

BIO-PULSE AIR SPARGING EVALUATION

FOR

**HADNOT POINT FUEL FARM
MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA**

NCDENR UST INCIDENT NOs.: 3671, 10615 and 22788

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1.0 PURPOSE AND AUTHORIZATION

The purpose of this report is to evaluate operational changes to the Hadnot Point Fuel Farm (HPFF) bio-pulse air sparging system based on data collected during the fourth, fifth and sixth rounds of bio-pulse air sparge events performed by Shaw Environmental, Inc. (Shaw). An additional purpose of this report is to evaluate the groundwater quality data recently collected by Shaw as part of the semi-annual monitoring activities at the site. This evaluation and report was authorized by NAVFAC Mid-Atlantic, in accordance with Contract No. N62470-05-D-6200 Delivery Order No. 0044.

2.0 SCOPE OF WORK

The scope of work for this project included:

- Obtain air sparging duration and air flow rate data for the fourth, fifth and sixth rounds of bio-pulse air sparge events from Shaw;
- Evaluate injection data;
- Evaluate laboratory analytical results from the latest groundwater sampling event performed by Shaw;
- Make operational recommendations to enhance system calibration and ultimately optimize system operation.

The former Hadnot Point Fuel Farm is located in the industrial area of Marine Corps Base Camp Lejeune and is shown on Figure 1. Figure 2 illustrates the location of the twenty five (25) Bio-pulse air sparge Wells.

3.0 BACKGROUND

3.1 INITIAL BIO-PULSE AIR SPARGING

From September 28, 2006 through November 10, 2006 Shaw performed the first round of pilot test bio-pulse air sparging. The intent of this first round, and subsequent rounds was to sparge the outer-most wells away from the center of the dissolved contaminant plume and work toward the plume core.

As recommended in the *Revised Corrective Action Plan*, prepared by CATLIN Engineers and Scientists (CATLIN), dated June 2003, each of the initial sparging events was performed for a duration of twenty-four (24) hours. During each event, the injection pressure was kept constant (95 psi) and the

flow was allowed to continually increase until pulse termination. Air flow measurements were taken and recorded on a two hour basis during each sparging event.

After initiation of the bio-pulse event on BP-13 on November 8, 2006, elevated Flame Ionization Detector (FID) readings were noted in the breathing zone at the north end of Building 1101 emanating from cracks in the concrete floor and from expansion joints around columns. An odor (presumably petroleum) was also noted. Similar findings were noted by Shaw on November 9, 2006 and again on November 13 and 14, 2006 and continued to be noted for at least a month after the pilot test sparge event.

Following discovery of the elevated FID readings and the conclusion of the initial round of sparging, CATLIN prepared a report, *Operational Addendum to Corrective Action Plan*, that recommended installation of a vapor extraction system within Building 1101 similar to those installed in other buildings on-site. In addition, CATLIN recommended modifying the duration of each bio-pulse air sparge event based on an evaluation of the air injection rate versus time graphs.

Based on the results of the first round of bio-pulse air sparging CATLIN proposed the following operational modifications:

- Modification of pulse durations based on observed departures from normal flow versus time curve geometry.
- Utilization of a continuous flow meter with recorder to develop an air flow versus time graph for each individual sparge well.
- Evaluate the improved flow versus time graphs and recommend adjustments in the duration prior to each pulse event.
- Continue to collect vapor readings within Building 1101 and other buildings within the assumed influence of the sparging events.
- Prepare a summary report after each round of sparging and make specific recommendations for the next pulse event at each of the twenty-five (25) sparging wells.

3.2 SECOND ROUND OF BIO-PULSE AIR SPARGING

The second round of bio-pulse air sparging was performed by Shaw between April 17, 2007 and June 14, 2007. During this round, air was injection for durations generally consistent with CATLIN's recommendations in the Operational Addendum report. In addition, prior to beginning the second round of bio-pulse air sparging, Shaw installed and initiated the proposed vapor extraction system within Building 1101.

During each event, the injection pressure was kept constant (95 psi) and the flow was allowed to continually increase until pulse termination. Shaw personnel manually adjusted the pressure periodically if it varied from 95 psi during an event. Air flow measurements were taken and recorded using

either an Oripac continuous flow meter with recorder or at one hour intervals using variable area flow meters. Air flow versus time graphs were created for each individual bio-pulse air sparge well. During this round, data from wells BP-1, BP-7, BP-10, BP-12, BP-21, BP-23 and BP-24 was obtained from a variable area flow meter. Data from all other wells was obtained and recorded using an Oripac continuous flow meter.

During collection of the data, a wiring problem was discovered with the Oripac flow meter and pressure differential transmitter resulting in unusable air flow data for wells BP-2, BP-4, BP-14, BP-15, BP-19, and BP-22. Following correction of the wiring, usable data for all subsequent injection events was obtained. In addition, while injecting air into wells BP-18 and SP-100 the system compressor shut down due to high temperatures. The pulse durations for both of these wells was extended to account for the time when the system was shut down.

3.3 THIRD ROUND OF BIO-PULSE AIR SPARGING

The third round of the bio-pulse air sparging was conducted by Shaw from June 18, 2007 to July 27, 2007. During this round, air was injected into each sparge well in general accordance with recommendations made by CATLIN prior to the second round of sparging.

During each event, the injection pressure was kept constant at 95 psi and the flow was allowed to continually increase until pulse termination. Shaw personnel manually adjusted the pressure if at any time it varied from 95 psi during an event. Air flow measurements were recorded using an Oripac continuous flow meter. Data obtained was used to develop an air flow versus time graph for each individual bio-pulse air sparge well.

When injecting air into bio-pulse air sparge wells BP-5, BP-9, BP-18, BP-21, BP-24, and SP-100, the compressor shut down due to high temperatures. The site was experiencing high ambient temperatures at the time of these events. The pulse durations for the bio-pulse air sparge events for the above mentioned wells were extended to account for the time when the system was shut down.

Upon review of the second and third rounds of bio-pulse air sparging and subsequent sampling event, CATLIN noted that it appeared that the air flow versus time graph did not indicate that the dewatered volume was reaching "breakthrough" or the lower boundary of the 75 feet deep high permeability zone (HPZ) as proposed in the *Revised Corrective Action Plan*, dated June 2003. If the "dewatered volume" was reaching the lower boundary of the 75 feet deep HPZ you could expect an increase in air flow as the sparge air breaks into or short circuits into the HPZ. Consequently, an anomaly or a diversion in the air flow versus time graph would be evident. Based on our review of the air flow versus time graphs there were no obvious changes in air flow that would indicate this "breakthrough". A review of the laboratory analytical data suggested evidence that the bio-pulse air sparging in

conjunction with the existing air sparge/soil vapor extraction (AS/SVE), biosparging and pump and treat systems was aiding in the reduction of dissolved Benzene within the groundwater at the site.

After evaluating the first three rounds of bio-pulse air sparging, CATLIN made the following recommendations in a report, *Bio-Pulse Air Sparging Evaluation*, dated October 11, 2007:

- Modification of pulse durations based on total volume of air injected as an indicator of safe termination times.
- Continue the sparge sequence from the outer-most wells and work toward the dissolved contaminant plume core.
- Continue to collect vapor readings at a reduced frequency within Building 1101 and other buildings within the assumed influence of the sparging events.
- Perform groundwater sampling on a semi-annual basis in order to help gauge the effectiveness of the existing remediation systems on site.
- Prepare a summary report after the next semi-annual sampling event and make specific recommendations for the subsequent rounds of bio-pulse air sparging.
- Insure injection pressures are kept constant at 95 psi, by verifying every thirty minutes and adjusting as necessary.

4.0 FOURTH, FIFTH AND SIXTH ROUNDS OF BIO-PULSE AIR SPARGING

The fourth, fifth and sixth rounds of bio-pulse air sparging were performed by Shaw between November 1, 2007 and December 12, 2007; January 3, 2008 and February 15, 2008; and between March 10, 2008 and April 12, 2008, respectively. During these rounds, air was injection for durations generally consistent with recommendations made by CATLIN in the Bio-Pulse Air Sparging Evaluation, dated October 11, 2007.

During each event, the injection pressure was kept constant (95 psi) and the flow was allowed to continually increase until pulse termination. Shaw personnel manually adjusted the pressure periodically if it varied from 95 psi during an event. Air flow measurements were taken and recorded using an Oripac continuous flow meter with recorder. Air flow rate versus time graphs were created for each individual bio-pulse air sparge well. Air flow versus time graphs for the fourth, fifth and sixth rounds of bio-pulse air sparging are provided in Appendices A, B and C respectively. Pulse durations, maximum injection flow rates, and total injection volumes for each bio-pulse air sparge well used during these rounds are presented in Table 1.

When injecting air into bio-pulse air sparge wells BP-18 during the fourth cycle and BP-24 during the fifth cycle the compressor shut down due to high temperatures. The pulse durations for the bio-pulse air sparge events for the above mentioned wells were extended to account for the time when the system was shut down.

5.0 GROUNDWATER QUALITY DATA

Shaw completed a groundwater sampling event in February/March 2008. Fifteen (15) shallow (Type II) wells, twelve (12) wells with a depth of 50 feet, six (6) wells with depths ranging from 70 to 90 feet, and two (2) wells that have depths of greater than 100 feet were sampled and analyzed for EPA Method 8260B parameters.

5.1 DISSOLVED BENZENE - TYPE II WELLS

Laboratory analysis of these groundwater samples revealed thirteen (13) wells containing dissolved Benzene concentrations above the NCAC T15A:02L Groundwater Quality Standards (2L GWQS) of 1 ug/L. The dissolved Benzene concentrations, from both the most recent event and historical events, are summarized in Table 2. The shallow Benzene plumes from the February 2008 and August 2007 sampling events are illustrated on Figures 3A and 3B respectively.

