment building and discharged through Outfall 01A.

- During the study period, overflows at Outfall 001 occurred on 100 days of which samples were collected on 22. None of the samples yielded a result above the PQL of 0.30 µg/L per Aroclor. Only 2 days and 3 samples (Aroclor 1260 at 0.076 µg/L in a grab sample on July 13, 2008, and at 0.092 µg/L in a grab sample and 0.083 µg/L in a composite sample on September 27, 2008) had a PCB concentration greater than the MDL of 0.065 µg/L per Aroclor, and then only marginally.

PS-2/Outfall 002

Data was obtained from PS-2/Outfall 002 during the study period, both during non-overflow (base flow or low storm water flow) and overflow conditions. Samples were obtained from outfall discharges at various times during the discharge events. Overall, samples were obtained on 35 days, with 9 days being during non-overflow conditions and 26 days being during overflow conditions.

- Of the 9 days that were sampled during non-overflow conditions, there were 3 composite samples and 2 grab samples that showed PCB detections on 3 days. Of these only 1 grab sample (0.35 µg/L for Aroclor 1260 on March 25, 2008) exceeded the PQL of 0.30 µg/L per Aroclor. The other grab sample and the 3 composite samples showed Aroclor 1260 at a concentration greater than the MDL of 0.065 µg/L per Aroclor, and Aroclor 1254 was detected above the MDL (but below the PQL) in both of the grab samples and 2 of 3 composite samples. All flows during these conditions are pumped to the treatment building and discharged through Outfall 01A.

- During the study period, overflows occurred on 90 days of which 26 days were sampled. Twenty-four grab samples were collected over 22 days, with 16 samples on 15 days having one or more Aroclor above the MDL. In three of these 16 grab samples on 3 days an Aroclor was detected above the PQL of 0.30 µg/L. Thirty-six composite samples were collected over 22 days, with 15 samples on 12 days having one or more Aroclor above the MDL. None of the composite samples yielded an Aroclor above the PQL of 0.30 µg/L. Among the days when overflows occurred, there was one instance (November 15, 2007) when a PCB-containing composite sample was collected late in the day after overflow conditions had ended.

3.2 PMP Findings to Date

In May 2008, a PMP was developed for the Carrier facility, as required by the Special Conditions listed in their permit. The quarterly PMP sampling program began in the fourth quarter of 2008, the results of which were submitted to NYSDEC in the *Pollutant Minimization Program, Annual Update — February 1, 2009.* Since that report submittal, Carrier has conducted three additional quarterly sampling events. A summary of the results gathered to date is summarized in Table 1 and discussed briefly below.

Total PCB concentrations using the U.S. Environmental Protection Agency (USEPA) Method 608A (Aroclor method) and the Green Bay Method (congener method) appear to correlate closely.

PS-1/Outfall 001

To date, PMP samples have been obtained on 4 days at this location, with all 4 samples obtained during overflow conditions. The first three quarterly sampling events indicated the absence of any Aroclor above the concentration of 0.065 µg/L. In the fourth event Aroclor 1260 was detected at a concentration of 0.128 µg/L and Aroclor 1254 was detected at 0.077 µg/L.

Table 1
PMP Data (Four Quarters)
Carrier Corporation, Syracuse, New York
(all results µg/L)

Sample Period:	**1st Quarterly Sampling Event (Oct. & Dec. 2008)**			**2nd Quarterly Sampling Event (Feb. 2009)**			**3rd Quarterly Sampling Event (Apr. & May 2009)**			**4th Quarterly Sampling Event (Jul. 2009)**		
Method:	**Green Bay Method**	**USEPA 608A**		**Green Bay Method**	**USEPA 608A**		**Green Bay Method**	**USEPA 608A**		**Green Bay Method**	**USEPA 608A**	
Aroclor:	**NA**	**1254**	**1260**	**NA**	**1254**	**1260**	**NA**	**1254**	**1260**	**NA**	**1254**	**1260**
Outfall 001	0.042	<0.065	<0.065	0.062	<0.065	<0.065	0.113	<0.065	<0.065	0.191	0.077	0.128
Outfall 002	0.089	<0.065	0.076	1.251	<0.065	1.190	1.120	0.720	0.743	0.571	0.173	0.377
Outfall 01A	0.122	<0.065	0.077	0.063	<0.065	<0.065	0.250	0.069	0.096	0.169	<0.065	0.113
MH-76	NS	<0.065	NS	1.593	<0.065	1.630	0.552	ND	0.483	NS	NS	NS
MH-116	0.677	<0.065	0.698	NS	NS	NS	NS	NS	NS	0.246	0.108	0.230
MH-99	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.187	<0.065	0.242

PS-2/Outfall 002

To date, PMP samples have been obtained on 4 days at this location, with all 4 samples obtained during overflow conditions. All four sampling events confirmed the presence of Aroclor 1260 at a concentration above 0.065 µg/L, and in three events the result for this Aroclor was greater than 0.3 µg/L. In addition, in the third and fourth sampling events the concentration of Aroclor 1254 was 0.720 and 0.173 µg/L, respectively.

Outfall 01A

Samples have been obtained on 4 days at this location. Three of the 4 samples exhibited Aroclor 1260 at a concentration between 0.065 and 0.3 µg/L. Aroclor 1254 was detected in this range only once, in the third sampling event.

Manhole 76

Manhole 76 was sampled during the second and third quarterly events, with Aroclor 1260 being detected at a concentration greater than 0.3 µg/L in samples from both events. Storm water samples will continue to be collected from this manhole as part of the PMP sampling program.

Manhole 116

Samples were obtained from Manhole 116 during the first sampling event, with Aroclor 1260 being detected at 0.698 µg/L. In the fourth sampling event the Aroclor 1260 was detected at 0.23 µg/L and Aroclor 1254 at 0.108 µg/L.

Manhole 99

Based on earlier PCB data collected at MH-76 and MH-116, Carrier reported in the July 2009 progress report that it had tentatively decided to sample storm water from MH-115 during the next quarterly sampling event. When deploying equipment for the most recent quarterly event, MH-99 was found to be the manhole most up-gradient from MH-116 and was chosen for sampling in lieu of MH-115. In the most recent sampling event Aroclor 1260 was detected at 0.242 µg/L. The result for Aroclor 1254 was less than 0.065 µg/L.

Carrier will continue to sample storm water from manholes in this area as part of the PMP and source investigation programs in an attempt to determine the most up-gradient (up-line) location of PCBs in storm water.

3.3 Conclusions

PCB detections have been found predominantly in unfiltered samples, with filtered samples (in most cases) showing a marked decrease in PCB concentration. The cause of the detectable level of PCBs in the discharge appears to be contaminated sediments that have washed into the storm water sewer collection system.

Each pumping station receives storm water flows from a distinct portion of the facility, and the assessment of potential treatment alternatives has taken into account the PCB contribution from each PS/Outfall. While the exact source or sources of the sediments is unknown, the data strongly suggests that the Outfall 002/PS-2 drainage system is the primary contributor of PCB-contaminated storm water to Outfall 01A discharges. Therefore, end-of-pipe PCB treatment for PS-2 storm water is recommended to meet the requirements of the current permit.

Capture and subsequent treatment of storm water from PS-1 and Outfall 001 for PCB is not warranted at this time. Storm water from this pump station and outfall will continue to be monitored (as part of Carrier's approved PMP). If data shows PCB concentrations in storm water from this outfall consistently exceed the MDL, Carrier will reassess its proposed PCB control strategy for possible modifications to mitigate these flows.

ENSAFE

4.0 PILOT STUDY

To verify certain information needed for design and to identify operational issues such as frequency of filter change-out and other maintenance, a pilot-scale treatment unit was operated at the Carrier site from late April 2009 through November 6, 2009.

Description of System

Figure 3 is an updated process flow diagram of the pilot system. An existing drain tap on the PS-2 force main inside the TR-3 wastewater treatment room was converted into a temporary sampling tap in order to draw storm water. A 4- to 5-gpm transfer pump was installed to convey storm water from the sampling tap to the pilot unit. The operation of the pump was activated by an electrical relay wired to a flow switch installed in the PS-2 force main.

- The pump inlet was protected by routing the water through a basket strainer.
- Filtration Step 1 — Since September 9, 2009, the water was pumped through a backwashable sand filter charged with a specially graded media reportedly able to remove particulate down to 3 to 4 microns in size. (Prior to September 9, a 25-micron bag filter was used in this step.)
- Filtration Step 2 — From the sand filter the water was routed through a 20-inch long, pleated cartridge filter. From October 24, 2009, through the end of the study, a 5-micron pore size filter was used in this housing. From July 17 through October 24, a 1-micron pore size filter was used. (Prior to July 17, 2009, this was a 1-micron bag filter.)
- Filtration Step 3 — Since October 24, the third filtration step has used a 20-inch long, 1-micron pore size pleated cartridge filter. Prior to that date a 20-inch long, 0.35-micron pore size pleated cartridge filter had been used in this housing.
- Prior to September 29 the flow was split into two parallel streams downstream of Filtration Step 3:
  - — One stream flows through two 1-micron MyCelx cartridge filters in series
  - — The other stream flowed through an activated carbon column

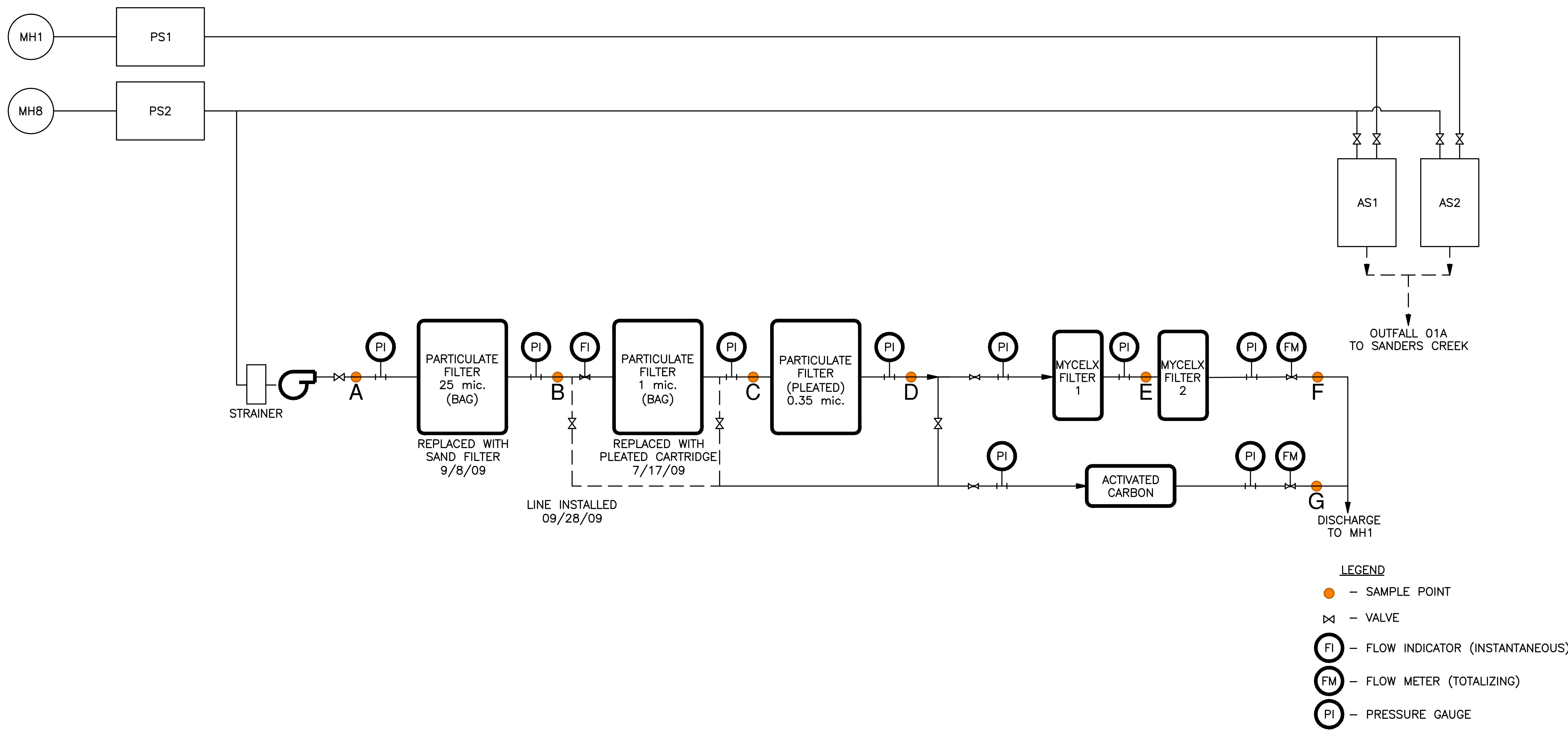


FIGURE 3
PILOT STUDY SCHEMATIC
PCB END OF PIPE TREATMENT
CARRIER CORPORATION
SYRACUSE, NEW YORK

REQUESTED BY: T.E.
DRAWN BY: A.W.
DWG DATE: 29SEPT09
DWG NO: 7394 PILOT STDY

ENSAFE
(800) 588-7962
WWW.ENSAFE.COM
MEMPHIS, TENNESSEE

From September 29 through the end of the study, the flow was split downstream of Filtration Step 1, the effect being that water directed to the activated carbon column was filtered in the backwashable sand filter only, while the MyCelx stream continued through Filtration Step 3. This was done in an effort to determine the effectiveness of the carbon column without fine filtration.

- Treated water was discharged into the PS-1 wetwell in the TR-3 treatment building
- Total flow and the flows through the MyCelx filter train and through the carbon column train were measured.
- Pressures before and after each treatment step were measured.

Samples for PCB analysis (by Method 608) were collected ahead of the initial filter (Sampling Point A), after each filtration step (Sampling Points B, C, and D), after each MyCelx filter (Sampling Points E and F) and after the carbon column (Sampling Point G).

Samples were collected during high flow events at PS-2 when PCB concentrations are most likely to be detectable.

Results and Discussion

When the study was halted on November 6, 2009, approximately 161,000 gallons had been treated in the pilot unit, with the flow almost evenly split between the MyCelx train (78,000 gallons) and the carbon train (83,000 gallons). Through October 27, 2009, samples were collected during 15 events. The results are summarized in Appendix B. In nine of the 15 events, no Aroclor was detected above 0.065 µg/L in the influent. Of the six events that had detectable PCB in the influent, filtration alone was sufficient to reduce each Aroclor to below 0.065 µg/L in five events, and in the sixth case (June 11), both the carbon bed and the MyCelx resin were effective in reducing the residual concentration of each Aroclor to below 0.065 µg/L.

While the pilot unit has demonstrated the effectiveness of the selected technology in meeting discharge standards, evaluation of data available at the time of the July 2009 progress report indicated that the 0.35-micron filter was becoming clogged after only about 2,600 gallons of flow. This would equate to about 4,000 gallons per filter for the larger filters that would be used in full-scale operation. Based on a typical design flow rate of 5 gpm per filter, each filter would require replacement after only about 13 hours of operation, imposing an impracticable demand on operations and resources. Therefore, in an attempt to lessen the solids loading on the 0.35-micron filter, EnSafe and Carrier replaced the 1-micron bag filter and housing with a 1-micron pleated cartridge filter and housing on July 17, 2009.

Data from July 17 through the end of August showed that this change extended the operational life of the 0.35-micron filter to about 7,500 gallons. On the other hand, the 1-micron cartridge filter required replacement about every 2,500 gallons during this period. In other words, the filter life problem had remained, but had shifted one step forward in the treatment process. Consequently, on September 9, 2009, EnSafe and Carrier replaced the 25-micron bag filter with a sand filter, which was charged with a specially graded media reportedly able to remove particulate to the range of 3 to 5 microns. Furthermore, this filter could be backwashed when needed.

Data collected since installation of the sand filter indicate that the 1-micron cartridge filter continues to be fouled at about the same rate as previously. The conclusion is that the solids in the 002 storm water are predominantly between 1 micron and 5 microns in effective size.

Because carbon columns in similar applications at other sites have been effective with pre-filtration in the range of 5 to 10 microns, on September 29 EnSafe and Carrier installed piping and valves to split the flow between the two treatment trains immediately after the sand filter as shown in Figure 3. Thereafter, approximately half the flow went from the sand filter directly through the carbon column and remainder went through the MyCelx train (1-micron and 0.35-micron pleated cartridge filters and the MyCelx cartridges). Of the three samples collected after this piping change, only the one on October 27 had detectable PCB in the influent. On that day, samples showed that 90% of the PCB passed through the sand filter, but all was removed by the 5-micron filter in the MyCelx train and by the carbon column in that train.

Although the single result showed PCB removal in the carbon train without fine pre-filtration, a concern at this site is that PCB-contaminated colloidal particles or silts finer than 5 microns will pass through a carbon column just as they have passed through a nominal 5-micron sand filter. In fact, most vendors of carbon columns that were contacted about this application strongly recommended a 0.5-micron filter downstream of the carbon column. This is similar to the pre-filtration requirements recommended by the MyCelx vendor. Consequently, the filtration requirements for carbon and MyCelx are essentially the same.

The run times of cartridge filters can be extended – and associated labor and materials costs reduced — if a larger fraction of the solids can be removed in a backwashable filter upstream of the cartridge filters. Toward this goal, EnSafe conducted a series of bench-scale experiments in which a commonly used coagulant (alum) and/or a flocculating polymer were added to samples of untreated storm water. The results showed that an alum dosage of about 25 milligrams per liter (mg/L) in conjunction with a polymer dosage of 5 mg/L was effective in combining the small (< 5-micron) particles into flocculated structures that were easily removed by a 5-micron filter.

Conclusions

In summary, the pilot study has demonstrated that a system of pre-filtration and adsorption can remove PCB from the site's storm water to below the discharge goal of 0.065 µg/L. Associated bench-scale testing has shown that coagulation and flocculation ahead of a backwashable filter can remove particles that would otherwise pass through a nominal 5-micron filter, which would extend the operating life of disposable, downstream cartridge filters. Test results show that in most cases filtration down to about 1 micron is effective in removing PCB from the storm water at this site; however, in rare instances adsorption after filtration is necessary. Activated carbon and a PCB-selective resin (MyCelx) are equally effective as adsorption media. Due to easier handling, the MyCelx resin filters are recommended as the adsorption media downstream of a pre-filtration train consisting of a nominal 5-micron backwashable filter and a series of cartridge filter housings (initially equipped with 5-micron, 1-micron, and 0.35 micron filters). It is further recommended that tanks, mixers and chemical feed equipment for coagulation and flocculation be included for optional use upstream of the backwashable filter.

5.0 TREATMENT PROCESS DESIGN

5.1 Storm Water Pumping

5.1.1 Pump Station PS-1

- Maintain existing capacity of 440 gpm to pump storm water to the air stripping towers for TCE removal.

5.1.2 Pump Station PS-2

- Replace the two existing self-priming centrifugal pumps with two similar pumps, each rated to deliver 600 gpm against a TDH of 115 feet. Each motor will be 40 HP, 1800 RPM with a VFD to adjust the flow rate from about 300 gpm to 600 gpm in response to level in the PS-2 wet well. The higher pressure of the new pumps is needed to overcome a backpressure of 25 pounds per square inch (psi) when the new basket strainer near the discharge end of the pipe in the storm water treatment building reaches its maximum operating pressure.

  The pumps will be operated in an alternating, lead-lag configuration. The primary control criterion for the pumps will be the water level in the wetwell. When the water level rises to the "Pump On" level, the lead pump will start at the low end of its flow range (approximately 300 gpm); as the wetwell level rises, the pump speed and flow rate will increase proportionally to the maximum flow rate of 600 gpm. When the wetwell level falls, pump speed and flow will decrease accordingly. Secondary criteria are high pressure at the basket strainer, which will turn the pumps off, and backwash mode of one of the backwashable filters, which will decrease the pumping rate to 450 gpm if it is greater at the time.

- Use the existing force main (approximately 850 linear feet of 8-inch and 650 linear feet of 10-inch diameter ductile iron pipe) from PS-2 to the 01A treatment system in the TR-3 wastewater treatment building.

- Install a new headwall with weir at the end of the 60-inch diameter Outfall 002 pipe near Sanders Creek to reduce the frequency of overflows and minimize backflow of creek water into PS-2. Currently, this outfall overflows when the water level in manhole MH-8 immediately upstream of the PS-2 wetwell reaches Elevation 27.19. As designed, the weir will have a 2-foot long section at Elevation 32.1, over which the initiation of overflows can be detected and sampled, and an additional 35 feet of weir length at Elevation 32.2. The length of the weir enables the crest elevation to be set as high as practical to minimize the frequency of overflows without creating excessively high backwater conditions in the upstream collection system.

During events that now cause overflows, this weir arrangement will allow approximately 60,000 gallons of storm water to accumulate temporarily in the weir structure, the PS-2 wetwell, and in the large diameter pipes immediately upstream of the wetwell before an overflow commences.

5.2 PCB Treatment

In the TR-3 treatment building, Carrier proposes to install a PCB treatment system for PS-2 storm water sized for 600 gpm. Preliminary engineering plans are included as Exhibit I. Based on design evaluation, principal elements include coagulation, flocculation, filtration, cartridge filtration, and adsorption as generally described below:

- Piping and valves to connect the PS-2 force main to the PCB treatment system. A 90-degree elbow and a small section of existing 8-inch pipe will be removed and replaced with a tee and two valves. A normally closed valve will be placed on the side of the tee leading to the air stripping towers and a normally open valve will be installed in the new piping that leads to a duplex strainer — the first unit process in the PCB treatment system.

- A duplex basket strainer with automatic switchover feature to remove gross solids (leaves, twigs, etc.) and protect downstream equipment. The switchover feature will be set to change the flow from one strainer to the other when the pressure drop across the dirty strainer reaches 25 psi.

- Flash mixing — From the basket strainer the pumped flow will continue under pressure to a 600-gallon flash mix chamber where Carrier will have the option to add coagulation aids (e.g., alum) and flocculating polymers into the storm water to promote the agglomeration of fine (< 5 micron) particles so they can be more easily removed by filtration. Chemical dosing will be proportional to flow, with the speed of the chemical feed pumps paced by the signal from the PS-2 flow meter located in the treatment plant building. The operator will be able to adjust the stroke of the pumps to increase or decrease the dosage at a given flow rate. Provision is being made for pH monitoring and the dosing of sodium hydroxide, if needed, to maintain pH in the acceptable range against the pH-lowering effects of alum. Mixing will be provided by a ¾-horsepower (HP) agitator mounted across the top of the tank.

- Flocculation — two existing tanks will be renovated and converted into use as flocculation tanks. Flocculation Tank 1 is 11 feet in diameter and will be operated with a side water depth of approximately 12 feet, giving a volume of 8,500 gallons. It will be equipped with a 2-HP slow speed flocculating mixer. Flocculation Tank 2, which will also be equipped with a 2-HP slow speed flocculating mixer, is 10.7 feet in diameter and will be operated with a side water depth of 20 feet, thus providing a working volume of 13,300 gallons. Combined these two tanks will provide a hydraulic detention time of 36 minutes at the design flow rate of 600 gpm.

- Backwashable filters — two parallel filters, such as the "Fuzzy Filters" marketed by Schreiber Equipment Company, or a functionally equivalent alternative are proposed. The "Fuzzy Filter" offers removal of particles to approximately 4 microns, and with a hydraulic loading rate up to 40 gpm per square foot, has a compact footprint compatible with the space available in the treatment building. Two "Fuzzy Filters", each with a 3-foot by 3-foot filter area, will be operated in parallel with the influent flow (300 to 600 gpm) split evenly between them.

  In addition, this filter offers a relatively low backwash rate of 3 percent of the design flow rate and uses untreated influent as backwash water. When one of the filters goes into backwash mode, its influent valve will close partially to decrease the flow to that filter to 90 gpm (9 square feet times 10 gpm per square foot) and the effluent valve will close. As the filter bed expands the water level in the filter will rise to the backwash overflow port, causing backwash water to flow by gravity to the backwash holding tanks for a period of approximately 30 minutes. During this time the flow to the active filter will increase (up to 360 gpm) to accept additional flow. If the flow from PS-2 just prior to initiation of backwash is greater than 450 gpm, a backwash initiation signal from the filter control panel will notify the PS-2 control panel to reduce the flow to this rate for the duration of the backwash cycle.

- A filtered water pumping station - Consisting of a 1,260-gallon surge tank for collecting effluent from the Fuzzy Filters and duplex pumps, this unit will convey the water under pressure through downstream treatment units. Pumps will be horizontal centrifugal type equipped with VFDs to allow the flow rate to be adjusted from about 300 to 600 gpm to match the influent flow rate from PS-2. This will be accomplished by a control system that will modulate pump speed to maintain a pre-selected water level in the surge tank. A third pump, sized at approximately 100 gpm, will be installed to provide a supply of filtered water for polymer dilution and an alternative supply of water for filter backwashing during periods of high influent turbidity.

- Two parallel filtration and adsorption trains, each with the following principal components piped in series:

  — Particulate Filter 1: A 30-inch diameter filter housing capable of holding eighty-two (82) 2-1/2-inch diameter by 40-inch long cartridge filters. The initial filter selection for this housing is pleated cartridges for particulate removal with a nominal pore size of 5 micron.

  — Particulate Filter 2: A 30-inch diameter filter housing capable of holding eighty-two (82) 2-1/2-inch diameter by 40-inch long cartridge filters. The initial filter selection for this housing is pleated cartridges for particulate removal with a nominal pore size of 1 micron.

  — Particulate Filter 3: A 30-inch diameter filter housing capable of holding eighty-two (82) 2-1/2-inch diameter by 40-inch long cartridge filters. The initial filter selection for this housing is pleated cartridges for particulate removal with a nominal pore size of 0.35 micron.

  — Adsorption Unit 1: A 30-inch diameter filter housing capable of holding eighty-two (82) 2-1/2-inch diameter by 40-inch long cartridge filters. The initial filter selection for this housing is wound cartridges impregnated with specialty resin (MyCelx or equal) for adsorption of PCB.

— Adsorption Unit 2: A second 30-inch diameter filter housing capable of holding eighty-two (82) 2-1/2-inch diameter by 40-inch long cartridge filters. The initial filter selection for this housing is wound cartridges impregnated with specialty resin (MyCelx or equal) for adsorption of PCB.

In the pilot study the 1-micron, 2-1/2-inch diameter by 20-inch long cartridges exhibited an average operating life of approximately 2,500 gallons. Based on the additional bench-scale coagulation studies, it is estimated that coagulation/flocculation ahead of the backwashable filter will reduce the loading on downstream units by 75 percent or more. This would extend the life of a 20-inch filter to approximately 10,000 gallons and of a 40-inch filter to 20,000 gallons. At this rate, a housing containing 82 cartridges would be able to filter 1,640,000 gallons between filter changes, which is a run time of approximately 45 hours at the design flow rate of 600 gpm. With two parallel housings in each filtration step, this would enable the system to operate over a 3-day weekend (from a Friday afternoon to the following Tuesday morning) during wet weather without a filter changeout.

- Piping and valves to return PCB-treated water to the existing piping upstream of the air stripping towers.

- Auxiliary to the main treatment system would be a secondary system for treating filter backwash, the volume of which is estimated to be 3 percent of the treated storm water flow, or approximately 26,000 gallons per day during wet weather periods when the treatment system operates around-the-clock. Design includes the following principal components:

— Backwash storage (two existing tanks at the western end of the treatment building have an aggregate capacity of about 11,000 gallons and will be used for this purpose)

— Two 40-gpm transfer pumps to convey backwash from the storage tanks to the backwash treatment unit

— A 40-gpm physical-chemical treatment unit with flash mixing and flocculation compartments and an inclined plate clarifier

— A sludge holding tank (an existing tank along the northern wall of the treatment building has a capacity of 9,700 gallons) and sludge pumps

— A 15-cubic-foot filter press for dewatering sludge

— An effluent sump and pump station to collect and transfer clarifier effluent and sludge dewatering filtrate back to the head of the Fuzzy Filters.

Appendix A
Summaries of Sampling Data Collected during PSWS

Summary of Sampling Data Collected at 01A

Date	Note	Daily Rainfall (inches)		Composite Samples TSS mg/l	O&G mg/l	TOC mg/l	PCB, Unfiltered (ug/l) 1260	1254	1248	Total	PCB, Filtered (ug/l) 1260	1254	Grab Samples TSS mg/l	O&G mg/l	TOC mg/l	PCB, Unfiltered (ug/l) 1260	1254	1248	PCB, Filtered (ug/l) 1260	1254
11/16/2007	C	0.12	10:15													< 0.065	< 0.065	< 0.065		
12/3/2007		0.68	0:05										16.4			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065
			0:33	1.2			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	1.4			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065
			3:33	0.4			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
			9:33	1.6			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
			23:15	0.0			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
12/4/2007		0	9:15	2.8			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	0.12								
12/11/2007		0.28	15:50	28.0	2.1	0.0	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	7.2	0	0	< 0.065	< 0.065	< 0.065		
			18:49	12.8	2.1	0.0	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
	C															< 0.065	< 0.065	< 0.065		
12/12/2007		0.4	0:49	6.8	3.7	0.0	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
1/8/2008	C	0														< 0.065	< 0.065	< 0.065		
1/9/2008		0.13	7:05	115	3.4		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	19.5	4.2		0.091	< 0.065	< 0.065	< 0.065	< 0.065
			9:20										28.5	1.6		0.094	< 0.065	< 0.065	< 0.065	< 0.065
			10:15	13.0	2.6		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
			16:15	3.0	3.1		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
1/11/2008		0.54	0:39	8.6	2.0	0.41	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
			9:18										6.6	3.6		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065
1/12/2008		0.01	0:39	1.4	2.3		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
2/1/2008		1.13	16:11	59	1.5		< 0.065	0.085	< 0.065	0.085	< 0.065	< 0.065	126	2.5		< 0.065	0.14	< 0.065	< 0.065	< 0.065
			19:51	5.0	2.6		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
2/2/2008		0.09	3:21	9.5	1.9		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
2/5/2008	C	0.5														< 0.065	< 0.065	< 0.065		
3/4/2008	C	0.4														< 0.065	< 0.065	< 0.065		
3/27/2008		0.11	21:22	25.3			< 0.065	< 0.065	< 0.065	< 0.065			22.7			< 0.065	< 0.065	< 0.065		
3/28/2008		0.46	0:52	13.3			< 0.065	< 0.065	< 0.065	< 0.065										
			8:22	19.5			< 0.065	< 0.065	< 0.065	< 0.065										
3/31/2008		0.69	13:10	6.2			< 0.065	< 0.065	< 0.065	< 0.065			7.4			< 0.065	< 0.065	< 0.065		
			16:50	6.2			< 0.065	< 0.065	< 0.065	< 0.065										
4/1/2008		0.11	0:20	6.4			< 0.065	< 0.065	< 0.065	< 0.065										
	C															< 0.25	< 0.25	< 0.25		
4/4/2008		0.19	6:42	29.0			< 0.065	< 0.065	< 0.065	< 0.065			47.4			< 0.065	< 0.065	< 0.065		
			10:12	9.8			< 0.065	< 0.065	< 0.065	< 0.065										
			17:42	3.6			< 0.065	< 0.065	< 0.065	< 0.065										
5/7/2008		0.12	20:00		2.2	2.1	< 0.065	< 0.065	< 0.065	< 0.065				3.3	6	< 0.065	< 0.065	< 0.065		
5/17/2008		0.22	15:45	13.5	3.0	3.5	< 0.065	< 0.065	< 0.065	< 0.065			129	3.4	4.2	< 0.065	< 0.065	< 0.065		
5/22/2008	C	0.19	12:40													0.5	< 0.065	< 0.065		
6/6/2008		0.72	1:30			1.5	< 0.065	< 0.065	< 0.065	< 0.065				5	6	0.16	0.14	< 0.065		
6/10/2008		0.52	12:27	2.8	2.6	3.2	< 0.065	< 0.065	< 0.065	< 0.065			80	0	2.8	0.22	< 0.065	< 0.065	< 0.065	< 0.065
	C		12:40													0.21	< 0.065	< 0.065		
7/3/2008		0.29	16:41	1.4	2.2	3.4	< 0.065	< 0.065	< 0.065	< 0.065			6	2.2	4.5	< 0.065	< 0.065	< 0.065		
	C		13:30													2.5	< 0.065	< 0.065		
7/11/2008		0.06	13:00	109							< 0.065	< 0.065	28.3						< 0.065	< 0.065
7/13/2008		0.73	11:48	21.2	0.0	0.33	0.14	< 0.065	< 0.065	0.14	< 0.065	< 0.065	1.8	1.8	0.28	0.17	< 0.065	< 0.065	< 0.065	< 0.065
7/21/2008		0.03	17:45	1.2	1.8	1.1	< 0.065	< 0.065	< 0.065	< 0.065										
8/2/2008		0.42	15:48	4.4	2.2	6.2	< 0.065	< 0.065	< 0.065	< 0.065			7.8	3.7	2.7	< 0.065	< 0.065	< 0.065		
8/4/2008		0	22:10		3.1	0.38	< 0.065	< 0.065	< 0.065	< 0.065				0	0.31	< 0.065	< 0.065	< 0.065		
8/7/2008	C	0.59	14:10													0.36	< 0.065	< 0.065		
9/9/2008	C	0.29	11:00													0.5	< 0.065	< 0.065		
9/27/2008		0.5	10:53	4.2	2.4	1.7	< 0.065	< 0.065	< 0.065	< 0.065			39	1.7	4.5	0.12	< 0.065	< 0.065	< 0.065	< 0.065
9/30/2008		0.14	13:45		1.9	0.22	< 0.065	< 0.065	< 0.065	< 0.065				1.9	1.5	< 0.065	< 0.065	< 0.065		
			23:48	3.8									7.2							
10/16/2008	C	1.28	9:10													1.6	< 0.065	< 0.065		
10/21/2008		0.42	10:47										20.8			0.077	< 0.065	< 0.065	< 0.065	< 0.065
Maximum		1.28		115	3.7	6.2	0.14	0.085	< 0.065	0.14	< 0.065	0.12	129	5	6	2.5	0.14	< 0.25	< 0.065	< 0.065

Note: "C" designates grab sample collected by Carrier for routine NPDES reporting.

Summary of Sampling Data Collected at 001

Date	Daily Rainfall (inches)		Composite Samples TSS mg/l	O&G mg/l	TOC mg/l	PCB, Unfiltered (ug/l) 1260	1254	1248	Total	PCB, Filtered (ug/l) 1260	1254	Grab Samples TSS mg/l	O&G mg/l	TOC mg/l	PCB, Unfiltered (ug/l) 1260	1254	1248	PCB, Filtered (ug/l) 1260	1254
12/1/2007	0	11:51	4.8			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
		14:51	2.2			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
		16:01										2			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065
		20:51	2.4			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
12/2/2007	0.5	23:15				< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
		23:59										4.4			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065
12/3/2007	0.68	1:40	5.7			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	7.8			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065
		8:15	1.3			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
		23:15	0.6			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
12/4/2007	0	11:22	3.2			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	0.074								
12/5/2007	0	1:15	4.2			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
12/11/2007	0.28	15:40	4.7	3.4	0.0	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	138	4.1	92	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065
		18:50	15.7	3.1	0.0	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
12/12/2007	0.4	0:50	11.0	3.1	0.0	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
1/9/2008	0.13	6:45	118	3.3		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	725	3.8		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065
		9:15	12.0	2.9		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	33.3	3.1		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065
		16:16	6.2	1.5		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
1/11/2008	0.54	0:39	9.0	1.6	97	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
		9:13										60.3	4.9		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065
1/12/2008	0.01	0:39	4.4	2.0		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
2/1/2008	1.13	16:13	71	1.8		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	135	2.1		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065
		19:53	7.5	2.2		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
2/2/2008	0.09	3:23	17.3	2.4		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
3/27/2008	0.11	21:12	36.0			< 0.065	< 0.065	< 0.065	< 0.065			59.7			< 0.065	< 0.065	< 0.065		
3/28/2008	0.46	0:52	21.0			< 0.065	< 0.065	< 0.065	< 0.065										
		8:22	28.0			< 0.065	< 0.065	< 0.065	< 0.065										
3/31/2008	0.69	13:10	9.2			< 0.065	< 0.065	< 0.065	< 0.065			18.5			< 0.065	< 0.065	< 0.065		
		16:50	20.3			< 0.065	< 0.065	< 0.065	< 0.065										
4/1/2008	0.11	0:20	9.5			< 0.065	< 0.065	< 0.065	< 0.065										
4/4/2008	0.19	6:42	38.3			< 0.065	< 0.065	< 0.065	< 0.065			67			< 0.065	< 0.065	< 0.065		
		10:12	16.8			< 0.065	< 0.065	< 0.065	< 0.065										
		17:42	5.2			< 0.065	< 0.065	< 0.065	< 0.065										
5/7/2008	0.12	20:02		2.2	2.2	< 0.065	< 0.065	< 0.065	< 0.065				2.2	28.3	< 0.065	< 0.065	< 0.065		
5/17/2008	0.22	15:47	8.7	1.9	4.4	< 0.065	< 0.065	< 0.065	< 0.065			256	3.4	6.4	< 0.065	< 0.065	< 0.065		
6/6/2008	0.72	1:32			1.1	< 0.065	< 0.065	< 0.065	< 0.065				2.2	5.2	< 0.065	< 0.065	< 0.065		
6/10/2008	0.52	12:28	0.67		3.2	< 0.065	< 0.065	< 0.065	< 0.065			39.3	1.8	3.6	< 0.065	< 0.065	< 0.065		
7/3/2008	0.29	13:04	1.8	2.4	4.6	< 0.065	< 0.065	< 0.065	< 0.065			18	2.7	4.9	< 0.065	< 0.065	< 0.065		
7/11/2008	0.06	13:00	3.2							< 0.065	< 0.065	18							
7/13/2008	0.73	11:50	3.5	2.0	1.2	< 0.065	< 0.065	< 0.065	< 0.065			2.8			0.076	< 0.065	< 0.065	< 0.065	< 0.065
7/21/2008	0.03	18:07	2.8	2.5	0.6	< 0.065	< 0.065	< 0.065	< 0.065			2.2	2	1.4	< 0.065	< 0.065	< 0.065		
8/2/2008	0.42	15:51	33.4	2.6	3.9	< 0.065	< 0.065	< 0.065	< 0.065			5.8	2	5.8	< 0.065	< 0.065	< 0.065		
8/4/2008	0	22:12		2.5	1.2	< 0.065	< 0.065	< 0.065	< 0.065					0.32	< 0.065	< 0.065	< 0.065		
9/27/2008	0.5	10:56	18.8	3.2	0.79	0.083	< 0.065	< 0.065	0.083	< 0.065	< 0.065	13.2	2	1.3	0.092	< 0.065	< 0.065	< 0.065	< 0.065
9/30/2008	0.14	13:46	13.5	5.0	0.29	< 0.065	< 0.065	< 0.065	< 0.065			5.8	2.2	1.5	< 0.065	< 0.065	< 0.065		
10/21/2008	0.42	10:47										28.5			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065
Maximum	1.13		118	5	97	0.083	< 0.065	< 0.065	0.083	< 0.065	0.074	725	4.9	92	0.092	< 0.065	< 0.065	< 0.065	< 0.065