A review of the historic laboratory results indicates an overall trend of declining Benzene concentrations in the shallow groundwater. In addition, a majority of the shallow wells that were sampled in February 2008 showed a decline in Benzene concentrations as compared to the August 2007 data. Figure 3C has been prepared that shows the extent of Benzene concentration reduction from August 2007 to February 2008 in the shallow (Type II) wells. As can be seen on Figure 3C, a large portion of the interior of the shallow dissolved Benzene plume appears to have been reduced in comparison to the August 2007 plume. The most dramatic reduction in Benzene concentrations are noted in the groundwater samples from monitoring wells USTHPFFC-MW19 and UST1115-MW07, which decreased from 13,700 µg/L to 3,760 µg/L and 6,230 µg/L to 4,250 µg/L, respectively.

There were two groundwater samples where the Benzene concentration increased from August 2007 to February 2008 that require discussion. The Benzene concentration in the sample from monitoring well USTHPFFC-MW20 increased from 374 µg/L to 3,210 µg/L. This well is located within the Michael Road Fuel Farm and the Benzene concentration was as high as 13,000 µg/L in 2000 and in 2005. Additionally, the Benzene concentration in monitoring well USTHPFF-MW12 increased from 758 µg/L to 1,100 µg/L. This well has contained free product as recently as November 2000.

5.2 DISSOLVED BENZENE - WELLS 50 FEET DEEP

Laboratory analysis of the groundwater samples collected from wells 50 feet deep revealed twelve (12) wells containing dissolved Benzene concentrations above the 2L GWQS. The dissolved Benzene concentrations, from both the most recent event and historical events, are summarized in Table 2. The February 2008 and August 2007 Benzene plumes as they pertain to wells 50 feet deep are illustrated on Figures 4A and 4B respectively.

As noted within the shallow groundwater, dissolved Benzene concentrations in monitoring wells 50 feet deep also show a general declining trend. The highest concentrations were noted in monitoring wells UST1115-MW20 at 3,280 µg/L, USTHPFFC-MW08 at 2,760 µg/L, and USTHPFFC-MW60 at 8,650 µg/L. Six of the twelve wells that were sampled show decreases in dissolved Benzene (from August 2007 to February 2008) with the maximum decreases noted in the samples from monitoring well UST1115-MW20 and USTHPFFC-MW08. The dissolved Benzene concentration decreased 15,420 µg/L in monitoring well UST1115-MW20 from 18,700 µg/L in August 2007 to 3,280 µg/L in February 2008 and in USTHPFFC-MW08 the dissolved Benzene concentration decreased 4,970 µg/L from 7,730 µg/L in August 2007 to 2,760 µg/L in February 2008. The maximum increase in Benzene concentration was only 480 µg/L in the sample from USTHPFFC-MW60 which increased from 8,170 µg/L to 8,650 µg/L.

Figure 4C has been prepared that shows the extent of Benzene concentration reduction from August 2007 to February 2008 in the wells 50 feet deep. As can be seen on this figure, the Benzene concentration reductions are over a fairly large area.

5.3 DISSOLVED BENZENE - WELLS 70-90 FEET DEEP

Laboratory analysis of the groundwater samples collected from monitoring wells 70-90 feet deep revealed five (5) wells containing dissolved Benzene concentrations above the 2L GWQS with the maximum concentration of 174 µg/L revealed in the sample from UST1115-MW22. The dissolved Benzene concentrations, from both the most recent event and historical events, are summarized in Table 2. The February 2008 and August 2007 Benzene plumes as they pertain to wells 70 to 90 feet deep are illustrated on Figures 5A and 5B respectively.

A review of the recent historical laboratory results indicates a significant reduction in Benzene concentrations from groundwater samples obtained from monitoring wells 70-90 feet deep. There were two significant decreases from August 2007 to February 2008. The Benzene concentration in the samples from IR78-GW32-02 decreased from 915 µg/L to 33.7 µg/L and in UST1115-MW22 declined from 600 µg/L to 174 µg/L. Figure 5C shows the extent of Benzene concentration reduction from August 2007 to February 2008 in the wells 70-90 feet deep. In addition, monitoring wells UST1115-MW22, UST1115-MW24 and UST1115-MW25 also show significant improvement as compared to the 2006 laboratory data. The Benzene concentrations in the samples from UST1115-MW22 decreased from 3,880 µg/L to 174 µg/L, UST1115-MW24 decreased from 2,250 µg/L to 1.4 µg/L and UST1115-MW25 decreased from 5,160 µg/L to 3.9 µg/L. These reductions are most likely a result of the on site remediation systems including the bio-pulse air sparging.

5.4 DISSOLVED BENZENE - WELLS GREATER THAN 100 FEET DEEP

Only two (2) groundwater samples were collected from monitoring wells greater than 100 feet deep and only one contained dissolved Benzene concentrations above the 2L GWQS of 1 µg/L. The sample from monitoring well IR78-GW32-03 contained an estimated concentration of 0.53 µg/L dissolved Benzene and USTHPFFC-MW12 contained 63.6 µg/L dissolved Benzene. The dissolved Benzene concentrations, from both the most recent event and historical events, are summarized in Table 2. The February 2008 and August 2007 Benzene plumes as they pertain to wells greater than 100 feet deep are illustrated on Figures 6A and 6B respectively.

As illustrated on Figure 6C, the dissolved Benzene concentration in samples collected from monitoring well IR78-GW32-03 decreased from 74.6 µg/L in August 2007 to 0.53 µg/L in February 2008. The sample from monitoring well USTHPFFC-MW22 showed a minor increase from 47 µg/L in August 2007 to 63.6 µg/L in February 2008.

6.0 INJECTION DURATION RECOMMENDATIONS

In the *Operational Addendum to Corrective Action Plan*, CATLIN recommended the optimum safe termination time for each air pulse based on the air flow versus time graphs from the first bio-pulse cycle. CATLIN then evaluated the second and third bio-pulse cycles, including the air flow versus time graphs and the total air injected versus time graphs. Based on CATLIN's understanding of the data at that time, it appeared that the air flow versus time graph did not indicate that the dewatered volume was reaching "breakthrough" or the lower boundary of the 75 feet deep high HPZ as proposed in the *Revised Corrective Action Plan*, dated June 2003. A review of the laboratory analytical data suggested evidence that the bio-pulse air sparging in conjunction with the existing AS/SVE, biosparging and pump and treat systems was aiding in the reduction of dissolved Benzene within the groundwater at the site.

Based on these observations, CATLIN used the total volume of injected air as an indicator of the safe termination time for each bio-pulse cycle. The average volume of air injected during the second and third bio-pulse cycles was approximately 58,000 cubic feet. Therefore, if the injected volume in a bio-pulse event was well below this average, CATLIN recommended increasing the bio-pulse duration. Conversely, there were two bio-pulse wells, BP-3 and BP-5, that the total air injected was greater than 100,000 cubic feet and CATLIN recommended reducing the bio-pulse cycle duration at these wells to limit the amount of injected air to approximately 100,000 cubic feet. The 100,000 cubic feet of air was calculated as a conservative theoretical volume that would produce a dewatered sphere with a radius approximately equivalent to the design radius but safely below "breakthrough".

Similar to the evaluation that followed the second and third rounds of bio-pulse air sparging, CATLIN reviewed air flow versus time graphs created from data obtained during the fourth, fifth and sixth rounds of sparging as well as laboratory analytical results from the subsequent sampling event. Review of this data indicated an

overall reduction in the dissolved contaminant plume size; however, in some areas the reduction in dissolved contaminant concentrations was minimal or none. Closer inspection revealed that these areas were in the general vicinity of bio-pulse air sparge wells which were receiving volumes of air well below the average of approximately 62,000 cubic feet as determined from third through sixth rounds of bio-pulse cycles.

As was the case previously it appears that the bio-pulsing is working; therefore, CATLIN is not inclined to recommend any drastic modifications in the duration of bio-pulses. However, incremental increases are proposed at bio-pulse air sparge wells BP-6 and BP-15. Decreases in bio-pulse durations are proposed at bio-pulse air sparge wells BP-3 and BP-5 in an attempt to limit total injected volumes to less than 100,000 cubic feet.

After evaluating the previous six (6) bio-pulse air sparge cycles, the following observations/recommendations are made:

1. CATLIN recommends the following modified pulse durations:

No.	Well	Pulse Duration (min.)
1	BP-1	420
2	BP-21	360
3	BP-12	480
4	BP-7	600
5	BP-24	480
6	BP-4	300
7	BP-15	420 (+120)
8	BP-22	300
9	BP-2	180
10	BP-14	180
11	BP-19	200
12	BP-10	540
13	BP-23	300
14	BP-9	500
15	BP-11	300
16	BP-20	200
17	BP-5	630 (-320)
18	SP-100	480
19	BP-16	810
20	BP-6	300 (+120)
21	BP-17	300
22	BP-8	980
23	BP-13	120
24	BP-18	420
25	BP-3	600 (-120)

Bold indicates recommended pulse duration, number in parentheses indicates amount of increase/decrease from last bio-pulse event.

2. Continue the sparge sequence from the outer-most wells and work toward the plume core.
3. Continue to collect vapor readings at a reduced frequency within Building 1101 and other buildings within the assumed influence of the sparging events.
4. Perform a site-wide groundwater sampling event on all monitoring wells for the next semi-annual event (August 2008). Samples should be collected for EPA Method 602 only. The last site-wide sampling event was conducted in 2000.
5. Continue maintaining injection pressures at a constant at 95 psi, this pressure should be verified every thirty (30) minutes and adjusted as necessary.

7.0 REFERENCES

CATLIN Engineers and Scientists, *Revised Corrective Action Plan (CAP) for Hadnot Point Fuel Farm, Marine Corps Base, Camp Lejeune, North Carolina*, 2003.