Summary of Sampling Data Collected at 002

	Daily	Overflow?		Sampled?				Composite Samples									Grab Samples							
	Rainfall							TSS	O&G	TOC	PCB, Unfiltered (ug/l)				PCB, Filtered (ug/l)		TSS	O&G	TOC	PCB, Unfiltered (ug/l)			PCB, Filtered (ug/l)	
Date	(inches)	001	002	001	002	01A		mg/l	mg/l	mg/l	1260	1254	1248	Total	1260	1254	mg/l	mg/l	mg/l	1260	1254	1248	1260	1254
11/14/2007	0.05		0		1		6:00	1.0			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	1.4			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065
11/15/2007	1.19				1		6:00	3.8			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
					1		12:00	0.8			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
							13:00	1.0			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
			1		1		19:00	1.0			0.15	0.27	< 0.065	0.42	< 0.065	< 0.065								
11/16/2007	0.12		1		1		19:00	0.6			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
11/17/2007	0		0		1		19:00	0.4			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
11/18/2007	0		0				19:00	0.4			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
11/29/2007	0.02						0:36	0.8			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
			0		1		13:36	1.8			0.18	0.12	< 0.065	0.3	< 0.065	< 0.065								
					1		17:06	0.67			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
12/2/2007	0.5	1	1	1	1		14:06	0.8			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	1			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065
					1		17:36	4.6			< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
12/11/2007	0.28	1	1	1	1	1	13:58	2.8	2.8	0.0	0.092	< 0.065	< 0.065	0.092	0.1	< 0.065	0.8	1.9	0	< 0.065	< 0.065	< 0.065	0.094	< 0.065
					1		16:58	7.7	2.5	0.0	0.081	< 0.065	< 0.065	0.081	< 0.065	< 0.065								
					1		22:58	1.6	0.0	78.0	< 0.065	< 0.065	< 0.065	< 0.065	0.1	< 0.065								
1/9/2008	0.13	1	1	1	1	1	7:16	99.5	1.6		0.13	< 0.065	< 0.065	0.13	< 0.065	< 0.065	407	25.8		0.21	< 0.065	< 0.065	< 0.065	< 0.065
					1		10:14	4.0	3.2		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	6.8	4		0.094	< 0.065	< 0.065	< 0.065	< 0.065
					1		16:16	1.0	2.9		0.068	< 0.065	< 0.065	0.068	< 0.065	< 0.065								
1/11/2008	0.54	1	1	1		1	0:38	3.6	1.9	0.0	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
1/12/2008	0.01		0	1		1	0:38	1.2	3.5		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065								
2/1/2008	1.13	1	1	1	1	1	15:38	29.7	4.4	0.0	0.19	0.23	< 0.065	0.42	< 0.065	< 0.065	74	7.2	0	0.81	0.44	0.98	< 0.065	< 0.065
					1		19:18	2.6	2.9	0.0	0.065	0.084	< 0.065	0.149	< 0.065	< 0.065								
2/2/2008	0.09	1	1	1		1	2:48	3.8	2.4	0.0	< 0.065	0.068	< 0.065	0.068	< 0.065	< 0.065								
3/20/2008	0.06	1	1		1		12:51				0.091	0.084	< 0.065	0.175	< 0.065	< 0.065				0.55	0.31	< 0.065	< 0.065	< 0.065
					1		16:31				< 0.065	< 0.065	< 0.065	< 0.065										
3/21/2008	0		0		1		0:01				< 0.065	< 0.065	< 0.065	< 0.065										
3/25/2008	0.04		0		1		23:46				0.087	< 0.065	< 0.065	0.087	< 0.065	< 0.065				0.16	0.077	< 0.065	< 0.065	< 0.065
3/26/2008	0.02		0		1		3:26				< 0.065	< 0.065	< 0.065	< 0.065										
					1		10:56				< 0.065	< 0.065	< 0.065	< 0.065										
4/1/2008	0.11	1	1	1	1	1	14:02	2.3			< 0.065	< 0.065	< 0.065	< 0.065										
							14:52										159			0.16	0.11	< 0.065	< 0.065	< 0.065
					1		15:02	57.2			< 0.065	< 0.065	< 0.065	< 0.065										
					1		18:32	5.7			< 0.065	< 0.065	< 0.065	< 0.065										
4/4/2008	0.19		1	1	1	1	6:27	5.6			< 0.065	< 0.065	< 0.065	< 0.065			5.6			< 0.065	< 0.065	< 0.065		
					1		10:07	2.7			< 0.065	< 0.065	< 0.065	< 0.065										
					1		17:37	0.0			< 0.065	< 0.065	< 0.065	< 0.065										
5/2/2008	0.21	1	1		1		1:47	2.2	3.8	1.3	0.072	< 0.065	< 0.065	0.072	< 0.065	< 0.065	8.2	27.3	1.9	0.38	0.29	< 0.065	< 0.065	< 0.065
5/7/2008	0.12	1	0	1	1	1	20:07		2.5	4.5	0.11	0.091	< 0.065	0.201	< 0.065	< 0.065		5.3	10.9	0.35	0.2	< 0.065		
5/17/2008	0.22	1	1	1	1	1	15:33	11.2	3.2	0.0	0.071	0.11	< 0.065	0.181	< 0.065	< 0.065	61	2.9	9.8	0.096	0.12	< 0.065	< 0.065	< 0.065
5/22/2008	0.19						5:33	3.6		1.3							3.4		2.6					
6/6/2008	0.72	1	1	1	1	1	1:28		1.8	3.3	0.079	0.1	< 0.065	0.179				2.3	3.7	0.19	< 0.065	< 0.065		
6/10/2008	0.52	1	1	1	1	1	12:36	6.0	0	1.8	< 0.065	0.14	< 0.065	0.203	< 0.065	< 0.065	78	1.9	2.5	0.14	0.2	< 0.065	< 0.065	< 0.065
7/3/2008	0.29	1	1	1	1	1	17:05	0.8	0	0.55	< 0.065	< 0.065	< 0.065	< 0.065			0.6	2.3	3.1	< 0.065	< 0.065	< 0.065		
7/11/2008	0.06	1	1	0	0	0	13:15	35.8									9.7		3.7				< 0.065	< 0.065
7/13/2008	0.73	1	1	1	1	1	12:49	22.0	2.1	0.65	< 0.065	< 0.065	< 0.065	< 0.065			41.5	2	8.5	0.13	0.14	< 0.065	< 0.065	< 0.065
7/22/2008	0.16	1	1		1		15:31	3.4	1.9	1.5	< 0.065	< 0.065	< 0.065	< 0.065			28	1.9	3	0.12	< 0.065	< 0.065	< 0.065	< 0.065
8/2/2008	0.42	1	1	1	1	1	14:57	2.8	3.3	3.1	0.074	< 0.065	< 0.065	0.074	< 0.065	< 0.065	11	2.9	3.9	0.12	< 0.065	< 0.065	< 0.065	< 0.065
8/7/2008	0.59	1	1		1		11:33	19.2		3.5	0.09	< 0.065	< 0.065	0.09	< 0.065	< 0.065	821	3	4.8	< 0.065	< 0.065	< 0.065		
8/19/2008	0.33	1	0				1:14								0.12	0.12	34.2	3.4	3.5	0.13	0.092	< 0.065	0.17	0.15
9/12/2008	0.55	1	1		1		11:53	7.6	2.2	2.1	< 0.065	< 0.065	< 0.065	< 0.065			12.5	0	2.9	< 0.065	< 0.065	< 0.065		
9/27/2008	0.5						13:33										1	0	8.4	0.092	< 0.065	< 0.065	< 0.065	< 0.065
9/30/2008	0.14						22:11										2			< 0.065	< 0.065	< 0.065		
							23:42											2.2	0.21	< 0.065	< 0.065	< 0.065		
10/21/2008	0.42						10:47										10.9			0.076	< 0.065	< 0.065	< 0.065	< 0.065
Maximum	1.19	21	22	16	41	15		99.5	4.4	78	0.19	0.27	< 0.065	0.42	0.12	0.12	821	27.3	10.9	0.81	0.44	0.98	0.17	0.15

Appendix B
Summary of Sampling Data Collected during Pilot Study

Lab Results Summary
Carrier PCB Removal Pilot Study

Sample Date	Precip.	A		B		C		D		E		F		G	
		TS/TSS	PCB	TS/TSS	PCB	TS/TSS	PCB	TS/TSS	PCB	TS	PCB	TS	PCB	TS	PCB
	(inches)	(mg/L)	(µg/L)	(mg/L)	(µg/L)	(mg/L)	(µg/L)	(mg/L)	(µg/L)	(mg/L)	(µg/L)	(mg/L)	(µg/L)	(mg/L)	(µg/L)
Configuration		Strained Influent		25 mic filtered (bag)		1 mic filtered (bag)		0.35 mic filtered		MyCelx 1		MyCelx 2		25u/1u/.35u then GAC	
04/28/09	0.04	726	< 0.056	740	----	757	----	731	< 0.053	----	----	----	----	----	----
05/07/09	0.34	425	< 0.053	431	----	439	----	436	< 0.052	478	----	----	----	----	----
05/14/09	0.10	1330	**0.079**	1310	< 0.053	1300	< 0.052	1180	**0.055**	1140	< 0.050	----	----	1130	< 0.052
05/22/09	0.00	1840	< 0.053	1800	----	1810	----	1820	< 0.052	----	----	----	----	----	----
05/27/09	0.09	877	**0.089**	871	< 0.052	875	----	878	< 0.052	----	----	----	----	----	----
06/11/09	1.71	308/93	**0.120**	268	**0.085**	205	**0.070**	160	**0.097**	97	< 0.053	----	----	368	< 0.051
06/18/09	0.60	433	< 0.053	298	----	390	----	240	< 0.052	----	----	----	----	----	----
06/26/09	0.09	380	**0.070**	363	< 0.053	377	----	371	< 0.052	----	----	----	----	----	----
07/16/09	0.01	593	< 0.053	590	----	587	----	544	< 0.053	----	----	----	----	----	----
Configuration		Strained Influent		25 mic filtered (bag)		1 mic filtered		0.35 mic filtered		MyCelx 1		MyCelx 2		25u/1u/.35u then GAC	
08/18/09	0.11	1730	< 0.053	1490	----	1160	----	835	< 0.053	----	----	----	----	----	----
08/29/09	0.58	158	**0.094**	130	**0.085**	119	**0.068**	71	< 0.053	----	----	----	----	----	----
09/28/09	0.10	265	< 0.053	296	----	236	----	218	----	----	----	----	----	----	----
Configuration		Strained Influent		Sand filtered		1 mic filtered		0.35 mic filtered		MyCelx 1		MyCelx 2		Sand/1u/.35u then GAC	
10/02/09	0.53	202	< 0.050	200	----	199	----	211	----	----	----	----	----	----	----
10/09/09	0.13	892/2.3	< 0.050	829/1.7	----	847/0.67	----	809/0.67	----	----	----	----	----	----	----
Configuration		Strained Influent		Sand filtered		5 mic filtered		1 mic filtered		MyCelx 1		MyCelx 2		Sand then GAC	
10/24/09	0.97	96/34	**1.0**	71/10	**0.90**	64/1.2	< 0.053	55/1.2	< 0.053	----	----	----	----	----	< 0.053

TSS Results for 6/11/09 Sampling Event (Sampling Point "A"):
- Unfiltered 93 mg/l
- Lab filtered (25 micron) 91 mg/l
- Lab filtered (0.8 micron) 94 mg/l

Configuration Note: All filters "pleated" unless noted otherwise.

Appendix C
Information on Major Pieces of Treatment Equipment

PS-2 Pumps

T Series™ Solids & Corrosive Liquids Pumps

Gorman-Rupp T Series™ pumps are designed for economical, trouble-free operation in handling solids-laden liquids and slurries.

Pumps feature a large volute design which allows them to reprime automatically in a completely open system without the need for suction or discharge check valves. And they can do it with the pump casing only partially filled with liquid and a completely dry suction line.

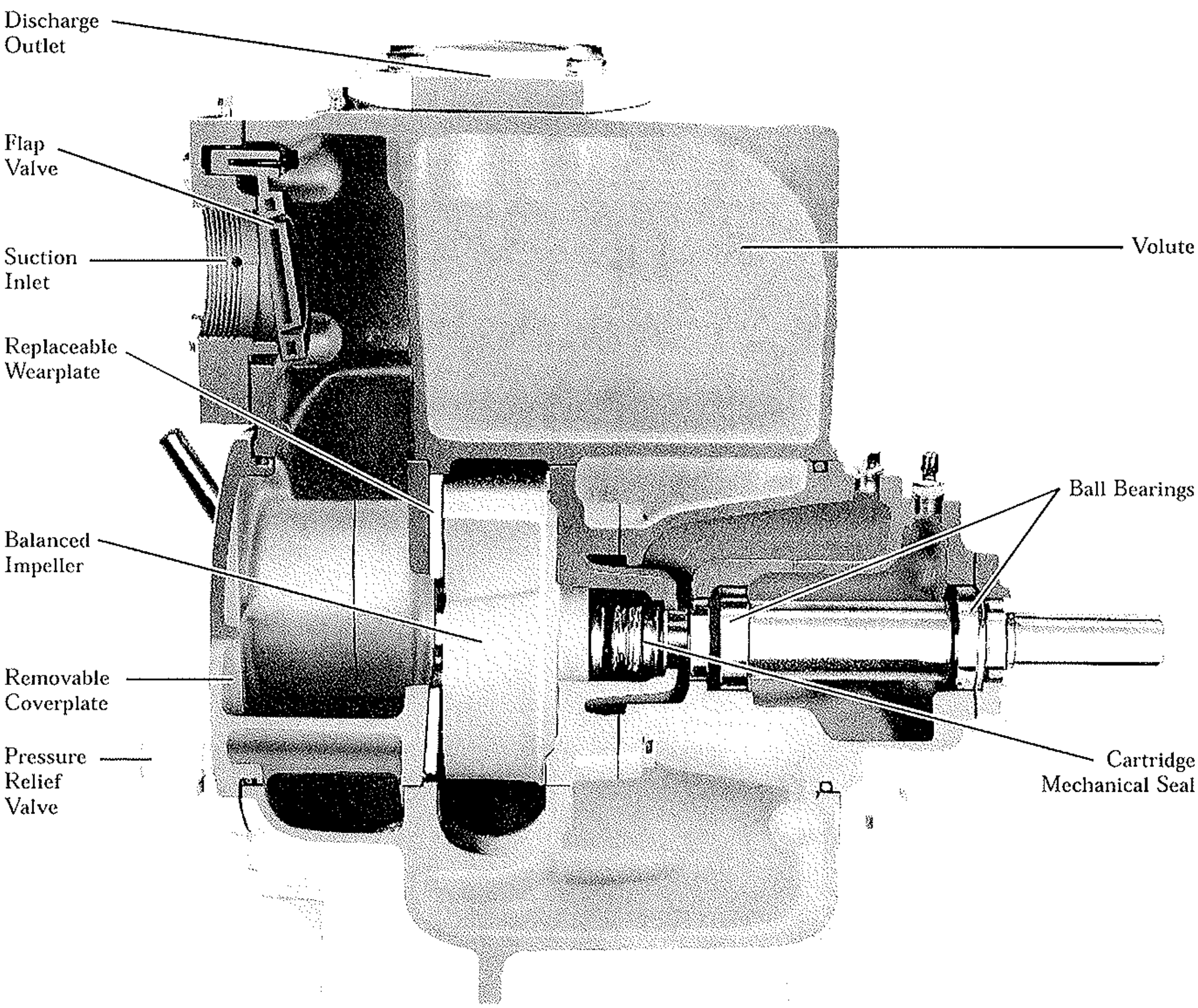
Sizes: 3", 4", 6", 8", 10" (75 mm, 100 mm, 150 mm, 200 mm, 250 mm)

Materials of Construction: Cast Iron, 316 Stainless Steel, CD4MCu, G-R Hard Iron

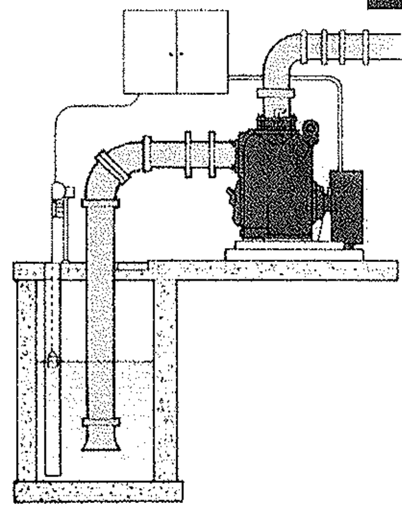
Max. Capacity: 3400 gpm (214 lps)

Max. Head: 130 ft. (39.6 m)

Max. Solids: 3" (76 mm)

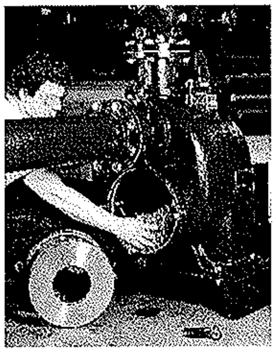


Self-Priming–the Superior Solution, for Several Reasons:



1. High and dry mounting for fast and easy service and maintenance

Because Gorman-Rupp centrifugal pumps are self-priming, they can be mounted high and dry at floor level, with only the suction line down in the liquid. Service or maintenance can be performed quickly and simply with common hand tools and without having to pull the pump. There are no long drive shafts to install and align, no hoists or cranes required, and no need for service personnel to enter the sump.

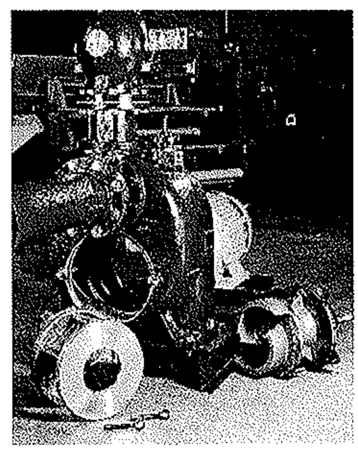


2. Clogging is kept to a minimum, so downtime is virtually eliminated

Gorman-Rupp solids handling, self-priming T Series™ pumps help keep productivity high because they are designed for virtually clog-free performance. Solids handling pump models will handle spherical solids up to 3" (76 mm) in diameter and allow solids to pass through the entire pump, not just the impeller. If a clog does occur, it can be eliminated quickly and easily by opening the coverplate, removing the clog, and returning the pump to normal operation, all in just a few minutes' time.

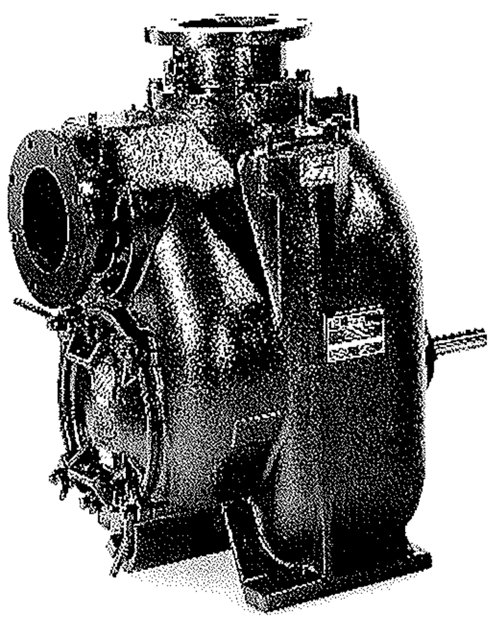
3. Service is simple, fast and economical

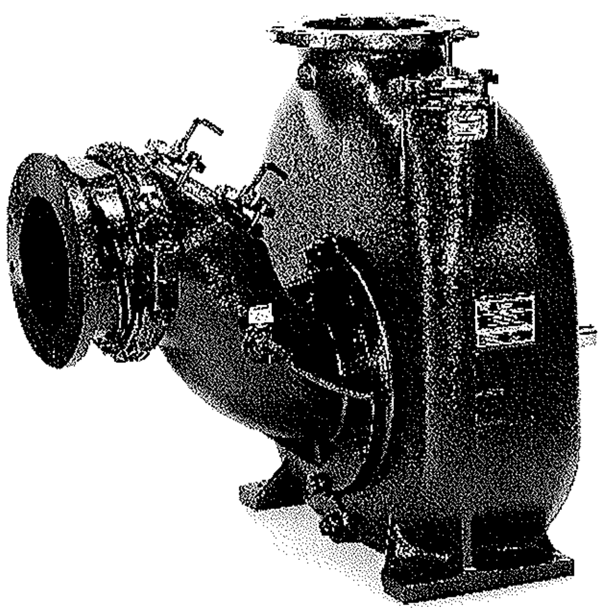
Our solids handling pump models are designed to make servicing a fast, simple and cost-efficient process. The removable coverplate allows for convenient inspection or service of the impeller, seal and wearplate, with no special tools required. If the pump shaft or bearings need service, the back pull-out design of this pump allows the entire rotating assembly to be removed without disturbing the pump casing or piping. Plus, the rotating assembly is sealed with an O-ring which permits external clearance adjustments.



4. Automatic priming means dependable performance

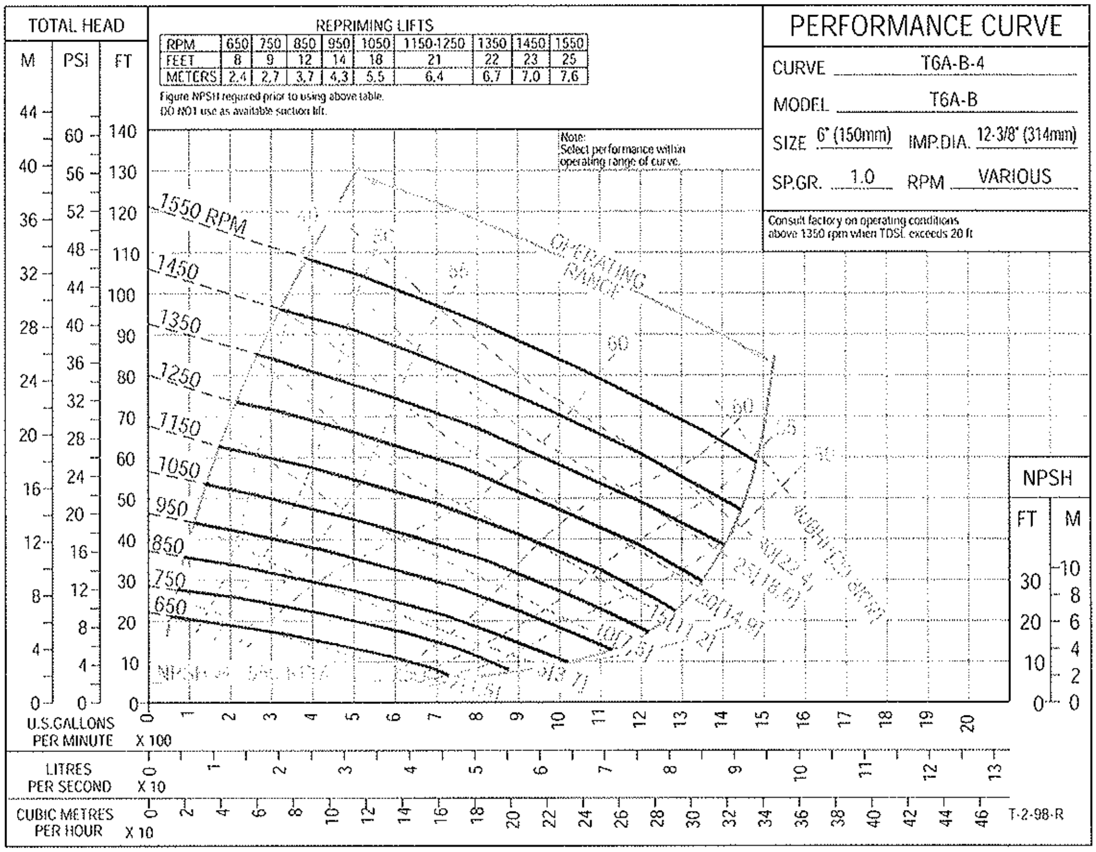
T Series™ self-priming pumps are a sensible solution for industry and municipalities because they require very little attention, resulting in significant savings of maintenance time and money. Properly applied and installed, and after an initial priming, Gorman-Rupp T Series™ pumps will continue to reprime automatically. In fact, T Series™ pumps will reprime with only a partially filled pump casing and a completely dry suction line.





6 INCH Performance Curve
(150 mm)

MODEL T6A60-B
MODEL T6A61-B
MODEL T6A65-B



REPRIMING LIFTS

RPM	650	750	850	950	1050	1150-1250	1350	1450	1550
FEET	8	9	12	14	18	21	22	23	25
METERS	2.4	2.7	3.7	4.3	5.5	6.4	6.7	7.0	7.6

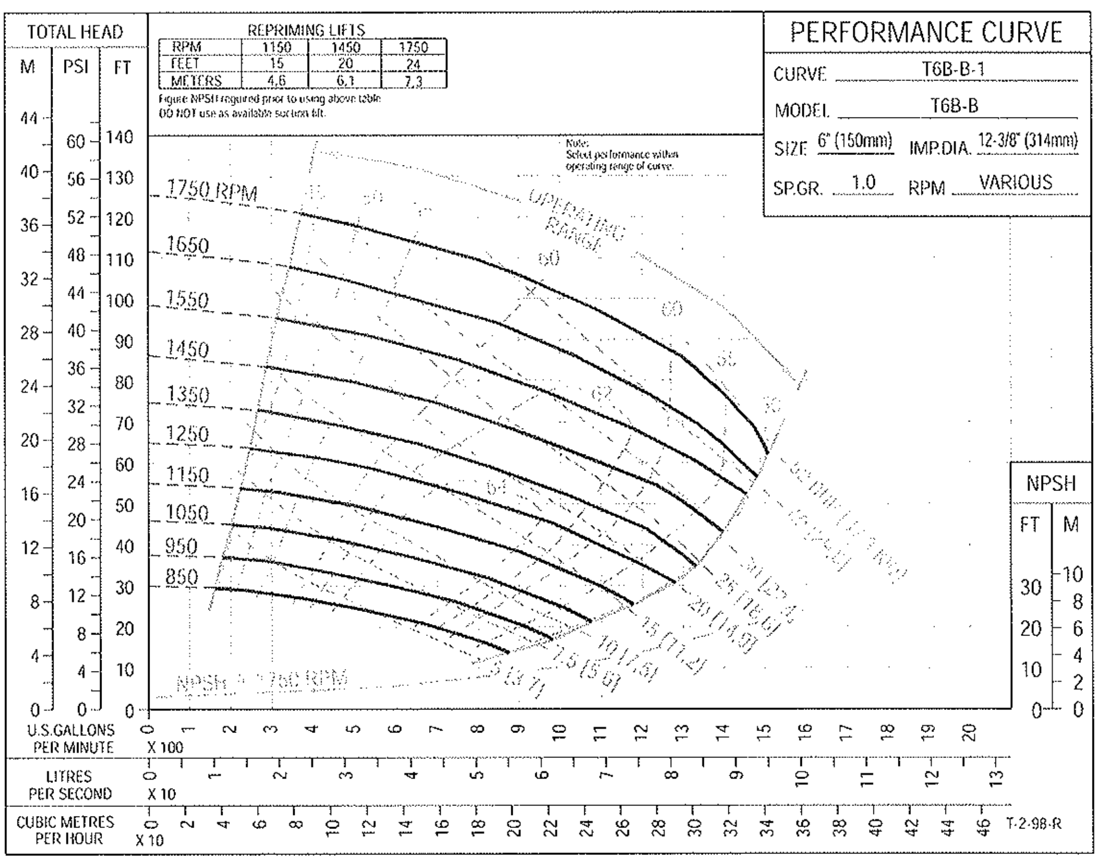
Figure NPSH required prior to using above table.
DO NOT use as available suction lift.

PERFORMANCE CURVE

CURVE T6A-B-4
MODEL T6A-B
SIZE 6" (150mm) IMP.DIA. 12-3/8" (314mm)
SP.GR. 1.0 RPM VARIOUS

Consult factory on operating conditions above 1350 rpm when TDSL exceeds 20 ft

MODEL T6B60-B
MODEL T6B61-B



REPRIMING LIFTS

RPM	1150	1450	1750
FEET	15	20	24
METERS	4.6	6.1	7.3

Figure NPSH required prior to using above table.
DO NOT use as available suction lift.

PERFORMANCE CURVE

CURVE T6B-B-1
MODEL T6B-B
SIZE 6" (150mm) IMP.DIA. 12-3/8" (314mm)
SP.GR. 1.0 RPM VARIOUS

BASKET STRAINER

Duplex Bag Filters With Automatic Sequencing

Continuous, uninterrupted filtering of large flows of liquid is provided by these automatic duplex filters

When the filter bags on one side get to the point of requiring change-out, the incoming flow is automatically diverted to the clean filter bags on the other side. Maintenance personnel are alerted to the need to change the dirty filters so that the system will be ready for the next cycle.

Typical step-by-step operation

1. As the filter bags in vessel A become so loaded with particulate that the differential pressure increases to a selected level, a switch actuates an air-operated valve in the loop pipe. This diverts a small flow of fluid to fill vessel B. After enough time to equalize the pressure in the two vessels, the four main valves are actuated by an air cylinder.

2. The duplex valve system shifts four valves at once, closing the inlet and outlet on vessel A and opening the two on vessel B.

   An indicator light (and remote signal, if desired) shows that vessel B is now being utilized. Another light shows that the shift from one vessel to the other has occurred, and that filter bags need to be replaced, An electrical interlock prevents another shift cycle until the dirty filter bags have been replaced and the operator has pushed a reset button.

3. With the interlock released, the system is ready to cycle whenever the pressure differential again indicates the necessity.

Availability

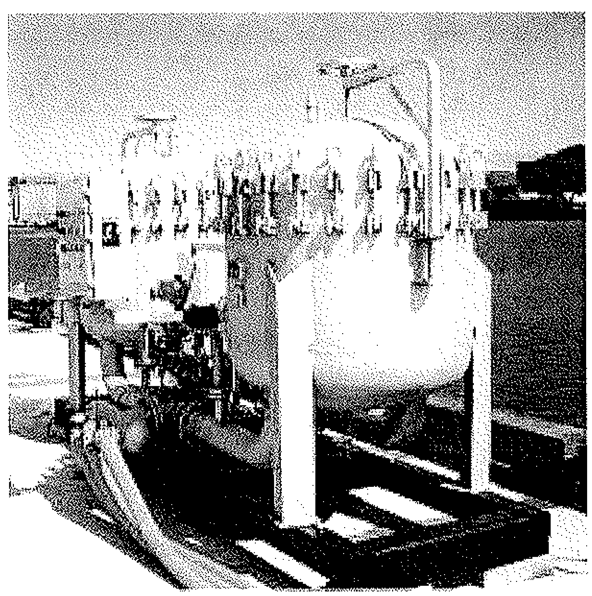
The automatic duplex valve system can be ordered on any Rosedale filter vessel. The standard multi-bag filter models are shown in the table.

The main inlet and outlet connections can be positioned to accommodate any flow direction within reason.

Systems are shipped assembled, ready for use, often on dollies or skids to assist putting them in place.

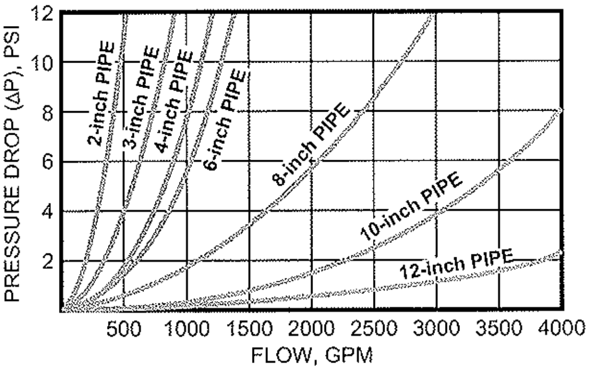
Rosedale Model No.*	Number of bags	Nominal flow rate, gpm
16	2	400
18	3	600
22	4	800
24	6	1200
30	8	1600
36	12	2000
42	17	3500
48	23	4500

* Model number also indicates vessel diameter in inches.



Models 16 through 48 – For flow rates to 4600 gpm

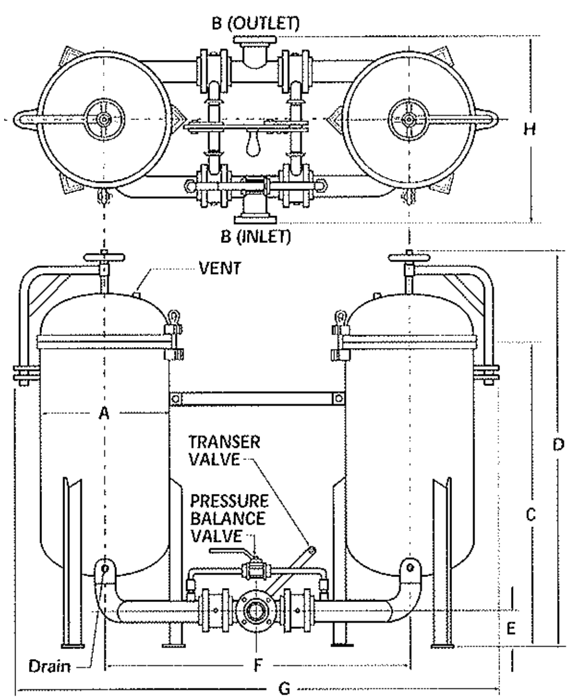
- Contain from 2 to 23 baskets
- Pipe sizes 2 through 12 inches, flanged
- Two basket depths: 15 or 30 inches (nominal) both 6.7 inches in diameter



Model Number	Number of Baskets	Basket Depth (nom.)	Surface Area (sq. ft.)	Flow Rate* (gpm)
16	2	30	8.8	400
18	3	30	13.2	600
22	4	30	17.6	800
24	6	30	26.4	1200
30	8	30	35.2	1600
36	12	30	52.8	2400
42	17	30	74.8	3400
48	23	30	101.2	4600

*Based on housing only. Fluid viscosity, filter cartridge used, and expected dirt loading should be considered when sizing a filter.

Multi-Basket Models (IN)



The inlets and outlets on all duplex systems come standard in a horizontal configuration (facing opposite directions). The option of arranging the inlet and outlet is available in three positions, 90° apart. The system is designed with flanged tees, allowing the orientation to be changed in the field.

Model (Dia.) A	Inlet/ Outlet B	C	D	E	F	G	H
16	2	40.1	57.1	4.5	40.3	65.3	25.3
	3	42.5	59.5	5.3	42.5	67.5	30.3
	4	44.9	61.9	6.0	45.0	70.0	35.0
18	2	40.5	58.0	4.5	42.3	69.3	26.4
	3	42.9	60.4	5.3	44.5	71.5	31.4
	4	45.3	62.8	6.0	47.0	74.0	36.3
22	2	41.4	60.0	4.5	46.3	77.3	24.9
	3	43.9	62.4	5.3	48.5	79.5	28.4
	4	46.2	64.7	6.0	51.0	82.0	31.8
	6	50.4	69.0	7.0	54.3	85.3	37.8
24	2	41.7	60.7	4.5	50.3	83.3	24.1
	3	44.1	63.1	5.3	52.5	85.5	28.8
	4	46.5	65.5	6.0	55.0	88.0	34.1
	6	50.7	69.7	7.0	58.3	91.3	40.1
30	2	42.8	63.3	4.5	56.3	95.3	28.4
	3	45.2	65.7	5.3	58.5	97.5	30.4
	4	47.6	68.1	6.0	61.0	100.0	32.4
	6	51.9	72.4	7.0	64.3	103.3	44.4
	8	56.4	76.8	8.3	67.0	106.0	49.4
36	3	46.4	68.4	5.3	64.5	109.5	34.1
	4	48.8	70.8	6.0	67.0	112.0	36.1
	6	53.1	75.1	7.0	70.3	115.3	39.1
	8	57.6	79.6	8.3	73.0	118.0	41.1
	10	62.1	84.1	9.5	77.0	122.0	60.1
42	4	50.0	73.5	6.0	73.0	124.0	40.1
	6	54.3	77.8	7.0	76.3	127.3	43.1
	8	58.8	82.3	8.3	79.0	130.0	45.1
	10	63.3	86.8	9.5	83.0	134.0	49.1
	12	68.0	91.5	11.0	86.0	137.0	69.1
48	4	51.0	76.0	6.0	79.0	136.0	44.5
	6	55.4	80.4	7.0	82.3	139.3	47.5
	8	60.0	85.0	8.3	85.0	142.0	49.5
	10	64.4	89.4	9.5	89.0	146.0	53.5
	12	69.2	94.2	11.0	92.0	149.0	55.5

BACKWASHABLE FILTER

Fuzzy Filter Operating Sequence

The Fuzzy Filter filtration system is controlled and operated automatically by programming in a PLC. Before initiating a filter run, the following conditions must exist. The upper moveable perforated plate is in the down (filtering) position. Between this plate and the lower fixed perforated plate is the Fuzzy Filter media which is compressed. The filtering cycle is initiated through the PLC controller as the following occurs:

1. The filter effluent valve opens, then the filter influent valve opens permitting the water to be filtered to enter the lower chamber of the filter vessel and rise up through the lower plate into and through the media and upper plate with discharge of the filtered water.

2. As the water travels up through the filter media bed, solids are captured by the fibrous media. After passing through the media bed, the filtered wastewater continues flowing upward and exits the filter vessel via the filter effluent outlet.

3. As filter continues, suspended solids are accumulated which results in an increase of pressure in the lower chamber. As pressure increases to predetermined set point, a sensor located in the side wall of the vessel below the lower plate, signals the PLC to initiate a wash cycle.

4. When the wash cycle is initiated, the effluent valve is closed. The water level in the vessel will then rise until it flows out through the wash water outlet. The upper perforated plate is raised to relieve the compression of the filter media and to increase the distance between the lower and upper plates for scouring of the media.

5. At a preset distance, the upper traveling plate will stop and the wash blower will start, which will then begin a sequence of air scouring of the expanded media bed. Air is introduced through diffusers located in the lower chamber of the filter vessel.