CATLIN Engineers and Scientists, *Operational Addendum to Corrective Action Plan for Hadnot Point Fuel Farm, Marine Corps Base, Camp Lejeune, North Carolina*, 2007.

CATLIN Engineers and Scientists, *Bio-Pulse Sparging Evaluation for Hadnot Point Fuel Farm, Marine Corps Base, Camp Lejeune, North Carolina*, 2007.

TABLES

TABLE 1
BIO-PULSE AIR SPARGE INJECTION DATA

Bio-Pulse Sparge Well	First Cycle		Second Cycle		Third Cycle			Fourth Cycle			Fifth Cycle			Sixth Cycle		
	Duration (min)	Max flow (cfm)	Duration (min)	Max flow (cfm)	Duration (min)	Max flow (cfm)	Total Volume (cf)	Duration (min)	Max flow (cfm)	Total Volume (cf)	Duration (min)	Max flow (cfm)	Total Volume (cf)	Duration (min)	Max flow (cfm)	Total Volume (cf)
BP-1	1440	172	360	169	362	134	40,755	427	153	53,868	419	151	52,938	438	152.11	53,656
BP-2	1440	134			120	142	13,668	182	143	25,532	179	148	23,459	179	145.24	23,097
BP-3	1440	142	716	140	720	158	98,784	717	182	112,279	719	199	123,064	713	203.07	124,181
BP-4	1440	104			240	76	15,895	299	108	27,248	310	118	30,127	299	114.42	28,975
BP-5	1440	98.3	1426	175	1740	213	247,258	990	204	169,888	990	199	165,823	957	189.7	154,377
BP-6	1440	196.6	125	157	120	152	16,414	179	160	25,998	179	159	25,606	219	176.88	34,587
BP-7	1440	156	600	194	630	182	100,719	599	201	104,064	600	180	95,474	602	180.04	91,524
BP-8	1440	98.3	1447	126	1440	133	159,642	1,019	127	105,408	1,019	126	103,415	1,010	157.14	126,001
BP-9	1440	248.4	497	177	516	165	68,944	500	182	76,081	499	187	78,209	480	179.03	72,576
BP-10	1440	240	540	232	553	200	98,068	539	209	101,009	504	219	95,417	539	220.7	105,039
BP-11	1440	103.7	230	125	255	143	31,562	300	160	40,886	299	165	43,304	301	163.51	42,602
BP-12	1440	104	480	175	480	155	65,776	480	175	73,176	480	165	68,895	421	155.45	55,269
BP-13	1440	188	120	128	100	133	11,561	119	150	15,344	134	142	16,690	125	147.25	15,845
BP-14	1440	199			120	173	19,661	179	193	31,327	178	196	31,362	179	189.06	31,061
BP-15	1440	41			240	54	9,781	304	38	17,729	301	75	19,245	300	91.53	24,051
BP-16	1440	81.9	752	81	747	72	44,747	1,096	112	105,607	809	100	66,961	814	134.39	96,013
BP-17	1440	46.4	244	46	236	90	18,148	299	114	28,614	299	128	32,805	301	116.21	30,880
BP-18	1440	232.1	497	223	1080	254	72,438	477	212	87,468	429	236	85,328	419	241.03	88,343
BP-19	1440	205			140	52	6,315	202	61	9,905	212	58	11,024	201	62.23	11,209
BP-20	1440	65.5	141	63	150	92.9	12,720	203	93	17,294	200	125	22,058	202	108.01	19,912
BP-21	1440	186	370	93	435	230	77,031	359	222	71,350	366	225	72,943	368	222.62	72,253
BP-22	1440	60			255	89	19,865	315	107	29,103	299	111	29,086	300	113.42	30,758
BP-23	1440	237	240	246	325	229	66,347	299	223	62,557	307	218	62,680	298	231.59	63,157
BP-24	1440	213	480	246	525	230	102,259	479	228	100,312	587	248	107,298	475	245.15	84,534
SP-100	1440	218.4	487	180	791	209	94,115	479	198	80,652	480	187	75,639	476	193.04	80,219

Max flow for first cycle is value recorded at proposed pulse duration for comparative purposes

Indicates measurements were taken with VisiFlow Meter and later corrected

Blanks in Cycle 2 indicate missing (BP14) data or faulty Flow Data (BP2, BP4, BP15, BP19 and BP22)

VisiFlow Meter readings corrected using: $Q2=Q1*((95+14.7)/14.7)^{(0.5)}$

TABLE 2

SUMMARY OF HISTORICAL ANALYTICAL RESULTS - GROUNDWATER (EPA METHOD 602/8260B) - BENZENE ONLY

Well ID	Screen Interval (feet BLS)	Date Sampled	Benzene Concentration (µg/L)
2L GWQS (µg/L)			1
UST1101-MW01	3-13	11/14/2000	BQL
		7/17/2002	<1
		8/16/2007 +	<1
UST1101-MW02	3-13	11/13/2000	BQL
UST1101-MW03	3-13	11/13/2000	BQL
		7/18/2002	<1
UST1115-MW01	5-15	6/5/1997	1.3
		1/7/1999 +	310 B
		2/16/2000	BQL
		5/30/2000 +	<1.0
		11/13/2000	BQL
		1/24/2001 +	32
		7/29/2001 +	14
		2/2/2002 +	6
		8/5/2002 +	<1
		2/17/2003 +	187
		8/20/2003 +	<1
		2/21/2004 +	<1
		8/19/2004 +	17.7
		3/24/2005 +	3.8
		8/18/2005 +	<1
		1/23/2006 +	<1
		10/3/2006 +	163
		8/21/2007 +	<1
UST1115-MW02	4-15	6/5/1997	0.9
		1/6/1999 +	29
		8/12/1999 +	53
		2/15/2000	BQL
		5/26/2000 +	<1
		11/13/2000	BQL
		1/24/2001 +	150
		7/29/2001 +	51
		2/2/2002 +	11.9
		8/6/2002 +	9.3
		2/19/2003 +	125
		8/19/2003 +	3.1
		2/25/2004 +	10.9
		8/19/2004 +	24.3
		3/22/2005 +	31.1
		8/18/2005 +	<1
		1/20/2006 +	14.9
		10/2/2006 +	28.3
		8/23/2007 +	<1
		8/23/2007 + dup	<1
UST1115-MW03	5-20	6/5/1997	BQL
		2/15/2000	BQL
		11/13/2000	11

TABLE 2
SUMMARY OF HISTORICAL ANALYTICAL RESULTS - GROUNDWATER (EPA METHOD 602/8260B) - BENZENE ONLY

Well ID	Screen Interval (feet BLS)	Date Sampled	Benzene Concentration (µg/L)
2L GWQS (µg/L)			1
UST1115-MW04	5-15	6/4/1997	BQL
		1/7/1999 +	190 B
		8/12/1999 +	28
		2/15/2000	BQL
		5/26/2000 +	<1
		11/13/2000	BQL
		1/23/2001 +	660
		7/27/2001 +	210
		2/2/2002 +	22.6
		8/7/2002 +	31.5
		2/19/2003 +	128
		8/19/2003 +	<1
		2/25/2004 +	16.8
		8/19/2004 +	31.5
		3/10/2005 +	42.7
		8/18/2005 +	0.63 J
		1/20/2006 +	9.0
		10/2/2006 +	56.6
		8/22/2007 +	<1
UST1115-MW05	5-15	2/23/2000	1,500
		11/20/2000	1,900
		11/20/2000 dup	1,800
UST1115-MW06	5-20	6/4/1997	BQL
		2/22/2000	5
		11/13/2000	81
		11/13/2000 dup	67
UST1115-MW07	5-20	11/15/2000	3,000
		7/17/2002	6,000
		8/22/2007 +	6,230
		2/27/2008 +	4,250
UST1115-MW08	5-20	6/4/1997	BQL
		2/15/2000	BQL
		11/13/2000	BQL
		11/13/2000	BQL
UST1115-MW09	5-20	6/4/1997	BQL
		2/15/2000	710
		11/14/2000	800
		7/18/2002	140
		7/18/2002 dup	150
		8/22/2007 +	120
		2/26/2008 +	107
UST1115-MW10	4-14	6/4/1997	3.1
		2/17/2000	11
		11/15/2000	200
UST1115-MW11	5-20	6/4/1997	BQL
		2/15/2000	150
		11/15/2000	140
UST1115-MW12	5-15	2/23/2000	4,200
		11/15/2000	2,000
		11/15/2000 dup	4,300

TABLE 2
SUMMARY OF HISTORICAL ANALYTICAL RESULTS - GROUNDWATER (EPA METHOD 602/8260B) - BENZENE ONLY

Well ID	Screen Interval (feet BLS)	Date Sampled	Benzene Concentration (µg/L)
2L GWQS (µg/L)			1
UST1115-MW13	46-51	6/4/1997	10,800
		1/7/1999 +	15,000 B
		8/12/1999 +	230
		2/17/2000	14,000
		5/26/2000 +	13,000
		11/20/2000	10,000
		1/24/2001 +	6,400
		7/29/2001 +	2,300
		2/2/2002 +	298
		8/12/2002 +	95.5
		2/19/2003 +	872
		8/20/2003 +	340
		2/24/2004 +	228
		8/25/2004 +	202
		3/22/2005 +	82.1
		8/17/2005 +	61.6
		1/23/2006 +	263
		10/3/2006 +	278
UST1115-MW14	46-51	8/24/2007 +	78.5
		2/25/2008 +	40.8
		6/4/1997	11,760
		2/15/2000	120
		11/20/2000	300
		11/20/2000 dup	310
		7/18/2002	6,600
		7/18/2002	6,700
UST1115-MW15	46-51	8/22/2007 +	170
		2/25/2008 +	229
		6/4/1997	16,500
		2/23/2000	10,000
		11/20/2000	6,100
UST1115-MW17	45-50	7/18/2002	2,300
		8/24/2007 +	<1
		6/4/1997	7,900
		1/7/1999 +	9,200
		8/12/1999 +	9,200
		2/15/2000	7,800
		5/26/2000 +	8,900
		11/13/2000	9,400
		2/23/2000	3,900
		1/23/2001 +	7,900
		7/27/2001 +	7,400
		2/2/2002 +	8,670
		8/7/2002 +	7,770
		2/19/2003 +	3,490
		8/19/2003 +	84.3
		2/25/2004 +	36.9
		8/19/2004 +	34.1
		3/10/2005 +	72.3
		8/18/2005 +	9.5
		1/20/2006 +	39.3
		10/2/2006 +	168
		8/22/2007 +	304
		2/25/2008 +	442

TABLE 2
SUMMARY OF HISTORICAL ANALYTICAL RESULTS - GROUNDWATER (EPA METHOD 602/8260B) - BENZENE ONLY

Well ID	Screen Interval (feet BLS)	Date Sampled	Benzene Concentration (µg/L)
2L GWQS (µg/L)			1
UST1115-MW18	45-50	6/5/1997	4,820
		1/6/1999 +	16,000
		8/12/1999 +	990
		2/22/2000	280
		5/26/2000 +	1,200
		11/13/2000	280
		1/22/2001 +	420
		7/29/2001 +	3.1
		2/2/2002 +	30.2
		8/7/2002 +	33.8
		8/20/2003 +	215
		3/2/2004 +	2,630
		3/22/2005 +	9.6 J
		1/25/2006 +	<1
		8/22/2007 +	5.5
		2/26/2008 +	3.1
UST1115-MW19	45-50	6/5/1997	13,900
		2/22/2000	15,000
		11/16/2000	2,200
		7/17/2002	2,400
UST1115-MW20	45-50	6/5/1997	15,000
		2/23/2000	19,000
		11/16/2000	23,000
		7/18/2002	15,000
		8/20/2007 +	18,700
		2/27/2008 +	3,280
UST1115-MW21	45-50	6/5/1997	890
		1/6/1999 +	2,000
		8/12/1999 +	1,600
		2/15/2000	1,300
		5/26/2000 +	2,200
		11/13/2000	1,600
		1/24/2001 +	1,200
		7/29/2001 +	960
		2/2/2002 +	1,920
		8/6/2002 +	620
		2/19/2003 +	727
		8/19/2003 +	485
		2/25/2004 +	607
		8/19/2004 +	521
		3/10/2005 +	338
		8/18/2005 +	282
		1/20/2006 +	175
		10/2/2006 +	197
		8/23/2007 +	45.2
		2/25/2008 +	1.7

TABLE 2
SUMMARY OF HISTORICAL ANALYTICAL RESULTS - GROUNDWATER (EPA METHOD 602/8260B) - BENZENE ONLY

Well ID	Screen Interval (feet BLS)	Date Sampled	Benzene Concentration (µg/L)
2L GWQS (µg/L)			1
UST1115-MW22	75-80	6/4/1997	1,640
		1/7/1999 +	460
		8/12/1999 +	1,100
		2/15/2000	890
		5/26/2000 +	900
		11/13/2000	1,100
		1/23/2001 +	940
		7/27/2001 +	700
		2/2/2002 +	1,250
		8/7/2002 +	<1
		9/4/2002 +	251
		2/19/2003 +	1,320
		8/19/2003 +	1,930
		2/25/2004 +	2,230
		8/19/2004 +	3,270
		3/10/2005 +	2,850
		8/18/2005 +	3,380
		1/20/2006 +	1,830
		10/2/2006 +	3,880
UST1115-MW23	75-80	8/22/2007 +	600
		2/25/2008 +	174
		6/5/1997	9,700
		1/6/1999 +	15,000
		8/12/1999 +	5,000
		2/22/2000	480
		5/26/2000 +	270
		11/13/2000	6
		1/22/2001 +	4.7 J
		7/29/2001 +	13
		2/2/2002 +	22
		8/5/2002 +	17.8
		2/18/2003 +	0.98 J
		8/20/2003 +	260
		2/21/2004 +	703
		8/19/2004 +	2,720
		3/24/2005 +	3,120
		8/19/2005 +	5,240
		1/23/2006 +	7,230
		10/2/2006 +	1,910
		8/22/2007 +	<5*

TABLE 2

SUMMARY OF HISTORICAL ANALYTICAL RESULTS - GROUNDWATER (EPA METHOD 602/8260B) - BENZENE ONLY

Well ID	Screen Interval (feet BLS)	Date Sampled	Benzene Concentration (µg/L)
2L GWQS (µg/L)			1
UST1115-MW24	75-80	6/5/1997	708
		1/6/1999 +	1,800
		8/12/1999 +	2,400
		2/15/2000	2,700
		2/15/2000 dup	2,800
		5/26/2000 +	3,200
		11/13/2000	3,100
		1/24/2001 +	2,700
		7/29/2001 +	2,900
		2/2/2002 +	2,480
		8/6/2002 +	3,060
		2/19/2003 +	4,120
		8/19/2003 +	3,990
		2/25/2004 +	4,100
		8/19/2004 +	3,630
		3/10/2005 +	1,030
		8/18/2005 +	3,120
		1/20/2006 +	1,750
		10/2/2006 +	2,250
		8/23/2007 +	4.4
		2/25/2008 +	1.4
UST1115-MW25	75-80	6/4/1997	86
		1/7/1999 +	63 B
		8/12/1999 +	240
		2/22/2000	340
		5/26/2000 +	650
		11/20/2000	770
		1/24/2001 +	1,100
		7/29/2001 +	29
		2/2/2002 +	3.1
		8/12/2002 +	1,850
		9/4/2002 +	1,660
		2/19/2003 +	2,840
		8/22/2003 +	3,300
		2/24/2004 +	3,580
		8/25/2004 +	5,960
		3/22/2005 +	5,170
		8/17/2005 +	4,990
		1/23/2006 +	5,000
		10/3/2006 +	5,160
		8/24/2007 +	0.83 J
		2/25/2008 +	3.9
IR78-GW12	5-25	6/5/1997	BQL
		2/16/2000	BQL
		11/13/2000	BQL
IR78-GW13	5-25	6/5/1997	BQL
		2/16/2000	BQL
		11/16/2000	BQL
IR78-GW14	5-25	6/5/1997	BQL
		2/16/2000	BQL
		11/13/2000	BQL
IR78-GW15	5-15	6/5/1997	BQL
		2/16/2000	BQL
		11/13/2000	BQL

TABLE 2
SUMMARY OF HISTORICAL ANALYTICAL RESULTS - GROUNDWATER (EPA METHOD 602/8260B) - BENZENE ONLY

Well ID	Screen Interval (feet BLS)	Date Sampled	Benzene Concentration (µg/L)
2L GWQS (µg/L)			1
IR78-GW16	5-25	6/5/1997	BQL
		2/15/2000	BQL
		11/13/2000	BQL
IR78-GW17-01	5-25	6/5/1997	BQL
		2/15/2000	BQL
		11/16/2000	BQL
IR78-GW17-02	53-73	2/22/2000	3
		11/15/2000	1
		11/15/2000 dup	1
		7/18/2002	2
		8/16/2007 +	9.8
		2/27/2008 +	9.4
IR78-GW19	5-25	6/4/1997	BQL
		2/15/2000	BQL
		11/13/2000	25
IR78-GW21	5-25	6/5/1997	BQL
		2/23/2000	BQL
		11/15/2000	BQL
IR78-GW22-02	7-17	6/5/1997	BQL
		1/6/1999 +	320
		8/12/1999 +	69
		2/23/2000	17
		5/26/2000 +	28
		11/13/2000	28
		1/22/2001 +	50
		7/27/2001 +	3.2
		2/2/2002 +	22.8
		8/5/2002 +	28.3
		2/17/2003 +	41.1
		8/20/2003 +	17.2
		2/21/2004 +	6.6
		8/19/2004 +	6.4
		3/24/2005 +	78.5
		8/18/2005 +	4.7
		1/23/2006 +	95.4
		10/2/2006 +	98.3
IR78-GW31-02	65-75	6/4/1997	BQL
		2/17/2000	BQL
		11/16/2000	BQL
		11/16/2000 dup	BQL
		8/28/2002	<1
IR78-GW31-03	140-150	8/14/2007 +	<1
		6/4/1997	BQL
		2/17/2000	BQL
		11/16/2000	BQL
		8/28/2002	<1

TABLE 2
SUMMARY OF HISTORICAL ANALYTICAL RESULTS - GROUNDWATER (EPA METHOD 602/8260B) - BENZENE ONLY

Well ID	Screen Interval (feet BLS)	Date Sampled	Benzene Concentration (µg/L)
2L GWQS (µg/L)			1
IR78-GW32-02	64-74	6/4/1997	64.2
		1/28/1999 +	170
		10/15/1999 +	<1
		2/18/2000	6
		7/20/2000 +	8.9
		11/14/2000	23
		1/13/2001 +	39
		7/22/2001 +	1.9
		2/9/2002 +	228
		8/14/2002 +	13.1
		2/21/2003 +	109
		8/25/2003 +	176
		2/23/2004 +	325
		9/13/2004 +	321
		4/6/2005 +	604
		8/18/2007 +	915
		3/3/2008 +	33.7
IR78-GW32-03	140-150	6/4/1997	5.1
		1/28/1999 +	84
		10/15/1999 +	<1
		7/19/2000 +	25
		1/13/2001 +	7.3
		7/22/2001 +	98
		2/9/2002 +	2.7
		8/14/2002 +	124
		2/21/2003 +	7.1
		8/26/2003 +	0.64 J
		2/23/2004 +	20.9
		9/9/2004 +	28.9
		4/6/2005 +	8.2
		8/18/2007 +	74.6
		3/3/2008 +	0.53 J
UST1115GT-MW01	5-20	6/5/1997	BQL
		1/7/1999 +	310 B
		8/12/1999 +	8,300
		2/15/2000	14
		5/26/2000 +	13
		11/14/2000	120
		1/24/2001 +	25
		7/29/2001 +	12
		2/2/2002 +	4
		8/5/2002 +	0.88 J
		2/18/2003 +	80
		8/22/2003 +	<1
		2/21/2004 +	29.7
		8/25/2004 +	44.7
		3/24/2005 +	35.8
		8/17/2005 +	268
		1/23/2006 +	1,100
		10/3/2006 +	2,720
		8/24/2007 +	<1