6. Rising air flowing up through the expanded media bed will cause an agitation of the spherical filter media. This agitation causes the media to release the captured solids to the surrounding water which is then conveyed up and out through the wash water outlet.

7. After a preselected series of scours the unit will return to the pre-filter mode by lowering the upper plate (as wastewater continues flowing upward) and again compresses the media. The automatic opening of the drain valve during the compression of the media may be required. At this point, incoming water is filtered with flow continuing through the wash water outlet to transport any remaining solids out the wash water outlet.

8. At a preset time, the influent and effluent valves are fully opened and the filter will return to the filter mode.

SEQUENCE OF OPERATION

The "normal" operation mode of a Schreiber, LLC Fuzzy Filter ® is the filtration mode. During the filtration mode the positions of the valves and elevator plate are:

The influent valve is open.
The filter's effluent valve is open.
The washing filter's two (2) air valves are closed.
The elevator plate is down at the assigned compression point.

Upon an instruction to wash, the Schreiber LLC Fuzzy Filter ® executes the following sequence. Each step of this sequence is timer based and is changeable by the operator. The steps are:

1) The effluent valve closes.
2) The filter's influent valve closes to the WASH position.
3) The elevator plate moves to the upper limit position (this gives the media room to move around during the next six (6) steps (air valve "stages").
4) The Blower is started.
5) Air Valve A is opened.
6) Air Valve B is opened and Air Valve A is closed.
7) Air Valve A is opened while Air Valve B remains open (called Scour).
8) Air Valve B is closed while Air Valve A remains open.
9) Air Valve A is opened while Air Valve B remains open (Scour).
11) Air Valve A is closed and Air Valve B is closed.
12) The Blower is stopped.
13) The elevator plate is lowered to the assigned compression point.
14) This stage is called the Purge Stage:
    - Air valves are closed.
    - Effluent valve is closed.
    - Influent valve is opened.
    - Elevator plate is down.
    - Blower is stopped.
15) At the end of the Purge stage the effluent valve is opened.

The events that will initiate the wash sequence are:

The "time since last wash" timer (operator adjustable).
Pressure transmitter located at the bottom of the filter.
The time of day clock, if set.
The Press to Wash push button on the **SYSTEM STATUS AND FILTER STATUS SCREEN.**
The Next Wash will Occur if ENABLED.

FACTORY DEFAULT VALUES

Air Valve Wash Sequence Timers

Each step of the wash sequence is timer based and is changeable by the operator.
The factory default timer values are:

1) Stage 1 — Air Valve A is opened (120 seconds).
2) Stage 2 — Air Valve B is opened and Air Valve A is closed (120 seconds).
3) Stage 3 — Air Valve A and Air Valve B are open (120 seconds).
4) Stage 4 — Air Valve A is opened (120 seconds).
5) Stage 5 — Air Valve B is opened and Air Valve A is closed (120 seconds).
6) Stage 6 — Air Valve A and Air Valve B open (180 seconds).
7) Stage 7 — Air Valve A and Air Valve B closed (300 seconds).

WASH TIMERS
Minimum 30 seconds
Maximum 1200 seconds

WASH TIMER #6
Minimum 120 seconds
Maximum 1200 seconds

PURGE TIMERS
Minimum 200 seconds
Maximum 1200 seconds

Pressure Transmitter Set Point

Each Fuzzy Filter ® has a pressure transmitter located at the bottom of the vessel. The pressure transmitter monitors the back pressure on the influent side of the filter media. When this back pressure reaches its set point, a wash cycle is initiated.

The factory default set point of the pressure transmitters is 5.2 psi.

The set point is operator adjustable from 3.0 psi to 8.0 psi.

Filter Media Compression

Filter media compression is used to optimize performance of the filter. At increased compressions, the filter will remove smaller particles. The trade off is the smaller the particles removed, the shorter the filtering run time. It is the operating personnel's responsibility to decide the optimum operating media compression.

Minimum 0%
Maximum 40%
Increments 1%

Password

The password to make any changes to any set points or settings is 123. The password can to changed on the **SECURITY** screen.

Wash Timer Intervals

Minimum 1 hour
Maximum 24 hours

BACKWASH TREATMENT UNIT

ECOLOGIX ENVIRONMENTAL SYSTEMS

5100 Old Ellis Point - Suite 200
Roswell, GA 30076
Tel: 678-514-2100 / 888-326-2020
Email: info@EcologixSystems.com
Web Site: www.EcologixSystems.com

Metal Hydroxides Inclined Plate Clarifier (Lamella) Principles of Operation

The IPC Series is a cost competitive clarifier which utilizes the time proven concept of Inclined Plate Clarification. Unlike conventional circular or rectangular basins, an Inclined Plate Clarifier relies solely on gravity to settle and concentrate suspended solids in the pre-treated liquid flow. The most significant aspect of the design is the large settling area provided by the 60° Inclined Plates. Each plate pack offers a projected equivalent settling area of 140 sq. ft. and is constructed of F.R.P. to resist corrosion.

Metal hydroxide wastes, which have been previously treated, flow by gravity or are pumped to the IPC to remove the insoluble Hydroxides. Flowing first to the Flash Mix/Flocculation Chamber where polymer flocculants are automatically removed at concentrations of 2-3% by weight for subsequent final dewatering.

IPC Construction

The "IPC" is constructed of rugged ¼" rolled mild steel. All wetted steel parts are sand blasted to white metal then coated with coal tar epoxy to resist corrosion. Exterior surfaces are, likewise, sandblasted, primed and painted with chemical resistant epoxy. The Inclined Plate packs are made of chemical resistant fiberglass providing a smooth surface which retards solids build-up between the plates. Influent V-Notch weirs and effluent launderers guarantee even flow throughout the plate settling area.

Included as standard to the IPC is the built-in flash mix/flocculator section with gear driven mixer, sludge removal butterfly and air operated pinch valves. The conservative sludge collection/thickening cone sizing eliminates the need for additional thickening devices, prior to dewatering.

STATE OF THE ART
Metal Hydroxides Removal

Large circular and rectangular clarifiers have been used for many years in the Metal Finishing Industry. The Inclined Plate Clarifier designed for metal hydroxides offers state of the art clarification proven effective in numerous installations.

The IPC is a complete package offering high efficiencies of solids removal combined with built-in sludge thickening within the large coned bottom storage area.

MODEL IPC 140/60 INCORPORATED INTO A 30GPM SYSTEM. DESIGN INCLUDES: NEUTRALIZATION, CLARIFICATION, SLUDGE STORAGE AND DEWATERING FILTER PRESS.

WWE OFFERS INDIVIDUAL COMPONENTS, ENGINEERING, SYSTEM UPGRADES AND COMPLETE TREATMENT SYSTEMS.

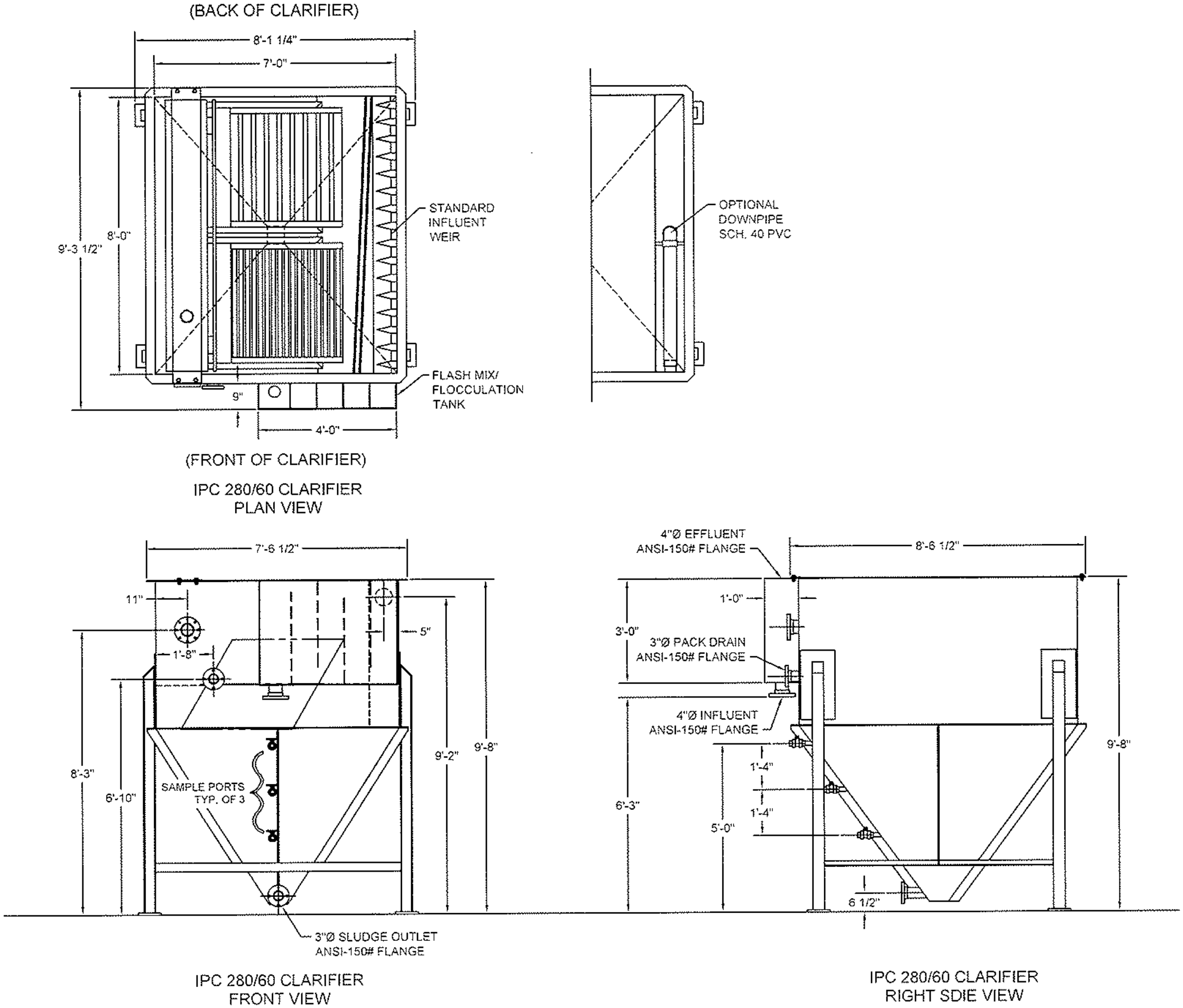
BASIC IPC CLARIFIER									
IPC Model	No. Of Packs	Projected Settling Area	No. Of Cones	Weights		Flow Rate GPM*	Dimensions		
				Operating	Dry		L	W	H
140/60	1	140ft.^{2}	1	11,000#	4,000#	30	8'-1"	4'-6"	10'-0"
280/60	2	280ft.^{2}	1	18,000#	5,000#	60	7'-0"	8'-0"	10'-0"
560/60	4	560ft.^{2}	2	35,000#	7,000#	120	11'-6"	8'-0"	10'-6"
840/60	6	840ft.^{2}	2	54,000#	10,800#	180	11'-6"	12'-0"	12'-0"
1120/60	8	1120ft.^{2}	2	60,000#	12,500#	240	19'-6"	8'-0"	11'-0"
1680/60	12	1680ft.^{2}	4	98,000#	17,000#	360	19'-6"	12'-0"	12'-0"

The IPC Gravity Clarifier is available in six standard sizes as shown in the chart above. Custom modifications of the standard units and installation of packs to existing circular or rectangular clarifiers to improve efficiency are available to meet your exact requirements.

IPC

Offers these important **Benefits** and **Advantages** over the competition.

- **Lower installed costs, up to 50%**
- **Reduced floor space, up to 90%**
- **Less Equipment, No additional thickening required**
- **Low Maintenance, No moving parts**
- **Completely automatic, gravity in gravity out**
- **Conservative Design – 0.2 gpm/ft^2 hydraulic loading**

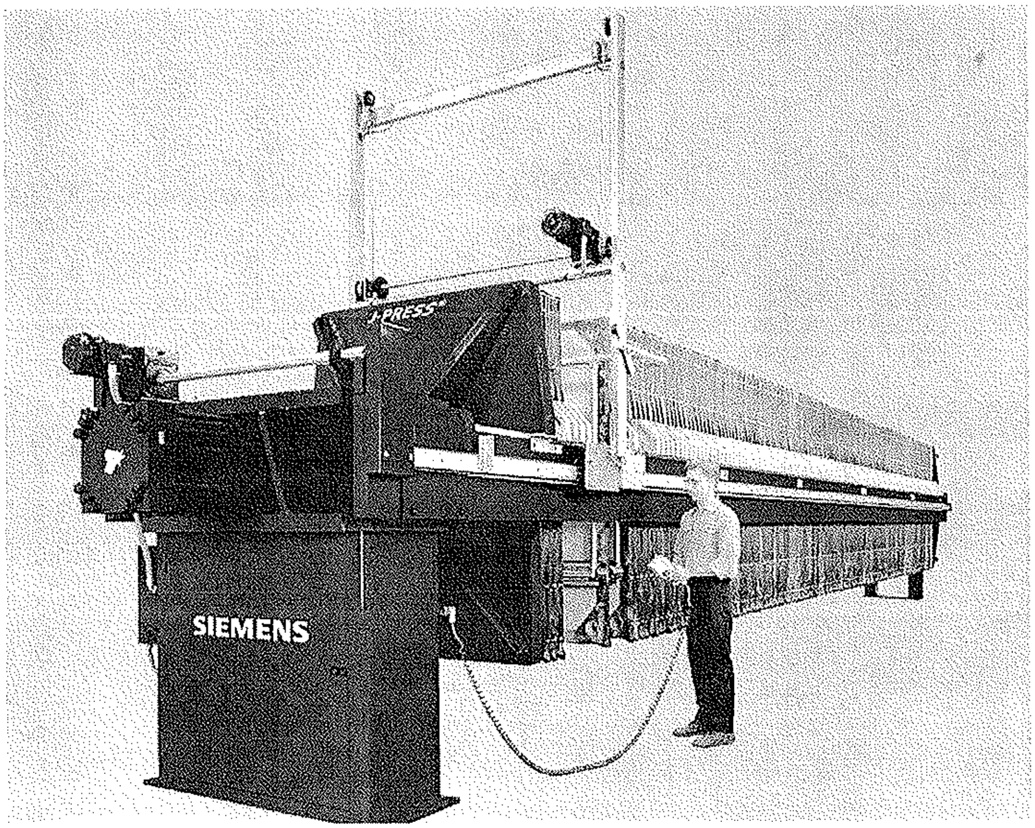


ECOLOGIX ENVIRONMENTAL SYSTEMS

DWG. NO.	
OF	
JOB NO.	
LAST UPDATE	08/25/2009
CAD FILE	
DATE	05/06/97
SCALE	NONE
DRAWN BY	R. STEPKA
CHECKED BY	

FILTER PRESS

J-Press® Filter Press – The Industry Standard



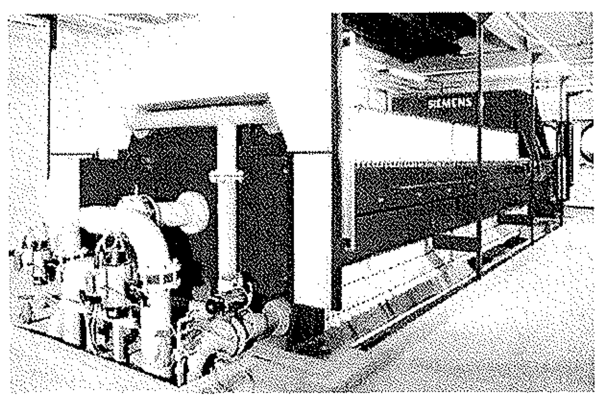
1.5m x 2.0m Fully automatic with automatic cloth washer.

Liquid/Solid Separation Process

The J-Press® sidebar filter press is the cost-effective solution for producing high solids filter cake with extremely high clarity in the liquid effluent. Considered by industry professionals as the premier sidebar filter press, the J-Press® filter press combines rugged construction, precision engineering, ease of operation and a wide range of features and options to tackle the most difficult dewatering problems.

The J-Press® filter press is one of the most versatile dewatering devices on the market, being used in a wide variety of industrial and municipal applications. The J-Press® filter press can be used to recover both solids and liquids from a waste or process stream. With superior materials of construction, the J-Press® filter press is especially useful in the dewatering of aggressive acid and alkali suspensions.

Available in a wide range of sizes and styles, the J-Press® filter press can be configured to provide a dewatering solution to most all process flows from as little as 25 gallons to 1,000,000 gallons per day. It produces consistent results under varying influent conditions.

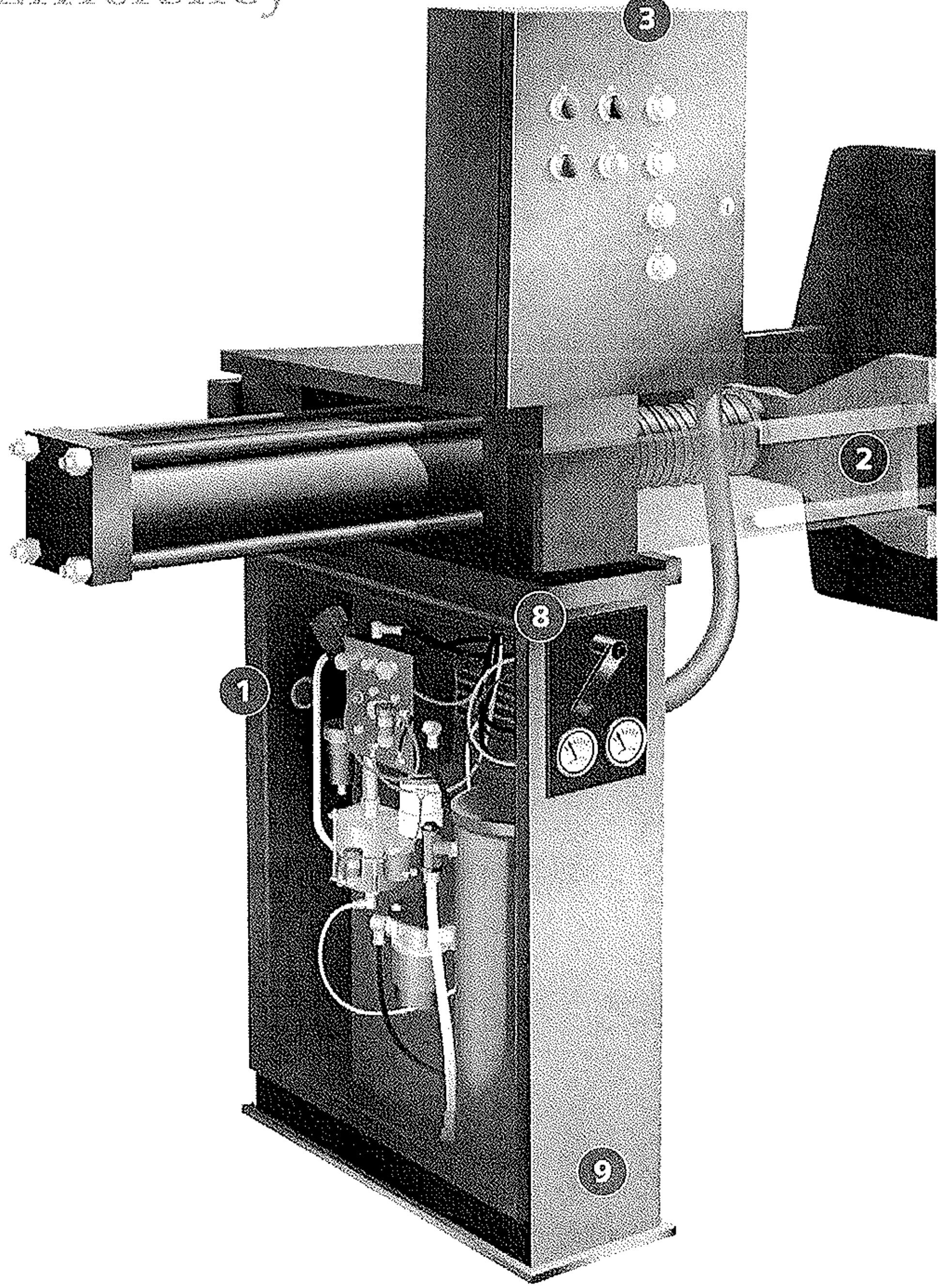


1500mm fully automatic with automatic cloth washer.