TABLE 2

SUMMARY OF HISTORICAL ANALYTICAL RESULTS - GROUNDWATER (EPA METHOD 602/8260B) - BENZENE ONLY

Well ID	Screen Interval (feet BLS)	Date Sampled	Benzene Concentration (µg/L)
2L GWQS (µg/L)			1
UST1115GT-MW02	5-20	2/17/2000	43,000
		11/14/2000	21,000
UST1115GT-MW03	5-20	6/4/1997	109
		2/17/2000	920
		11/14/2000	1,800
UST1115GT-MW04	5-20	6/4/1997	22
		2/17/2000	140
		11/15/2000	120
UST1115GT-MW05	5-20	6/4/1997	4.2
		2/17/2000	20
		11/14/2000	7
UST1115GT-MW06	5-20	2/17/2000	8,400
		11/14/2000	4,000
UST1115GT-MW07	4-19	6/4/1997	BQL
		2/16/2000	540
		11/15/2000	1,000
		8/12/2002 +	2.9
		2/17/2003 +	205
		8/20/2003 +	235
		2/21/2004 +	0.74 J
		8/19/2004 +	37.9
		3/24/2005 +	11
		8/17/2005 +	22.7
		1/25/2006 +	421
		10/9/2006 +	220
		8/21/2007 +	0.65 J
		2/26/2008 +	71.0
UST1115GT-MW08	4-19	6/4/1997	BQL
		2/16/2000	1
		11/13/2000	4
		7/18/2002	<1
UST1115GT-MW09	5-20	6/4/1997	BQL
		2/16/2000	96
		11/13/2000	3
		8/7/2002 +	0.92 J
		2/21/2003 +	21.1
		8/20/2003 +	<1
		2/24/2004 +	<1
		8/27/2004 +	3.2
		3/22/2005 +	<1
		8/17/2005 +	<1
		1/23/2006 +	154
		10/2/2006 +	9.7
		8/22/2007 +	21.4
		2/26/2008 +	2.3

TABLE 2

SUMMARY OF HISTORICAL ANALYTICAL RESULTS - GROUNDWATER (EPA METHOD 602/8260B) - BENZENE ONLY

Well ID	Screen Interval (feet BLS)	Date Sampled	Benzene Concentration (µg/L)
2L GWQS (µg/L)			1
USTHPFFC-MW01	5-15	12/1/1995	BDL
		6/4/1997	BQL
		1/27/1999 +	<1
		10/18/1999 +	5.4
		2/16/2000	BQL
		7/20/2000 +	2.2
		11/15/2000	BQL
		2/1/2001 +	42
		7/17/2002	<1
		8/13/2002 +	<1
		2/21/2003 +	32.3
		8/22/2003 +	<1
		2/13/2004 +	<1
		8/27/2004 +	3.8
		4/5/2005 +	<1
		8/20/2005 +	<1
		1/24/2006 +	<1
USTHPFFC-MW02	5-15	10/4/2006 +	26.3
		8/23/2007 +	<1
		8/23/2007 dup +	<1
		12/1/1995	BDL
		6/4/1997	BQL
		2/15/2000	BQL
		11/16/2000	BQL
USTHPFFC-MW03	6-16	7/18/2002	<1
		8/20/2007 +	<1
		8/20/2007 dup +	<1
		12/1/1995	0.5
		6/5/1997	BQL
		2/17/2000	BQL
USTHPFFC-MW04	5-15	11/15/2000	BQL
		7/18/2002	<1
		8/14/2007 +	<1
		11/30/1995	BDL
		6/5/1997	BQL
USTHPFFC-MW05	5-15	2/16/2000	BQL
		11/13/2000	BQL
		12/1/1995	6.6
		6/5/1997	1.3
		2/17/2000	2
		11/14/2000	140
		7/17/2002	3
		8/14/2002 +	0.7 J
		2/21/2003 +	674
		8/25/2003 +	44.2
		2/13/2004 +	8.4
		8/27/2004 +	4.1
		4/5/2005 +	<1
		8/22/2005 +	<1
		1/24/2006 +	<1
		10/6/2006 +	156
		8/16/2007 +	<1
		2/25/2008 +	3.9

TABLE 2

SUMMARY OF HISTORICAL ANALYTICAL RESULTS - GROUNDWATER (EPA METHOD 602/8260B) - BENZENE ONLY

Well ID	Screen Interval (feet BLS)	Date Sampled	Benzene Concentration (µg/L)
2L GWQS (µg/L)			1
USTHPFFC-MW06	45-50	11/30/1995	0.7
		6/5/1997	5.6
		2/18/2000	BQL
		11/20/2000	BQL
		7/18/2002	<1
		8/14/2007 +	0.76 J
		2/28/2008 +	14.1
USTHPFFC-MW07	45-50	12/1/1995	320
		6/5/1997	41.5
		1/27/1999 +	79
		10/18/1999 +	63
		2/22/2000	13
		7/20/2000 +	23
		11/15/2000	6
		2/1/2001 +	13
		7/22/2001 +	4.2
		2/9/2002 +	24.9
		8/12/2002 +	1.6
		2/21/2003 +	9.5
		8/22/2003 +	0.79 J
		2/13/2004 +	<1
		8/27/2004 +	1.5
		4/5/2005 +	<1
		8/20/2005 +	<1
		1/24/2006 +	<1
		10/4/2006 +	4.7
		8/23/2007 +	2
		2/26/2008 +	11.3
USTHPFFC-MW08	45-50	11/30/1995	812.5
		6/5/1997	2,500
		1/28/1999 +	1,300
		10/18/1999 +	8,000
		2/22/2000	11,000
		7/24/2000 +	7,100
		11/15/2000	8,500
		1/13/2001 +	7,700
		7/22/2001 +	10,000
		2/9/2002 +	12,300
		8/13/2002 +	14,600
		2/21/2003 +	10,900
		8/25/2003 +	7,420
		2/20/2004 +	10,200
		8/31/2004 +	11,500
		4/13/2005 +	10,600
		8/31/2005 +	7,710
		1/24/2006 +	7,480
		10/6/2006 +	4,940
		8/15/2007 +	7,730
		2/28/2008 +	2,760

TABLE 2
SUMMARY OF HISTORICAL ANALYTICAL RESULTS - GROUNDWATER (EPA METHOD 602/8260B) - BENZENE ONLY

Well ID	Screen Interval (feet BLS)	Date Sampled	Benzene Concentration (µg/L)
2L GWQS (µg/L)			1
USTHPFFC-MW09	45-50	12/1/1995	8,170
		6/5/1997	10,500
		2/18/2000	18,000
		11/14/2000	17,000
		11/14/2000 dup	17,000
		7/17/2002	8,100
		8/14/2002 +	10,800
		2/21/2003 +	22,600
		8/22/2003 +	4,090
		2/13/2004 +	727
		8/27/2004 +	0.88 J
		4/5/2005 +	0.76 J
		8/22/2005 +	<5
		1/24/2006 +	<1
		10/6/2006 +	323
		8/16/2007 +	<1
USTHPFFC-MW10	75-80	2/27/2008 +	15.9
		2/27/2008 dup +	15.6
		8/21/1997	168.0
		2/18/2000	1,400
		11/20/2000	2,000
		11/20/2000 dup	2,000
		7/17/2002	580
		8/16/2007 +	0.73 J
USTHPFFC-MW11	105-110	2/28/2008 +	<1
		2/28/2008 dup +	<1
		8/21/1997	25.9
		2/18/2000	130
		11/16/2000	59.0
		7/17/2002	370
		8/13/2002 +	809
		2/21/2003 +	489
		8/25/2003 +	348
		2/20/2004 +	114
		8/31/2004 +	89.6
		4/13/2005 +	<1
		8/20/2005 +	44.7
USTHPFFC-MW12	105-110	1/24/2006 +	96.7
		12/1/2006 +	41.2
		8/15/2007 +	<1
		8/21/1997	51.8
		2/23/2000	1,500
		11/15/2000	1,600
		11/15/2000 dup	1,700
USTHPFFC-MW13	105-110	7/17/2002	3,000
		8/20/2007 +	47
		2/27/2008 +	63.6
		8/21/1997	14.7
		2/22/2000	150
		11/13/2000	180
		7/18/2002	160
		7/18/2002 dup	160
		8/24/2007 +	<1

TABLE 2
SUMMARY OF HISTORICAL ANALYTICAL RESULTS - GROUNDWATER (EPA METHOD 602/8260B) - BENZENE ONLY

Well ID	Screen Interval (feet BLS)	Date Sampled	Benzene Concentration (µg/L)
2L GWQS (µg/L)			1
USTHPFFC-MW14	5-15	2/17/2000	1,400
		11/15/2000	1,400
USTHPFFC-MW15	5-15	8/20/1997	23,900
		8/16/2007 +	21,300
USTHPFFC-MW16	5-15	8/20/1997	BQL
		2/16/2000	19
		11/15/2000	580
USTHPFFC-MW17	5-15	8/20/1997	BQL
		2/16/2000	880
		11/16/2000	540
USTHPFFC-MW18	5-15	8/20/1997	BQL
		2/16/2000	WELL DAMAGED
USTHPFFC-MW19	5-15	8/20/1997	17,900
		1/28/1999 +	28,000
		10/15/1999 +	12,000
		2/23/2000	19,000
		7/26/2000 +	17,000
		11/14/2000	20,000
		1/13/2001 +	19,000
		7/22/2001 +	13,000
		2/9/2002 +	15,000
		8/13/2002 +	16,800
		2/18/2003 +	16,300
		8/27/2003 +	7,760
		2/14/2004 +	11,300
		9/8/2004 +	10,900
		4/18/2005 +	3,720
		1/24/2006 +	12,100
		10/6/2006 +	1,110
		8/20/2007 +	13,700
USTHPFFC-MW20	5-15	8/20/2007 dup +	14,100
		2/27/2008 +	3,760
		8/20/1997	4,850
		1/27/1999 +	2,600
		10/15/1999 +	3,400
		2/18/2000	13,000
		2/18/2000 dup	4,700
		7/20/2000 +	4,400
		11/15/2000	5,800
		2/1/2001 +	4,700
		7/22/2001 +	2,800
		2/9/2002 +	3,070
		8/14/2002 +	1,250
		2/18/2003 +	3,280
		8/27/2003 +	6,020
		2/20/2004 +	6,430
		9/8/2004 +	3,030
		4/18/2005 +	13,200
		8/31/2005 +	1,030
		1/24/2006 +	4,050
		10/4/2006 +	453
		8/14/2007 +	374
		2/28/2008 +	3,210

TABLE 2
SUMMARY OF HISTORICAL ANALYTICAL RESULTS - GROUNDWATER (EPA METHOD 602/8260B) - BENZENE ONLY

Well ID	Screen Interval (feet BLS)	Date Sampled	Benzene Concentration (µg/L)
2L GWQS (µg/L)			1
USTHPFFC-MW21	5-15	1/28/2000	BQL
		11/16/2000	6
USTHPFFC-MW22	4-14	1/28/2000	11,000
		11/15/2000	11,000
USTHPFFC-MW23	3-13	1/28/2000	9,200
		11/16/2000	5,200
USTHPFFC-MW24	5-15	1/31/2000	3,600
		11/16/2000	1,700
USTHPFFC-MW25	5-15	1/28/2000	16,000
		11/16/2000	13,000
USTHPFFC-MW26	5-15	1/31/2000	5
		11/16/2000	BQL
USTHPFFC-MW27	4-14	2/2/2000	11
		11/14/2000	45
USTHPFFC-MW28	4-14	1/28/2000	29,000
USTHPFFC-MW29	4-14	1/28/2000	24,000
		11/16/2000	23,000
USTHPFFC-MW30	2-12	1/28/2000	510
		11/15/2000	150
USTHPFFC-MW31	4-14	1/31/2000	BQL
		11/13/2000	BQL
		7/18/2002	<1
		8/15/2007 +	<1
USTHPFFC-MW32	4-14	1/31/2000	BQL
		11/13/2000	BQL
USTHPFFC-MW33	4-14	1/31/2000	BQL
		11/13/2000	BQL
USTHPFFC-MW34	4-14	1/31/2000	5
		11/13/2000	BQL
USTHPFFC-MW35	4-14	2/1/2000	BQL
		11/13/2000	BQL
USTHPFFC-MW36	4-14	2/1/2000	BQL
		11/13/2000	BQL
		8/21/2007 +	<1
USTHPFFC-MW37	4-14	2/1/2000	1
		11/13/2000	BQL
USTHPFFC-MW38	4-14	2/1/2000	BQL
		11/15/2000	BQL
		7/17/2002	<1
		8/15/2007 +	<1
USTHPFFC-MW39	5-15	3/7/2000	BQL
		11/13/2000	BQL
		7/18/2002	<1
		8/25/2007 +	5.7
		2/25/2008 +	<1
USTHPFFC-MW40	5-15	3/7/2000	BQL
		11/15/2000	BQL
USTHPFFC-MW41	5-15	3/7/2000	BQL
		11/16/2000	86
USTHPFFC-MW42	5-15	3/7/2000	BQL
		11/15/2000	BQL

TABLE 2

SUMMARY OF HISTORICAL ANALYTICAL RESULTS - GROUNDWATER (EPA METHOD 602/8260B) - BENZENE ONLY

Well ID	Screen Interval (feet BLS)	Date Sampled	Benzene Concentration (µg/L)
2L GWQS (µg/L)			1
USTHPFFC-MW43	75-80	3/26/2002	<1
		8/25/2007 +	<1
USTHPFFC-MW44	45-50	3/26/2002	<1
		8/25/2007 +	<1
USTHPFFC-MW45	75-80	3/26/2002	710
USTHPFFC-MW46	145-150	3/26/2002	<1
USTHPFFC-MW47	45-50	3/26/2002	1,300
		8/25/2007 +	993
		2/25/2008 +	747
USTHPFFC-MW48	5-15	3/26/2002	<1
		8/24/2007 +	<1
		8/24/2007 + dup	<1
USTHPFFC-MW49	75-80	3/26/2002	<1
USTHPFFC-MW50	45-50	3/26/2002	28
		8/24/2007 +	<1
USTHPFFC-MW51	5-15	3/25/2002	<1
		8/25/2007 +	2.1
		8/25/2007 + dup	<1
		4/21/2008 +	<1
USTHPFFC-MW52	145-150	3/26/2002	<1
USTHPFFC-MW53	45-50	3/26/2002	1
		8/25/2007 +	<1
USTHPFFC-MW54	2-17	3/26/2002	<1
		8/25/2007 +	<1
USTHPFFC-MW55	75-80	3/26/2002	<1
		8/25/2007 +	<1
USTHPFFC-MW56	145-150	3/26/2002	<1
		8/24/2007 +	<1
USTHPFFC-MW57	45-50	3/26/2002	3,100
USTHPFFC-MW58	75-80	3/26/2002	7
USTHPFFC-MW59	75-80	3/27/2002	210
		8/23/2007 +	<1
USTHPFFC-MW60	45-50	3/27/2002	3,000
		7/17/2002	2,700
		8/20/2007 +	6,700
		8/20/2007 + dup	8,170
		2/27/2008 +	8,650
USTHPFFC-MW61	145-150	3/27/2002	<1
		3/27/2002 dup	<1
		8/20/2007 +	<1
USTHPFFC-MW62	150-155	3/26/2002	1
USTHPFFC-MW63	45-50	3/26/2002	6
		8/15/2007 +	<1
USTHPFFC-MW64	45-50	3/27/2002	46
USTHPFFC-MW65	75-80	3/27/2002	21
USTHPFFC-MW66	45-50	3/27/2002	3,000
		3/27/2002 dup	3,100
		8/17/2007 +	3,830
USTHPFFC-MW67	75-80	3/27/2002	<1
USTHPFFC-MW68	5-25	3/25/2002	30
USTHPFFC-MW69	45-50	3/27/2002	1
USTHPFFC-MW70	45-50	3/27/2002	<1
		8/16/2007 +	<1

TABLE 2

SUMMARY OF HISTORICAL ANALYTICAL RESULTS - GROUNDWATER (EPA METHOD 602/8260B) - BENZENE ONLY

Well ID	Screen Interval (feet BLS)	Date Sampled	Benzene Concentration (µg/L)
2L GWQS (µg/L)			1
USTHPFFC-MW71	75-80	3/27/2002	<1
		8/16/2007 +	<1
USTHPFFC-MW72	18-30	3/25/2002	15,000
		7/18/2002	21,000
		8/17/2007 +	16,800
USTHPFFC-MW73	45-50	4/23/2003	<1
		4/23/2003 dup	<1
		8/23/2007 +	<50*
USTHPFFC-MW74	75-80	4/23/2003	<1
		8/23/2007 +	<10*
USTHPFFC-MW75	55-75	5/7/2003	650
		5/14/2003	1,300
USTHPFFC-MW76	45-50	4/23/2003	71
		8/25/2007 +	<1
USTHPFFC-MW77	45-50	4/23/2003	<1
		8/15/2007 +	<1
USTHPFF-MW01	7-17	1/27/1999 +	16,000
		10/18/1999 +	9,400
		2/17/2000	11,000
		7/26/2000 +	11,000
		1/13/2001 +	8,300
		7/22/2001 +	7,700
		2/9/2002 +	3,280
		8/13/2002 +	5,710
		2/17/2003 +	5,380
		8/27/2003 +	6,670
		2/14/2004 +	4,970
		8/20/2004 +	3,180
		4/13/2005 +	4,480
		8/31/2005 +	4,140
		1/23/2006 +	2,860
		10/6/2006 +	2,790
		8/15/2007 +	4,530
		2/28/2008 +	3,910
USTHPFF-MW02	7-17	2/18/2000	40,000
USTHPFF-MW03	5-15	11/30/1995	BDL
		6/5/1997	BQL
		2/16/2000	BQL
		11/13/2000	BQL
		7/17/2002	<1
USTHPFF-MW04	5-15	11/30/1995	BDL
		6/4/1997	BQL
		2/16/2000	BQL
		11/13/2000	BQL
USTHPFF-MW05	5-15	6/5/1997	BQL
		2/17/2000	BQL
		11/16/2000	BQL
USTHPFF-MW06	5-15	11/30/1995	30
		6/4/1997	9.3
		2/22/2000	9
		11/16/2000	28
		7/17/2002	<10*
		8/21/2007 +	38.1
		2/27/2008 +	92.0