CWB Certification

The Canadian Welding Bureau acknowledges that Siemens Water Technologies is certified to CSA Standard W47.1.

Engineered Performance and Operating Efficiency



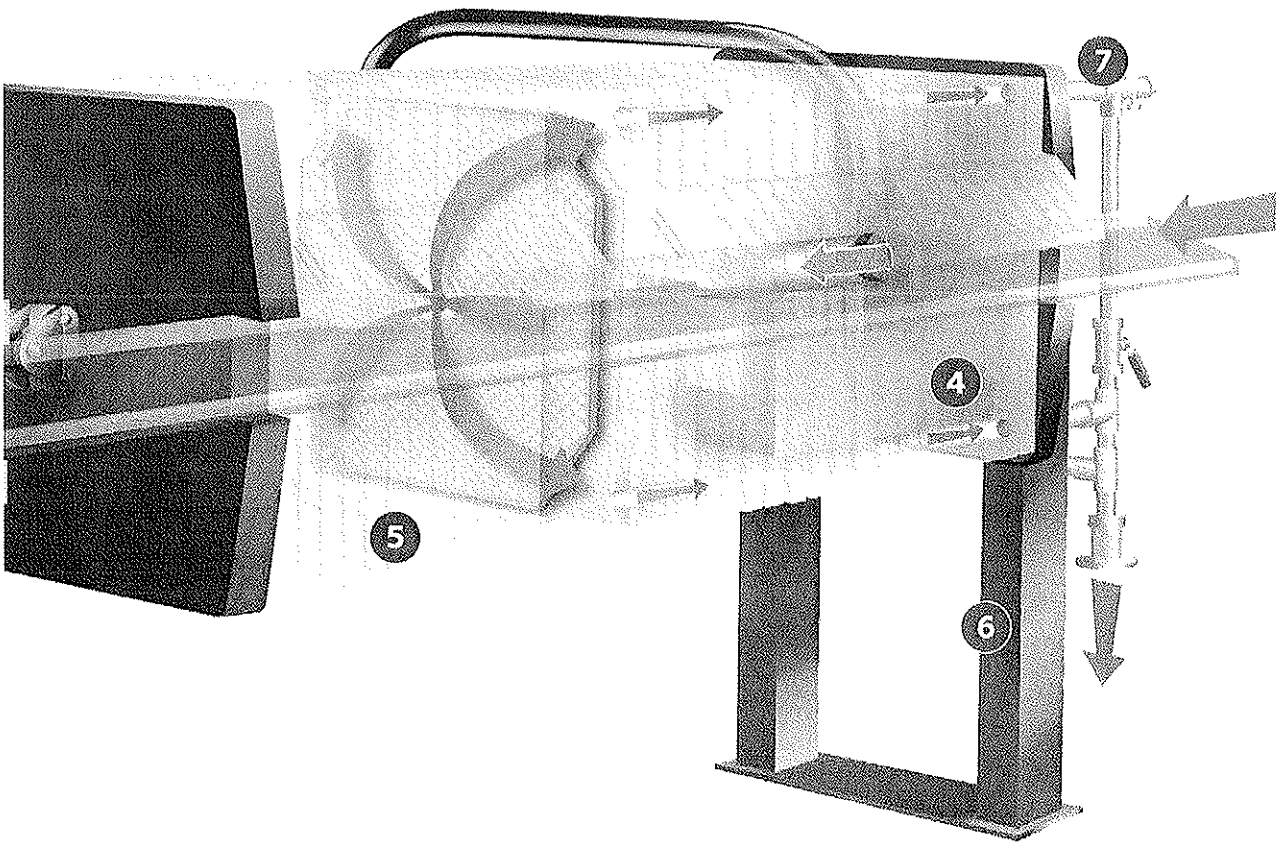
1. Modularized Hydraulic Closure Systems — Available with either pneumatic or electric power, the modular power pack delivers up to 5,000 psi of hydraulic pressure to the hydraulic cylinder. The unit automatically compensates for thermal expansion and contraction of the filter pack due to changes in process temperature. Designed to minimize power consumption, the power pack features color coded connections for quick and easy removal and replacement during service and maintenance. The hydraulic pump and associated components are fully enclosed in a steel cabinet for protection from contamination and accidental damage, yet are easily accessible for maintenance through the full width cabinet door.

2. Future Expandability — The J-Press® filter press can be equipped with an optional expansion piece for future expansion of operating capacity with no need for costly sidebar replacements or frame exchanges. Expanding the capacity is as easy as adding additional filter plates.

3. Automatic Pump Control System (APCS) — For smaller presses, the APCS automatically controls the filling cycle, gradually increasing the feed pressure of the slurry feed pump to ensure a uniform formation of filter cake in the filter plate chambers. The uniform cake formation enhances the dewaterability of the incoming slurry. The APCS includes a hydraulic pressure safety device that shuts down the feeding cycle if a loss in hydraulic pressure occurs. For larger presses, filter press filling is controlled by a PLC.

4. Plate Shifter/Cloth Washing — The J-Press® filter press is available with either semi-automatic or fully automatic plate shifting systems (depending on size). The semi-automatic plate shifter is an operator driven plate shifting device that reduces manpower requirements during cake discharge. Further reductions in manpower are available with fully automatic shifting systems. The patented Siemens pry, bump and weigh system offers the additional advantage of positive cake discharge from each chamber further reducing the requirement for operator interface with the filter press during cake discharge.

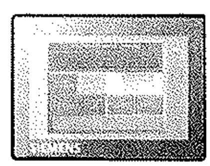
A cloth washing system can also be added to the automatic plate shifting system to provide a periodic high pressure cleaning cycle for the filter cloths. Operating in as little as 20 seconds per plate, the automatic high pressure cloth washing system can restore the porosity of the filter cloths to like new condition. Washing the cloths at regular intervals not only improves performance but prolongs the working life of the cloth as well.



5. Numerous Filter Pack Options — A wide selection of filter plate materials and styles makes the J-Press® filter press one of the most versatile dewatering devices on the market. With materials of construction ranging from polypropylene to PVDF and nylon, the J-Press® filter press can be designed to handle virtually any feed slurry no matter how corrosive or chemically aggressive. Filter plates are available in recessed gasketed, recessed non-gasketed and diaphragm (or membrane) squeeze designs that can dewater everything from the easiest metal hydroxide slurry to difficult organic solids. The J-Press® filter press can readily adapt to changes in product and process applications by simply changing the filter cloths or the filter plates, giving the system great operational flexibility.

6. Robust Frame Construction — The J-Press® filter press is a ruggedly built unit made of fabricated steel plate. Precision alignment and machining of the structural components provide for even distribution of all pressures and stresses generated during operation. Frame strength is based upon the filter press operating pressure of either 100 psi (7 bar) or 225 psi (16 bar).

7. Manifold Piping — Like the filter plates, manifold piping is supplied in a variety of non-metallic and metallic materials suited to meet the rigors of the application. Manifolds can also be configured in a variety of inlet, discharge and valve options to maximize the versatility of the filter press. With the appropriate manifold, a filter press can be designed to perform both pre and post dewatering operations that enhance both the dewaterability of the material and the quality of the final cake.



8. Control Systems — Filter press control can be as simple as a single switch for opening and closing to as complex as a fully integrated PLC with Ethernet or wireless capabilities for remote monitoring and operation. The PLC system provides the most advanced and complete press operation available, from automatic feed pressure adjustment, to cycle frequency, cake discharge, cloth wash and air blowdown.

9. Superior Paint System — Each J-Press® filter press is sandblasted to an SSPC-10 near white finish before being primed and finished with a high quality, single coat aliphatic polyurea, fast clad DTM urethane paint system that results in a durable, chemically resistant finish averaging 6-9 mils in thickness (other paint systems are available on request).

Specification/Selection Charts

The following formula may be used for establishing J-Press® filter press volume (ft^3) (L) for most dewatering applications:

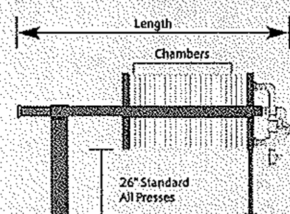
$$\text{Total Filter Press Volume } (ft^3)\,(L) = \frac{\begin{array}{c}\text{Total volume of product feed} \\ \text{(gallons) (liters)}\end{array} \times \begin{array}{c}\text{\% solids concentration} \\ \text{of product feed*}\end{array} \times \begin{array}{c}\text{8.34 (lbs per gallon of water)} \\ \text{(1 kg/L) (density of water)}\end{array} \times \begin{array}{c}\text{specific gravity} \\ \text{of feed slurry}\end{array}}{\begin{array}{c}\text{Density of wet filter cake**} \\ (lbs/ft^3)(kg/L)\end{array} \times \begin{array}{c}\text{\% dry solids content} \\ \text{of filter cake*}\end{array}} \quad \text{or} \quad \frac{\text{lbs (kg) dry solids}}{\text{cake density } (lbs/ft^3)(kg/L) \times \text{\% cake solids}}$$

* % concentration should be expressed in decimal form (e.g. 2% = .02).

**Density of wet filter cake = Specific gravity of wet filter cake x the density of water

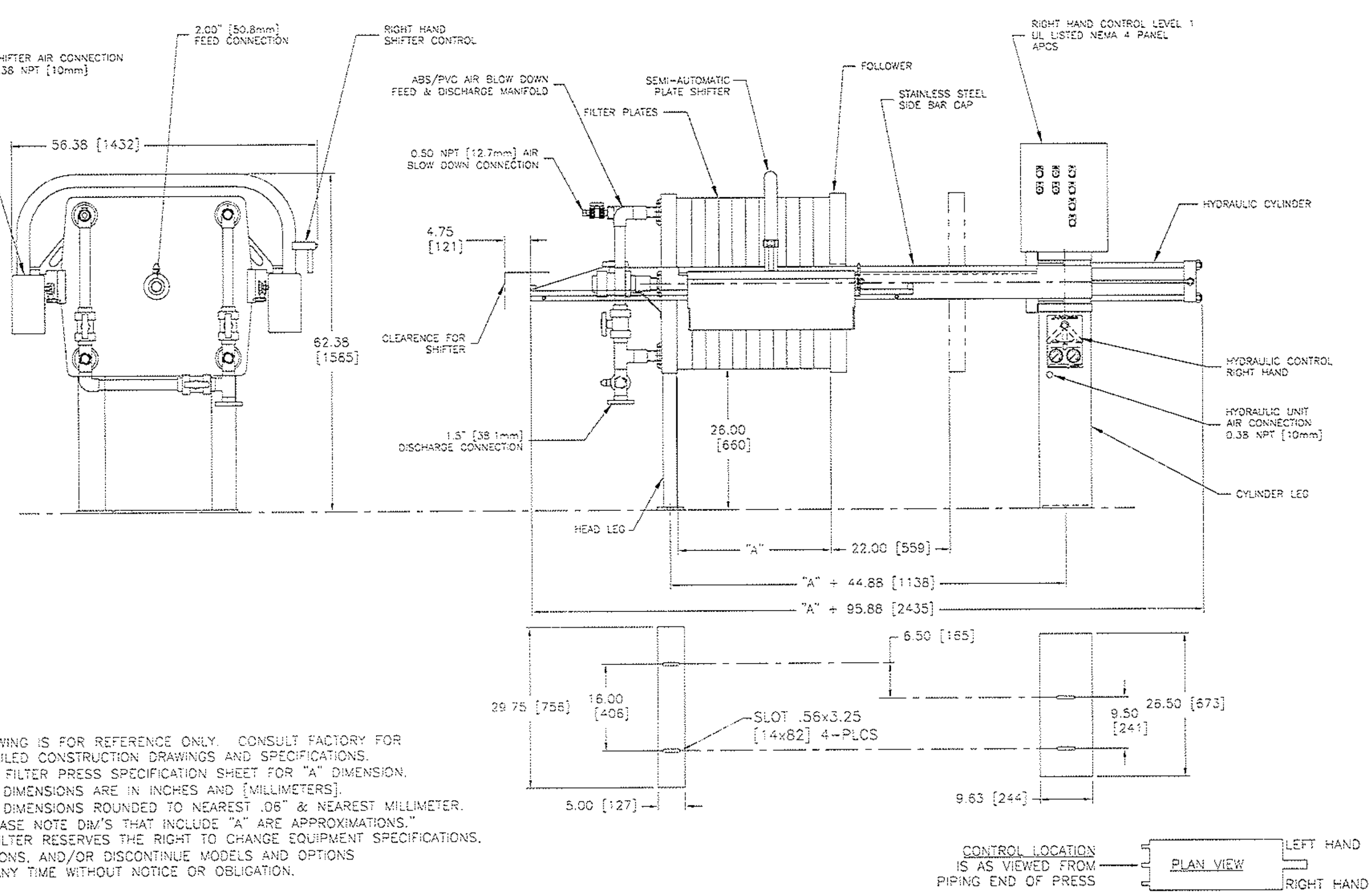
For dewatering applications where feed solids are less than 1%, the dewatering area is the controlling parameter rather than volume. For such applications, contact Siemens for size recommendations. Also, for advice on sizing for any application, contact Siemens or our authorized representative.

PRESS	MEASUREMENT	MINIMUM	MAXIMUM
250mm	Volume (ft^3)	0.1	0.4
	Volume (L)	2.8	11.3
Height 15" (381mm)	Length (in)	24.0	38.0
Width 18.5" (470mm)	Length (mm)	607.0	975.0
470mm	Volume (ft^3)	0.5	4.0
	Volume (L)	14.2	113.0
Height 45.8" (1162mm)	Length (in)	41.0	93.0
Width 33.0" (838mm)	Length (mm)	1041.0	2362.0
630mm	Volume (ft^3)	2.0	8.0
	Volume (L)	57.0	227.0
Height 51.0" (1299mm)	Length (in)	85.0	129.0
Width 36.0" (916mm)	Length (mm)	2168.0	3277.0
800mm	Volume (ft^3)	8.0	25.0
	Volume (L)	227.0	708.0
Height 58.0" (1473mm)	Length (in)	122.0	196.0
Width 43.5" (1105mm)	Length (mm)	3099.0	4978.0
1000mm	Volume (ft^3)	25.0	55.0
	Volume (L)	708.0	1558.0
Height 66.5" (1689mm)	Length (in)	175.0	260.0
Width 51.5" (1308mm)	Length (mm)	4445.0	6604.0
1200mm	Volume (ft^3)	50.0	125.0
	Volume (L)	1416.0	3540.0
Height 74.5" (1892mm)	Length (in)	217.0	356.0
Width 60.0" (1524mm)	Length (mm)	5512.0	9042.0
1500mm	Volume (ft^3)	130.0	270.0
	Volume (L)	3682.0	7646.0
Height 95.7" (2432mm)	Length (in)	313.0	500.0
Width 74.9" (1903mm)	Length (mm)	7950.0	12,700.0
1.5 x 2.0M	Volume (ft^3)	275.0	350.0
	Volume (L)	7788.0	9912.0
Height 136.6" (3470mm)	Length (in)	430.0	507.0
Width 79.0" (2007mm)	Length (mm)	10,922.0	14,097.0
2.0 x 2.0M	Volume (ft^3)	300.0	600.0
	Volume (L)	8496.0	16,992.0
Height 106.0" (2692mm)	Length (in)	405.0	562.0
Width 137.0" (3480mm)	Length (mm)	10,287.0	14,275.0



Notes:

- *Based on 32mm cake thickness, 100psi (7bar)*
- *Additional sizes and capacities available — consult factory.*
- *All dimensions are approximate and should only be used for reference.*
- *Dimensions do not include optional equipment such as plate shifters, cloth washers or piping manifolds.*



NOTES:
1. DRAWING IS FOR REFERENCE ONLY. CONSULT FACTORY FOR DETAILED CONSTRUCTION DRAWINGS AND SPECIFICATIONS.
2. SEE FILTER PRESS SPECIFICATION SHEET FOR "A" DIMENSION.
3. ALL DIMENSIONS ARE IN INCHES AND [MILLIMETERS].
4. ALL DIMENSIONS ROUNDED TO NEAREST .06" & NEAREST MILLIMETER. "PLEASE NOTE DIM'S THAT INCLUDE "A" ARE APPROXIMATIONS."
5. USFILTER RESERVES THE RIGHT TO CHANGE EQUIPMENT SPECIFICATIONS, OPTIONS, AND/OR DISCONTINUE MODELS AND OPTIONS AT ANY TIME WITHOUT NOTICE OR OBLIGATION.