TABLE 2

SUMMARY OF HISTORICAL ANALYTICAL RESULTS - GROUNDWATER (EPA METHOD 602/8260B) - BENZENE ONLY

Well ID	Screen Interval (feet BLS)	Date Sampled	Benzene Concentration (µg/L)
2L GWQS (µg/L)			1
USTHPFF-MW09	5-15	11/30/1995	1
		6/5/1997	BQL
		2/15/2000	BQL
		11/13/2000	BQL
		7/17/2002	<1
		8/16/2007 +	<1
USTHPFF-MW10R	5-15	6/5/1997	700
		1/28/1999 +	5,200
		10/18/1999 +	2,200
		2/17/2000	3,400
		7/24/2000 +	3,300
		11/16/2000	3,800
		1/13/2001 +	5,200
		7/22/2001 +	5,800
		2/9/2002 +	4,410
		8/13/2002 +	3,780
		2/17/2003 +	2,340
		8/27/2003 +	2,830
		2/14/2004 +	197
		9/8/2004 +	480
		4/13/2005 +	487
		8/27/2005 +	1,060
		1/24/2006 +	1,770
		10/4/2006 +	1,280
		8/21/2007 +	1,240
		2/28/2008 +	720
USTHPFF-MW11	5-25	11/30/1995	2.1
		6/4/1997	BQL
		1/27/1999 +	1.2
		10/18/1999 +	40
		2/15/2000	1,500
		7/26/2000 +	2,500
		11/16/2000	550
		2/1/2001 +	480
		2/9/2002 +	64.4
		8/13/2002 +	26.2
		2/18/2003 +	274
		8/22/2003 +	957
		2/14/2004 +	6.5
		4/5/2005 +	5.2
		8/27/2005 +	1.3
		1/25/2006 +	53.6
		10/9/2006 +	3.7
		8/16/2007 +	<1
USTHPFF-MW12	5-25	8/20/2007 +	758
		2/26/2008 +	1,110
USTHPFF-MW15	5-25	11/30/1995	18.5
		6/5/1997	BQL
		8/17/2007 +	561
		3/3/2008 +	422

TABLE 2
SUMMARY OF HISTORICAL ANALYTICAL RESULTS - GROUNDWATER (EPA METHOD 602/8260B) - BENZENE ONLY

Well ID	Screen Interval (feet BLS)	Date Sampled	Benzene Concentration (µg/L)
2L GWQS (µg/L)			1
USTHPFF-MW17	5-25	11/30/1995	5,750
		6/5/1997	5,340
		1/28/1999 +	7,700
		10/18/1999 +	5,400
		2/18/2000	32,000
		7/24/2000 +	6,700
		11/15/2000	15,000
		1/13/2001 +	16,000
		7/22/2001 +	12,000
		2/9/2002 +	12,200
		8/13/2002 +	6,140
		2/21/2003 +	5,720
		8/25/2003 +	6,830
		2/20/2004 +	5,520
		9/13/2004 +	4,910
		4/13/2005 +	6,500
		8/31/2005 +	7,380
		1/24/2006 +	5,630
		10/6/2006 +	4,480
		8/16/2007 +	7,240
		2/28/2008 +	6,480
USTHPFF-MW18	5-25	6/5/1997	20,450
		1/28/1999 +	28,000
		10/18/1999 +	15,000
		2/17/2000	20,000
		7/26/2000 +	16,000
		11/16/2000	15,000
		1/13/2001 +	12,000
		7/22/2001 +	11,000
		2/9/2002 +	18,900
		8/14/2002 +	18,200
		2/18/2003 +	16,900
		8/27/2003 +	5,440
		2/14/2004 +	12,900
		8/20/2004 +	7,040
		4/13/2005 +	12,800
		8/31/2005 +	12,300
		1/23/2006 +	12,400
		10/6/2006 +	10,300
		8/15/2007 +	15,400
USTHPFF-MW19	5-25	11/30/1995	3.3
		6/5/1997	5.6
		2/17/2000	BQL
		11/15/2000	BQL
		7/18/2002	210
		8/14/2007 +	<1
USTHPFF-MW20	4-24	11/30/1995	4.9
		6/5/1997	BQL
		2/23/2000	BQL
		11/20/2000	BQL
		7/18/2002	4
		8/24/2007 +	<1

TABLE 2**SUMMARY OF HISTORICAL ANALYTICAL RESULTS - GROUNDWATER (EPA METHOD 602/8260B) - BENZENE ONLY**

Well ID	Screen Interval (feet BLS)	Date Sampled	Benzene Concentration (µg/L)
2L GWQS (µg/L)			1
USTHPFF-MW21	4-19	6/5/1997	BQL
		2/16/2000	BQL
USTHPFF-MW23	8-18	6/5/1997	3.8
		2/23/2000	BQL
USTHPFF-MWA	4-14	11/13/2000	2,900

All results in micrograms per liter (µg/L).

Bold concentrations exceed the 2L GWQS.

BQL = Below Quantitation Limits. Refer to analytical report for a complete list of compounds and quantitation limits.

* Laboratory practical quantitation limit is higher than the 2L GWQS.

Dup = Duplicate sample taken.

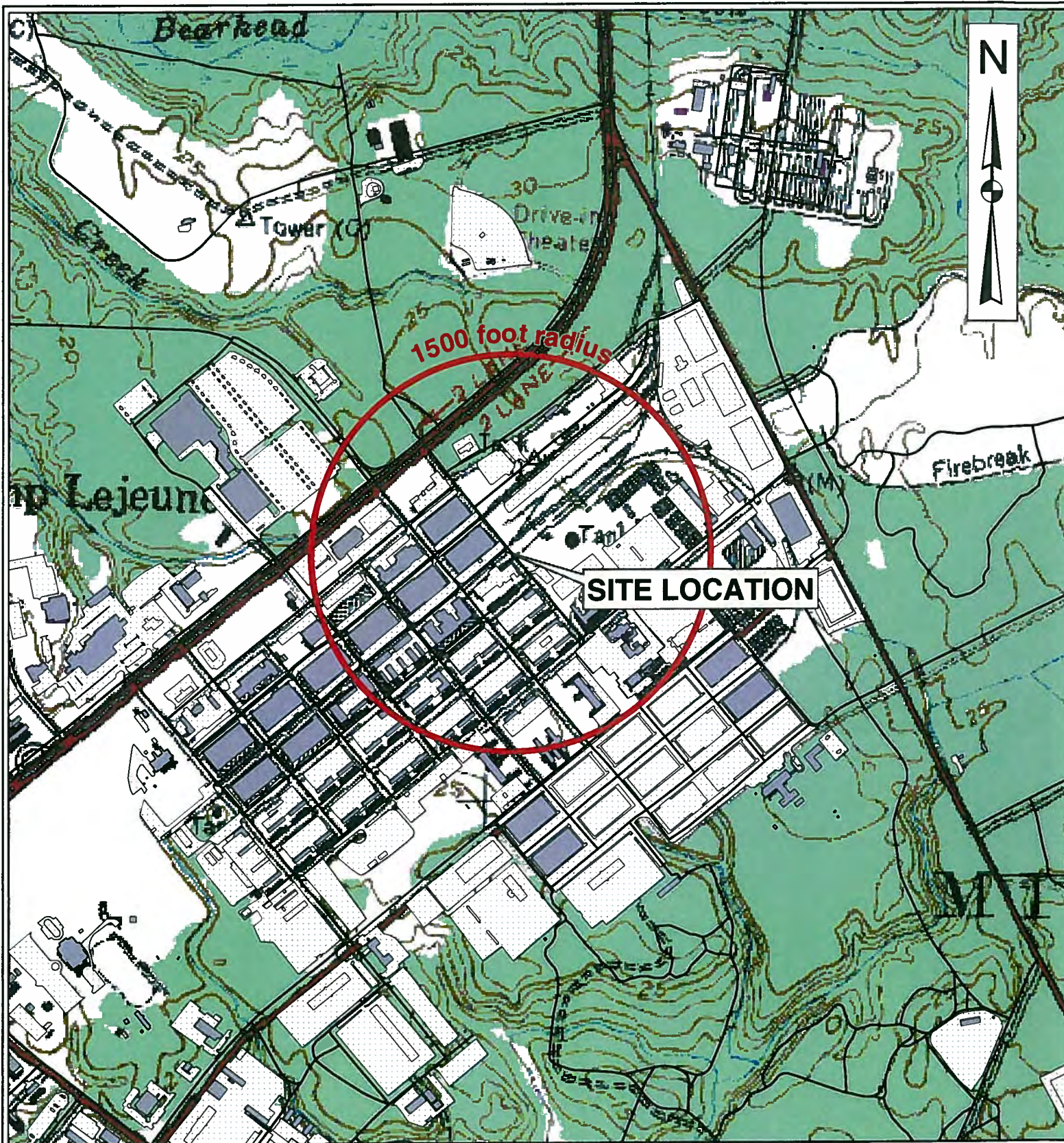
+ Wells sampled by Shaw Environmental & Infrastructure.

ND = Not Detected.

B = Indicates analyte detected in associated method blank

J = Estimated concentration, below calibration range and above method detection limit.

FIGURES



Data Sources: USGS Topographic Quadrangle
Camp Lejeune (1952, Photorevised 1971). GIS
data provided by Camp Lejeune GIS Department.