THIRD ANGLE PROJECTION

DIMENSIONS IN [ ] ARE MILLIMETERS
DO NOT SCALE DRAWING

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN

DESIGNER	DATE
MJB	05MAR01
CHECKER	DATE
ENGINEER	DATE
MANAGER	DATE
FILE:	
SCALE:	

TITLE FILTER PRESS 800mm 100psi (7bar)
SEMI-AUTOMATIC FILTRATION PROCESS
SEMI-AUTOMATIC DISCHARGE
WITH GASKETED PLATES

USFilter
DEWATERING SYSTEMS GROUP
HOLLAND MICHIGAN USA
TEL: 616-772-9011

PROJECT	CODE	DRAWING	SHEET	REV
		13744800	1 OF 1	–

CHEMICAL FEED PUMPS

Data Sheet

Series C
Electronic Metering Pumps

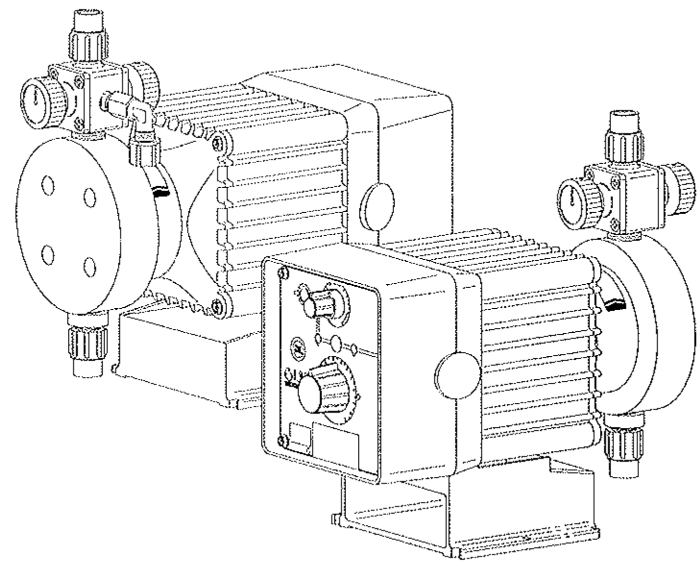
Configuration Data

Model [C92] [1] - [363SI]

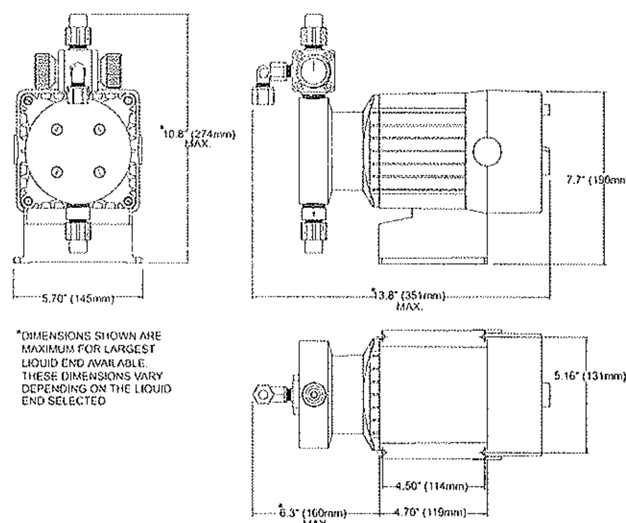
Control & Output Code
Manual Control
Speed (stroking frequency) and stroke length manually adjustable.
C10 --- 1.3 GPH (4.9 l/h) ... 300 psi (20.7 Bar)
C11 --- 2.5 GPH (9.5 l/h) ... 150 psi (10.3 Bar)
C12 --- 4.0 GPH (15.1 l/h) ... 100 psi (6.9 Bar)
C13 --- 8.0 GPH (30 l/h) ...... 60 psi (4.1 Bar)
C14 ---- 20 GPH (76 l/h) ..... 25 psi (1.7 Bar)
Instrument Responsive/Manual Control
Manual adjustment features of C1 Series plus switch conversion to external control for automatic systems.
C70 --- 1.3 GPH (4.9 l/h) ... 300 psi (20.7 Bar)
C71 --- 2.5 GPH (9.5 l/h) ... 150 psi (10.3 Bar)
C72 --- 4.0 GPH (15.1 l/h) ... 100 psi (6.9 Bar)
C73 --- 8.0 GPH (30 l/h) ..... 60 psi (4.1 Bar)
C74 ---- 20 GPH (76 l/h) ...... 25 psi (1.7 Bar)
C76 --- 4.0 GPH (15.1 l/h) .... 175 psi (12.1 Bar)
C77 ---- 10 GPH (38 l/h) ...... 80 psi (5.5 Bar)
C78 ---- 25 GPH (95 l/h) ...... 30 psi (2.07 Bar)
C90 --- 1.3 GPH (4.9 l/h) .... 300 psi (20.7 Bar)
C91 --- 2.5 GPH (9.5 l/h) .... 150 psi (10.3 Bar)
C92 --- 4.0 GPH (15.1 l/h) .... 100 psi (6.9 Bar)
C93 --- 8.0 GPH (30 l/h) ...... 60 psi (4.1 Bar)
C94 ---- 20 GPH (76 l/h) ...... 25 psi (1.7 Bar)

Voltage Code
1 -------- 120 VAC US Plug
2 -------- 240 VAC US Plug
3 -------- 220-240 VAC DIN Plug
5 -------- 240-250 VAC, UK Plug
6 -------- 240-250 VAC, AUST/NZ Plug
7 -------- 220-240 VAC, SWISS Plug

Liquid End
See next page for complete liquid end specifications and selection.



Dimensions



Specifications

Series	Strokes Per Minute (Adjustable) Min	Max	Stroke Length (Adjustable) Recommended Minimum	Average Input Power @Max Speed	Shipping Weight
C10, C70, C90 C11, C71, C91 C12, C72, C92 C13, C73, C93 C14, C74, C94	1	100	10%	44 watts	20 lbs (9.1 kg)
C76 C77 C78	1	100	10%	87watts	28 lbs (12.7 kg)

LMI MILTON ROY

8 Post Office Square
Acton, MA 01720 USA
TOLL FREE: (800) 564-1097
TEL: (978) 263-9800
FAX: (978) 264-9172
http://www.lmipumps.com

Replaces same of Rev.D 10/99
1712.E 11/01

Configuration Data & Materials of Construction

Drive Assembly	Liquid End No.	Size Code	Materials of Construction: Head & Fittings	Balls	Liquifram™	Check Valve	Accessory	Tubing & Connections: Discharge	Suction
C90 ▧ -	498SP	0.9	PVC	Ceramic	Fluorofilm™	PTFE	4FV	Pipe 1/4" NPT M	
C70 ▧ -	297	0.9	316 S.S.	316 S.S.	Fluorofilm™	316 S.S.		Pipe 1/4" NPT M	
C10 ▧ -									
	468SI	1.8	PVC / PVC	Ceramic	Fluorofilm™	PVDF / Polyprel®	4FV	PE .375" O.D.	
	460SI†	1.8	Acrylic / PVC	Ceramic	Fluorofilm™	PVDF / Polyprel®	4FV	PE .375" O.D.	
	460FI	1.8	Acrylic / PVC	PTFE	Fluorofilm™	PVDF / Polyprel®	4FV	PE .375 O.D.	
	368SI†	1.8	PVC / PVC	Ceramic	Fluorofilm™	PVDF / Polyprel®	4FV	PE .375" O.D.	
C92 ▧ -	362SI†	1.8	PVDF / PVDF	Ceramic	Fluorofilm™	PVDF / Polyprel®	4FV	PE .375" O.D.	
C91 ▧ -	363SI†	1.8	PVDF / PVDF	Ceramic	Fluorofilm™	PVDF / PTFE	4FV	PE .375" O.D.	
C72 ▧ -	75HV	1.8	Polypropylene	316 S.S.	Fluorofilm™	PTFE		PE .5" O.D.	Vinyl .938" O.D.
C71 ▧ -	75S*	1.8	Polypropylene	Ceramic	Fluorofilm™	PTFE	4FV	PE .5" O.D.	
C12 ▧ -	76HV	1.8	Acrylic/PP	316 S.S.	Fluorofilm™	Hypalon®		PE .5" O.D.	Vinyl .938" O.D.
C11 ▧ -	79	1.8	UHMW PE	Ceramic	Hypalon®	Hypalon®		PE .5" O.D.	Vinyl .5" O.D.
	277	1.8	316 S.S.	316 S.S.	Fluorofilm™	316 S.S.		Pipe 1/4" NPT M	
	418SI#	3.0	PVC / PVC	Ceramic	Fluorofilm™	PVDF / Polyprel®	4FV	PE .5" O.D.	
	410SI†#	3.0	Acrylic / PVC	Ceramic	Fluorofilm™	PVDF / Polyprel®	4FV	PE .5" O.D.	
	410FI†#	3.0	Acrylic / PVC	PTFE	Fluorofilm™	PVDF / Polyprel®	3FV	PE .5" O.D.	
C93 ▧ -	318SI†#	3.0	PVC / PVC	Ceramic	Fluorofilm™	PVDF / Polyprel®	4FV	PE .5" O.D.	
C73 ▧ -	313SI†#	3.0	PVDF / PVDF	Ceramic	Fluorofilm™	PVDF / PTFE	4FV	PE .5" O.D.	
C13 ▧ -	312SI†#	3.0	PVDF / PVDF	Ceramic	Fluorofilm™	PVDF / Polyprel®	4FV	PE .5" O.D.	
	20HV	3.0	Acrylic / PP	316 S.S.	Fluorofilm™	Hypalon®		PE .5" O.D.	Vinyl .938" O.D.
	22	3.0	PVDF	Ceramic	Fluorofilm™	PTFE		PE .5" O.D.	
	22P	3.0	PVDF	Ceramic	Fluorofilm™	PTFE		Pipe 1/2" NPT M	
	24	3.0	PVC	Ceramic	Fluorofilm™	PTFE		Pipe 1/2" NPT M	
	25HV	3.0	Polypropylene	316 S.S.	Fluorofilm™	PTFE		PE .5" O.D.	Vinyl .938" O.D.
	25P	3.0	Polypropylene	Ceramic	Fluorofilm™	PTFE		Pipe 1/2" NPT M	
	25T	3.0	Polypropylene	Ceramic	Fluorofilm™	PTFE		PE .5" O.D.	
	27	3.0	316 S.S.	316 S.S.	Fluorofilm™	PTFE		Pipe 1/2" NPT M	
	29	3.0	UHMW PE	Ceramic	Fluorofilm™	Hypalon®		PE .5" O.D.	
	30	6.0	Acrylic/PVC	Ceramic	Fluorofilm™	PTFE		PE .5" O.D	Vinyl .5" O.D.
	32	6.0	PVDF	Ceramic	Fluorofilm™	PTFE		PE .5" O.D.	
C94 ▧ -	32P	6.0	PVDF	Ceramic	Fluorofilm™	PTFE		Pipe 1/2" NPT M	
C78 ▧ -	34	6.0	PVC	Ceramic	Fluorofilm™	PTFE		Pipe 1/2" NPT M	
C74 ▧ -	35P	6.0	Polypropylene	Ceramic	Fluorofilm™	PTFE		Pipe 1/2" NPT M	
C14 ▧ -	35T	6.0	Polypropylene	Ceramic	Fluorofilm™	PTFE		PE .5" O.D.	
	36	6.0	PVC	Ceramic	Fluorofilm™	PTFE		PE .5" O.D.	
	37	6.0	316 S.S.	316 S.S.	Fluorofilm™	PTFE		Pipe 1/2" NPT M	
	468SP	1.8	PVC/PVC	Ceramic	Fluorofilm™	PVDF / Polyprel®	4FV	PE .375" O.D.	
C76 ▧ -	74S	1.8	Polypropylene	Ceramic	Fluorofilm™	PTFE	4FV	Pipe 1/4" NPT M	
	277	1.8	316 S.S.	316 S.S.	Fluorofilm™	316 S.S.		Pipe 1/4" NPT M	
	20HV	3.0	Acrylic/PP	316 S.S.	Fluorofilm™	Hypalon®		PE .5" O.D.	Vinyl .938" O.D.
	20S**	3.0	Acrylic/PVC	Ceramic	Fluorofilm™	Hypalon®	4FV	PE .5" O.D.	Vinyl .5" O.D.
	22	3.0	PVDF	Ceramic	Fluorofilm™	PTFE		Pipe 1/2" NPT M	
	22P	3.0	PVDF	Ceramic	Fluorofilm™	PTFE	4FV	Pipe 1/2" NPT M	
C77 ▧ -	24	3.0	PVC	Ceramic	Fluorofilm™	PTFE		Pipe 1/2" NPT M	
	25HV	3.0	Polypropylene	316 S.S.	Fluorofilm™	PTFE		PE .5" O.D.	Vinyl .938" O.D.
	25P	3.0	Polypropylene	Ceramic	Fluorofilm™	PTFE		Pipe 1/2" NPT M	
	25T	3.0	Polypropylene	Ceramic	Fluorofilm™	PTFE		PE .5" O.D.	
	26S**	3.0	PVC	Ceramic	Fluorofilm™	Viton®	4FV	PE .5" O.D.	
	27	3.0	316 S.S.	316 S.S.	Fluorofilm™	PTFE		Pipe 1/2" NPT M	
	29	3.0	UHMW PE	Ceramic	Fluorofilm™	Hypalon®		PE .5" O.D.	

▧ See front page for voltage code specifications.
**These Liquid Ends are available without a 4FV, simply drop the 'S' at the end of the Liquid End number to order the model without a 4FV.
#These liquid ends use 3/8" diameter balls. Pump output may be reduced in some applications.

†To specify ¼" NPT male, change 'I' to 'P'. To specify black, UV resistant tubing, change 'I' to 'U'. To specify Bleed 4FV, change 'S' to 'B'. To specify 3FV, change 'S' to 'T'.
Fluorofilm™ is a copolymer of PTFE and PFA.
Polyprel® is an elastomeric PTFE copolymer.

4FV indicates that the pump is equipped with an LMI Four Function Valve. This diaphragm type anti-syphon/pressure relief valve is installed on the pump head. It provides anti-syphon protection and aids in priming, even under pressure.

Output Information

Series	Gallons per Hour Min	Max	Liters per Hour Min	Max	mL/cc per Minute Min	Max	mL/cc per Stroke Min	Max	Maximum Injection Pressure	
C10, C70*, C90*	0.001	1.3	0.005	4.9	0.08	82	0.08	0.82	300 psi	(20.7 Bar)
C11, C71*, C91*	0.003	2.5	0.010	9.5	0.16	158	0.16	1.58	150 psi	(10.3 Bar)
C12, C72*, C92*	0.004	4.0	0.015	15.1	0.25	252	0.25	2.52	100 psi	(6.9 Bar)
C13, C73*, C93*	0.008	8.0	0.030	30.0	0.51	505	0.51	5.05	60 psi	(4.1 Bar)
C14, C74*, C94*	0.020	20.0	0.076	76.0	1.26	1262	1.26	12.62	25 psi	(1.7 Bar)
C76*	0.004	4.0	0.015	15.1	0.25	252	0.25	2.52	175 psi	(12.1 Bar)
C77*	0.010	10.0	0.038	38.0	0.63	631	0.63	6.31	80 psi	(5.5 Bar)
C78*	0.025	25.0	0.095	95.0	1.58	1577	1.58	15.77	30 psi	(2.07 Bar)

*Minimum output is based on 1 stroke per minute and 10% stroke setting, minimum output can be reduced further in external mode. Series C9 pumps may be programmed for strokes per hour for lower outputs.

Specification Sheet

Series C

GENERAL

Chemical metering pumps shall be positive displacement, Liquifram™ type pumps that are UL and CUL approved. Output volume shall be adjustable while pumps are in operation from zero to maximum capacity of:

C10, C70, C90	-	1.3 GPH	(4.9 liters per hour)
C11, C71, C91	-	2.5 GPH	(9.5 liters per hour)
C12, C72, C92	-	4.0 GPH	(15.1 liters per hour)
C13, C73, C93	-	8.0 GPH	(30.0 liters per hour)
C14, C74, C94	-	20.0 GPH	(75.7 liters per hour)
C76*	-	4.0 GPH	(15.1 liters per hour)
C77*	-	10.0 GPH	(38.0 liters per hour)
C78*	-	25.0 GPH	(95.0 liters per hour)

Chemical metering pumps shall be capable, without a hydraulically backed diaphragm, of injecting solutions against pressures up to:

C10, C70, C90	-	300 psig	(20.7 bar)
C11, C71, C91	-	150 psig	(10.3 bar)
C12, C72, C92	-	100 psig	(6.9 bar)
C13, C73, C93	-	60 psig	(4.1 bar)
C14, C74, C94	-	25 psig	(1.7 bar)
C76*	-	175 psig	(12.1 bar)
C77*	-	80 psig	(5.5 bar)
C78*	-	30 psig	(2.1 bar)

TYPE C1

Adjustment shall be by means of readily accessible dial knobs, one for changing stroke length and the other for changing stroke frequency (speed). Both knobs are to be located opposite the liquid handling end.

TYPE C7

Control of Series C7 metering pumps shall be selectable between internal and external pulsing by means of a 3-position center-off switch. Stroke length shall be adjustable by means of readily accessible dial knob. When in external pulsed mode, Series C7 units shall accept signals without the use of electrical timer or internal timer. Pressure capacity shall be adjustable to reduce noise, vibration and wear.

TYPE C9

Series C9 metering pumps shall have a clear liquid crystal display. Control shall be selectable between internal and external pulsing by means of a tactile keypad. Internal stroke frequency shall be adjustable from 1 stroke per hour to 100 strokes per minute. Pressure capacity shall be keypad adjustable to reduce noise, vibration and wear. Metering pump shall be capable of dividing or multiplying pulse inputs from 1 to 999 or responding directly or inversely to a 4-20mA input signal.

DRIVE

The pump drive shall be totally enclosed with no exposed moving parts. Solid state electronic pulser shall be encapsulated and supplied with quick connect terminals at least 3/16" (4.75 mm) wide. Electronics shall be housed in chemical resistant enclosure at the rear of the pump for maximum protection against chemical spillage. Electrical power consumption shall not exceed 87 watts under full speed and maximum pressure conditions. Pump weight shall not exceed 28 lbs (12.7 kg).

AUTOMATIC PRESSURE RELIEF

To eliminate need for pressure relief valve, Liquifram™ shall automatically stop pulsating when discharge pressure exceeds pump pressure rating by not more than 35%.

MATERIAL

Chemical metering pump housing shall be of chemically resistant glass fiber reinforced thermoplastic with a glass fiber reinforced polypropylene EPU carrier[1]. All exposed fasteners shall be stainless steel. Chemical metering pump valves shall be ball type, with ceramic balls[2]. Valve seat and seal ring shall be renewable by replacing the combination seat-seal ring[3] or cartridge valve assembly. Pump head shall be of transparent acrylic[4] material capable of resisting the pumped chemical. Fittings and connections at pump head shall be PVC[5].

CHECK VALVES AND TUBING

A total of 16 ft (4.8 m) of polyethylene tubing[6] shall be provided per pump complete with compression connections. A foot valve with integral one piece strainer shall be provided for the suction line, and an injection check/back pressure valve with ½" NPT male connection for the injection point. The injection check valve shall incorporate a dilating orifice which prohibits scale formation and accumulation of crystalline deposits.

(* - Not UL or CUL Approved)

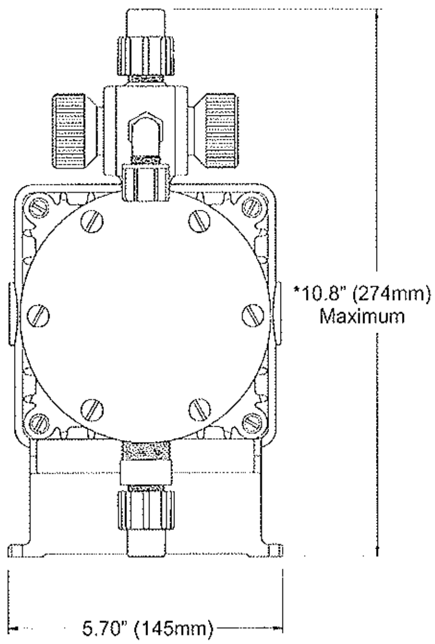
Notes:

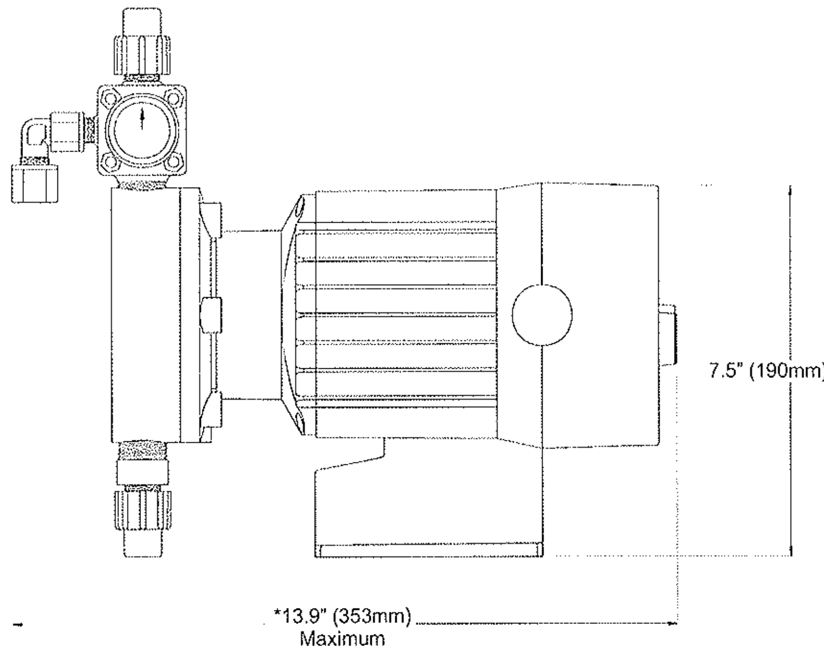
1. With plastic coated cast iron EPU carrier for Series C 76, C77 and C78.
2. Type 316 stainless steel or PTFE may be specified.
3. Hypalon®, PTFE, Viton® or Polyprel® may be specified.
4. PVC, Polypropylene, PDVF or Type 316 stainless steel may be specified.
5. PVDF, Polypropylene, or Type 316 stainless steel may be specified.
6. 6 ft. (1.8 m) of vinyl suction tubing may be specified in place of polyethylene for the suction side only. 1/4" or 1/2" male pipe thread may be specified.

LMI
MILTON ROY

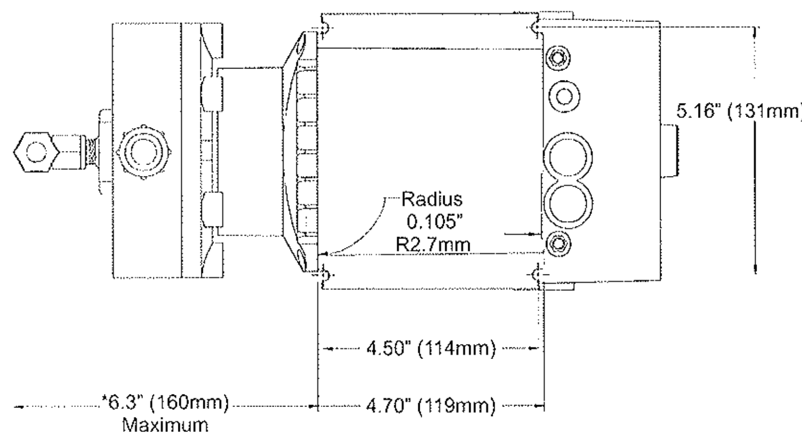
201 Ivyland Road
Ivyland, PA 18974 USA
TOLL FREE: (800) 564-1097
TEL: (215) 293-0401
FAX: (215) 293-0445
http://www.lmipumps.com

Replaces same of Rev.E 8/05
1619. F 11/06





*Dimensions shown are maximum for largest liquid end available.These dimensions vary depending on the liquid end selected.



SLUDGE PUMPS

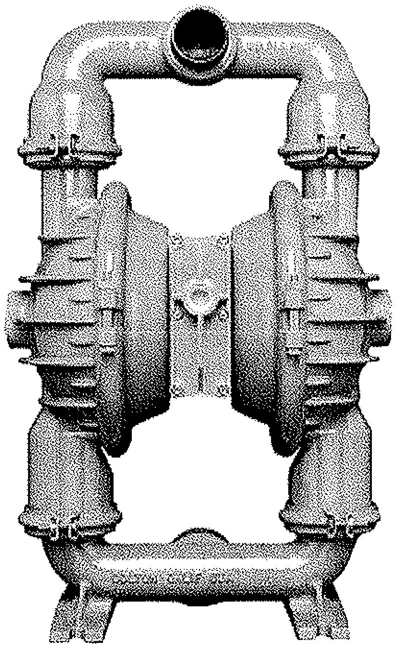
WILDEN®

AIR OPERATED DOUBLE DIAPHRAGM PUMPS

A DOVER RESOURCES COMPANY

P8 Metal Pump

FLOW RATE TO 156 GPM (590.5 LPM)
MAXIMUM OPERATING PRESSURE = 125 PSI (8.6 BAR)



PRO-FLO™ PROGRESSIVE PUMP TECHNOLOGY

SPECIFICATIONS

WETTED HOUSINGS (Water Chambers and Manifolds)

MATERIAL	SHIP WT.	MATERIAL	SHIP WT.
Aluminum	70 lbs. (31.8 kg.)	Cast Iron	104 lbs. (47.1 kg.)
316 S.S.	112 lbs. (51.0 kg.)	Hastelloy	114 lbs. (51.7 kg.)

NON-WETTED HOUSINGS

DESCRIPTION	MATERIAL
Center Block	Polypropylene
Air Chambers	Aluminum
Air Valve	Polypropylene

MAXIMUM SUCTION LIFT CAPABILITY

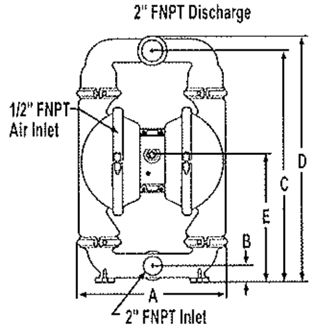
DRY LIFT
23' (7.0 m)
The above figure represents the rubber-fitted pump capability.

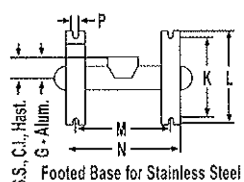
MAXIMUM DIAMETER SOLIDS

¼" (6.35 mm) Diameter

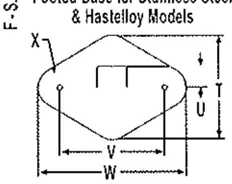
ELASTOMER OPTIONS

MATERIAL	TEMPERATURE LIMITS			
Polyurethane	+10 (−12.2)	to	+150 (65.6)	F° (C°)
Neoprene	0 (−17.8)	to	+200 (93.3)	F° (C°)
Buna-N®	+10 (−12.2)	to	+180 (82.2)	F° (C°)
Nordel®	−60 (−51.1)	to	+280 (137.8)	F° (C°)
Viton®	−40 (−40.0)	to	+350 (176.7)	F° (C°)
Saniflex™	−20 (−28.9)	to	+220 (104.4)	F° (C°)
Teflon® PTFE	+40 (4.4)	to	+220 (104.4)	F° (C°)
Wil-Flex™	−40 (−40.0)	to	+225 (107.2)	F° (C°)

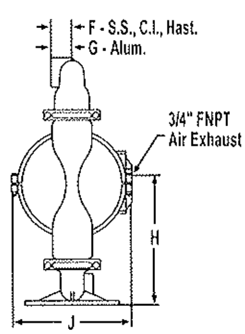




Footed Base for Stainless Steel & Hastelloy Models



Base for Aluminum Screen Model



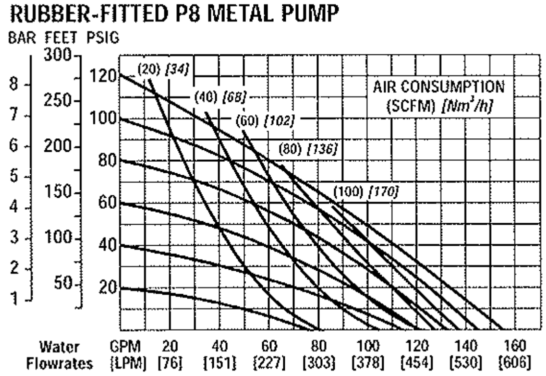
BSP threads available for liquid inlet and discharge.

Refer to the EOM manual for TPE and Ultra-Flex™ performance curves.

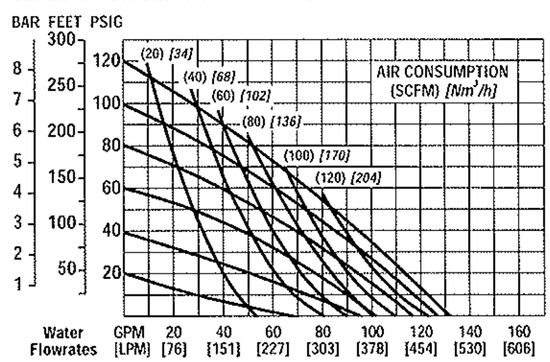
DIMENSIONS – P8 METAL

ITEM	STANDARD (inch)	METRIC (mm)
A	15 29/32	404.0
B	1 7/8	47.6
C	24 3/4	628.7
D	26 11/32	669.2
E	14	355.6
F	2 1/4	57.2
G	2 7/16	61.7
H	13 21/32	346.9
J	13 1/2	342.9
K	9 1/32	229.4
L	10	254.0
M	10 1/16	255.6
N	12 11/32	313.5
P	9/16	14.3
R	2 1/2	63.5
S	2 1/32	51.6
T	11 3/32	281.8
U	2 11/32	59.5
V	11 1/32	280.2
W	15 7/32	386.6
X	Ø9/16	Ø14.3

RUBBER-FITTED P8 METAL PUMP



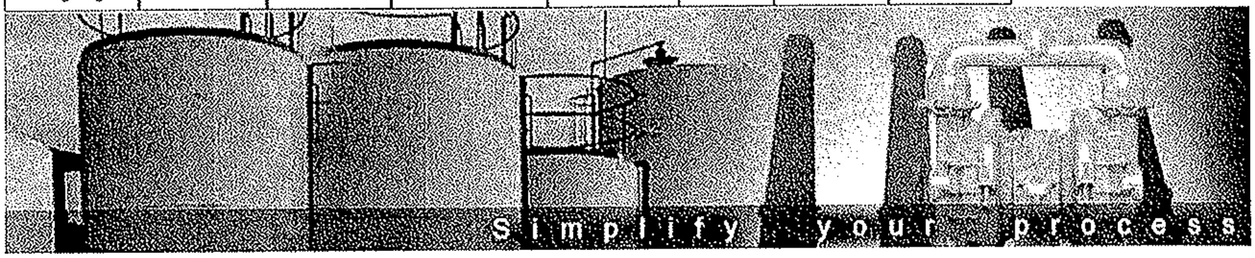
TEFLON®-FITTED P8 METAL PUMP



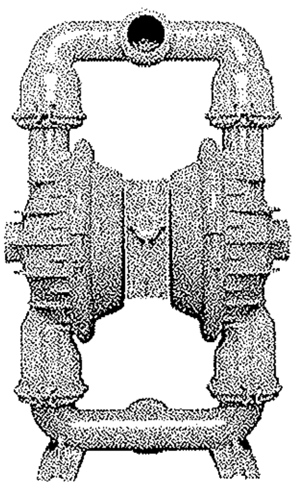
22069 Van Buren St. • Grand Terrace, CA 92313-5607 • Telephone 909-422-1730 • Fax 909-783-3440 • www.wildenpump.com

WILDEN

Original™ SERIES



Catalog : Original™ Metal Pumps : P8 - 51 mm (2") Metal Pump : Specifications



PRO-FLO

Flow Curves Drawings Pump User's Guide

Wilden P8 - 51 mm (2") Metal Pump

FLOW RATE TO 590.5 LPM (156 GPM)
MAX PRESSURE = 8.6 BAR (125 PSI)

WETTED HOUSINGS
(Water Chambers and Manifolds)

Material	Ship Wt
Aluminum	31.8 kg (70.0 lbs)
Cast Iron	47.1 kg (104.0 lbs)
Hastelloy	51.7 kg (114.0 lbs)
316 S.S.	51.0 kg (112.0 lbs)

NON-WETTED HOUSINGS

Description	Material
Center Block	Polypropylene
Air Chambers	Aluminum, 316 S.S.
Air Valve	Polypropylene

ELASTOMER OPTIONS

Material	Temperature Limits
Buna-N®	-12.2 (+10) to +65.6 (+150) °C (F°)
Neoprene	-17.8 (+0) to +93.3 (+200) °C (F°)
EPDM™	-51.1 (-60) to +137.8 (+280) °C (F°)
Polyurethane	-12.2 (+10) to +65.6 (+150) °C (F°)
Saniflex™	-28.9 (+20) to +104.4 (+220) °C (F°)
PTFE	+4.4 (+40) to +104.4 (+220) °C (F°)
Viton®	-40 (-40) to +176.7 (+350) °C (F°)
Wil-Flex™	-40 (-40) to +107.2 (+225) °C (F°)

ENGINEERING OPERATION & MAINTENANCE MANUAL

P8-PX8-ORG-MTL-PERF.pdf	918 k
P8-PX8-ORG-MTL-EOM.pdf	3417 k

DIMENSIONAL DRAWINGS (CAD REQUIRED)

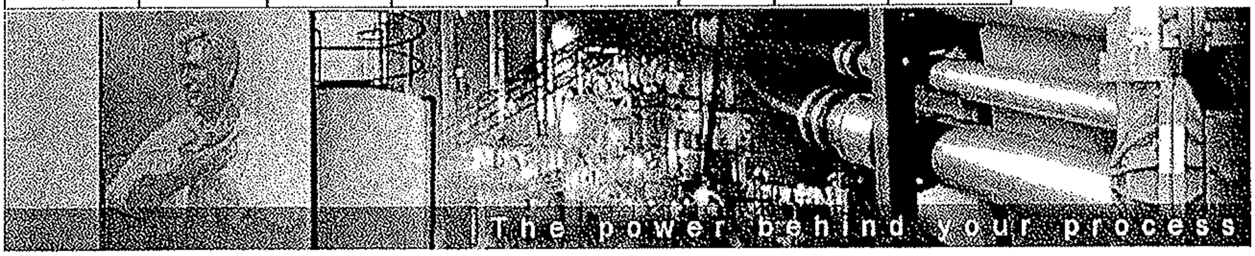
P8 Pro-Flo? Metal	469 k

FLYERS

P8 Metal Pump	105 k
Pro-Flo™Flyer	180 k

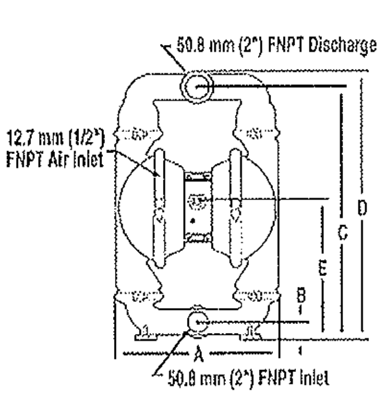
GENERAL SPECIFICATIONS

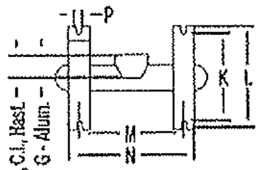
Safety Supplement.pdf	1675 k
ORIGINAL BROCHURE	5253 k
Cavitation and Friction Guide	888 k
Chemical Resistance Guide.pdf	435 k



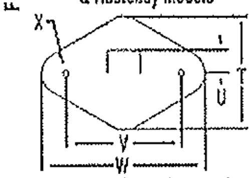
Catalog : Original™ Metal Pumps : P8 - 51 mm (2") Metal Pump : Dimensional Drawings

Dimensions for P8 - 51 mm (2") Metal Pump

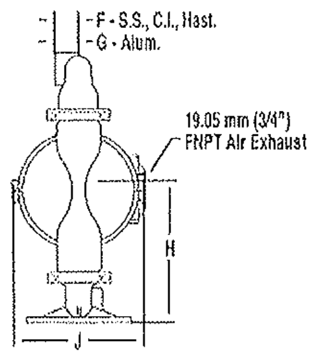




Footed Base for Stainless Steel & Hastelloy Models



Base for Aluminum Screen Model

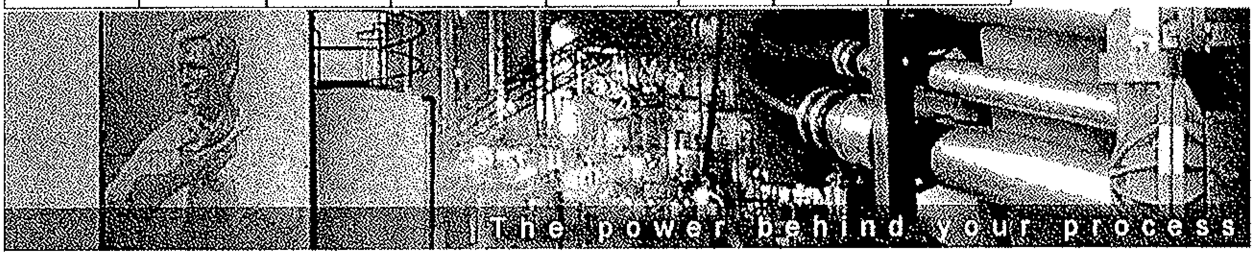


BSP threads available for liquid inlet and discharge.

Refer to the EOM manual for TPE and Ultra-Flex® performance curves.

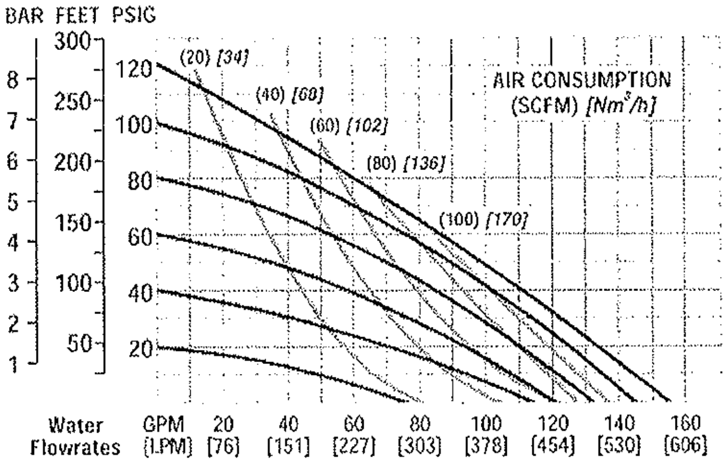
DIMENSIONS - P8 METAL

ITEM	METRIC (mm)	STANDARD (inch)
A	404.0	15 29/32
B	47.6	1 7/8
C	628.7	24 3/4
D	669.2	26 11/32
E	355.6	14
F	57.2	2 1/4
G	61.7	2 7/16
H	346.9	13 21/32
J	342.9	13 1/2
K	229.4	9 1/32
L	254.0	10
M	255.6	10 1/16
N	313.5	12 11/32
P	14.3	9/16
R	63.5	2 1/2
S	51.6	2 1/32
T	281.8	11 3/32
U	59.5	2 11/32
V	280.2	11 1/32
W	386.6	15 7/32
X	14.3	9/16



Learn more about how to read a Wilden flow curve.

RUBBER-FITTED P8 METAL PUMP



TEFLON®-FITTED P8 METAL PUMP

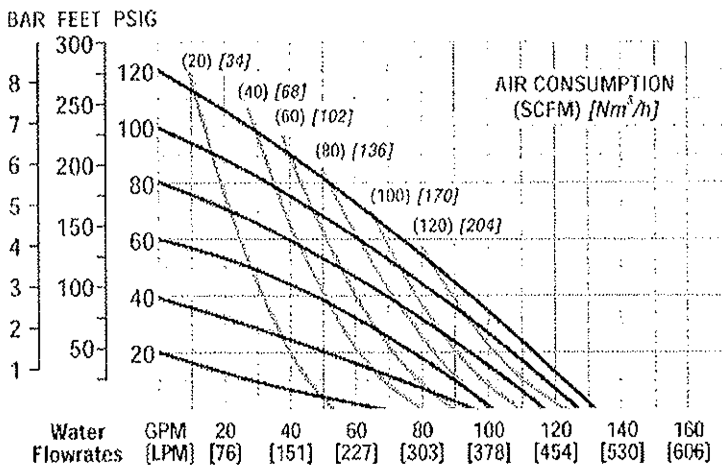


Exhibit I

Preliminary Engineering Drawings