1,000 500 0 1,000 Feet
SCALE



PROJECT

HADNOT POINT FUEL FARM
BIO-PULSE AIR SPARGING
EVALUATION REPORT
MCB CAMP LEJEUNE, NC

TITLE

SITE VICINITY MAP

FIGURE

1

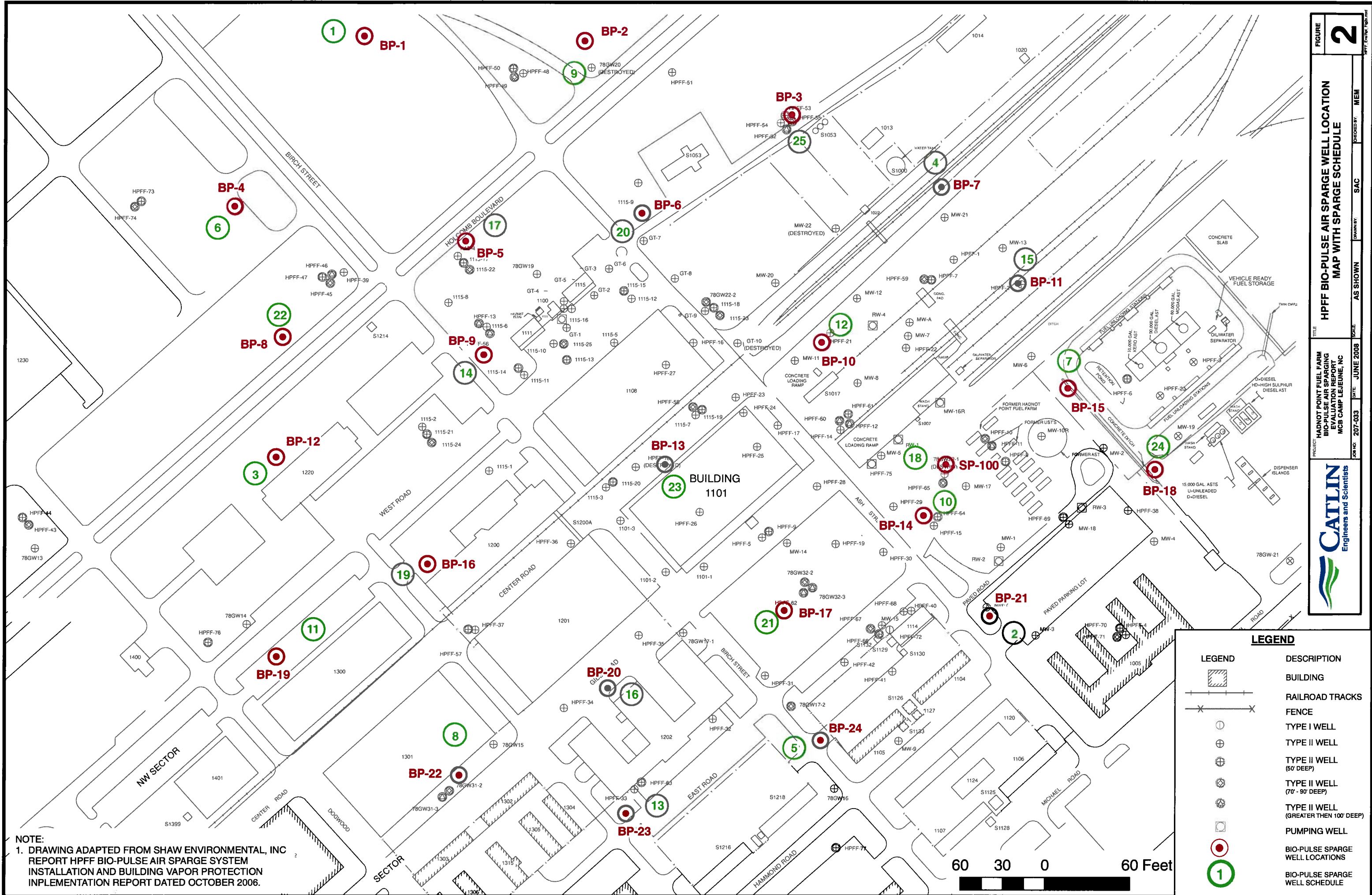
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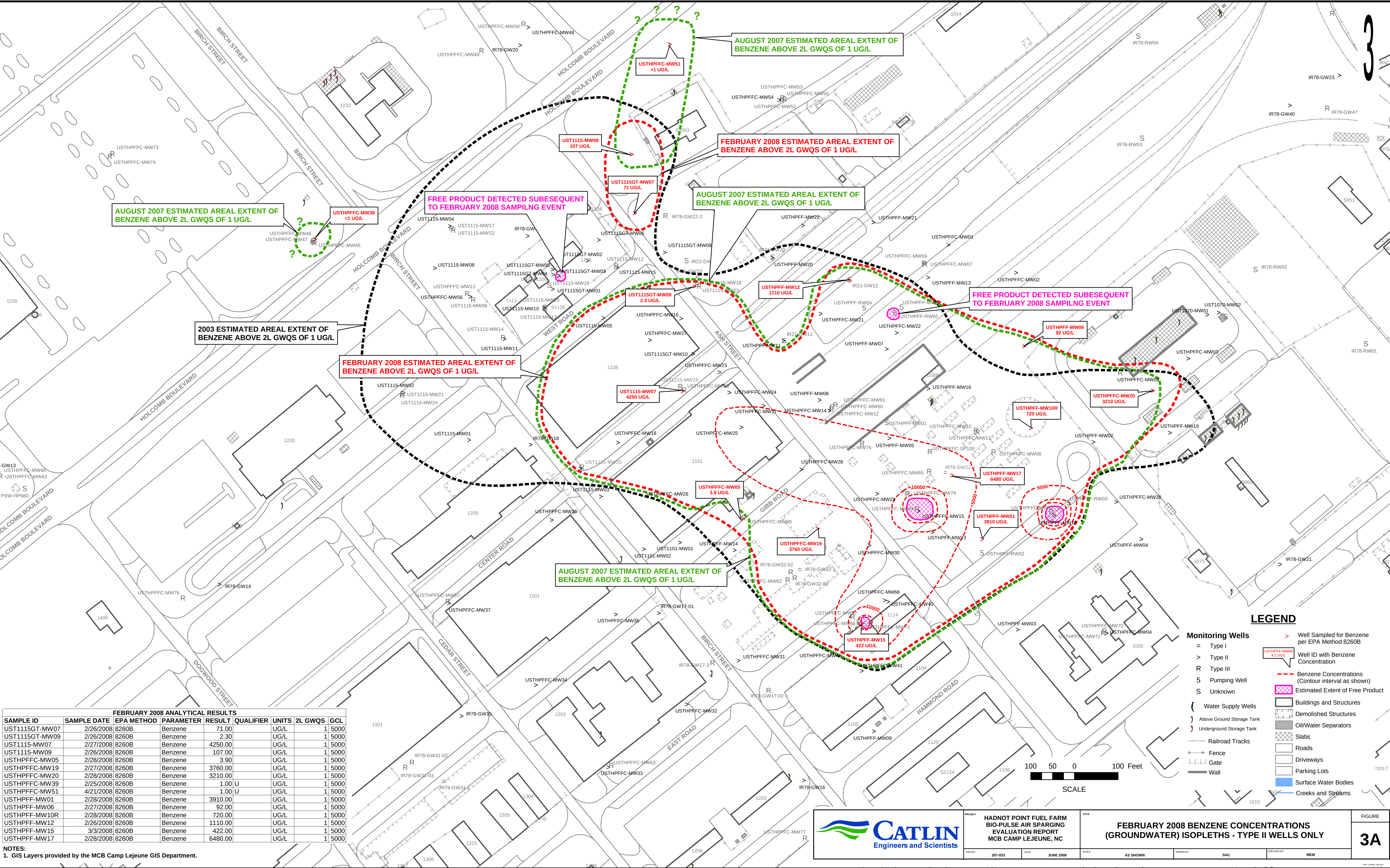
DATE JUNE 2008

SCALE AS SHOWN

DRAWN BY SAC

CHECKED BY MEM





FEBRUARY 2008 ANALYTICAL RESULTS							
SAMPLE ID	SAMPLE DATE	EPA METHOD	PARAMETER	RESULT	QUALIFIER	UNITS	2L GWQS
UST1115GT-MW07	2/26/2008	8260B	Benzene	71.00		UG/L	1.5000
UST1115GT-MW09	2/26/2008	8260B	Benzene	2.30		UG/L	1.5000
UST1115-MW07	2/27/2008	8260B	Benzene	4250.00		UG/L	1.5000
UST1115-MW09	2/26/2008	8260B	Benzene	107.00		UG/L	1.5000
USTHPFFC-MW05	2/28/2008	8260B	Benzene	3.90		UG/L	1.5000
USTHPFFC-MW19	2/27/2008	8260B	Benzene	3760.00		UG/L	1.5000
USTHPFFC-MW20	2/28/2008	8260B	Benzene	3210.00		UG/L	1.5000
USTHPFFC-MW39	2/25/2008	8260B	Benzene	1.00	U	UG/L	1.5000
USTHPFFC-MW51	4/21/2008	8260B	Benzene	1.00	U	UG/L	1.5000
USTHPFF-MW01	2/28/2008	8260B	Benzene	3910.00		UG/L	1.5000
USTHPFF-MW06	2/27/2008	8260B	Benzene	92.00		UG/L	1.5000
USTHPFF-MW10R	2/28/2008	8260B	Benzene	720.00		UG/L	1.5000
USTHPFF-MW12	2/26/2008	8260B	Benzene	1110.00		UG/L	1.5000
USTHPFF-MW15	3/3/2008	8260B	Benzene	422.00		UG/L	1.5000
USTHPFF-MW17	2/28/2008	8260B	Benzene	6480.00		UG/L	1.5000

NOTES:
1. GIS Layers provided by the MCB Camp Lejeune GIS Department.



PROJECT

HADNOT POINT FUEL FARM
BIO-PULSE AIR SPARGING
EVALUATION REPORT
MCB CAMP LEJEUNE, NC

FIGURE

3A

DATE

JUNE 2008

SCALE

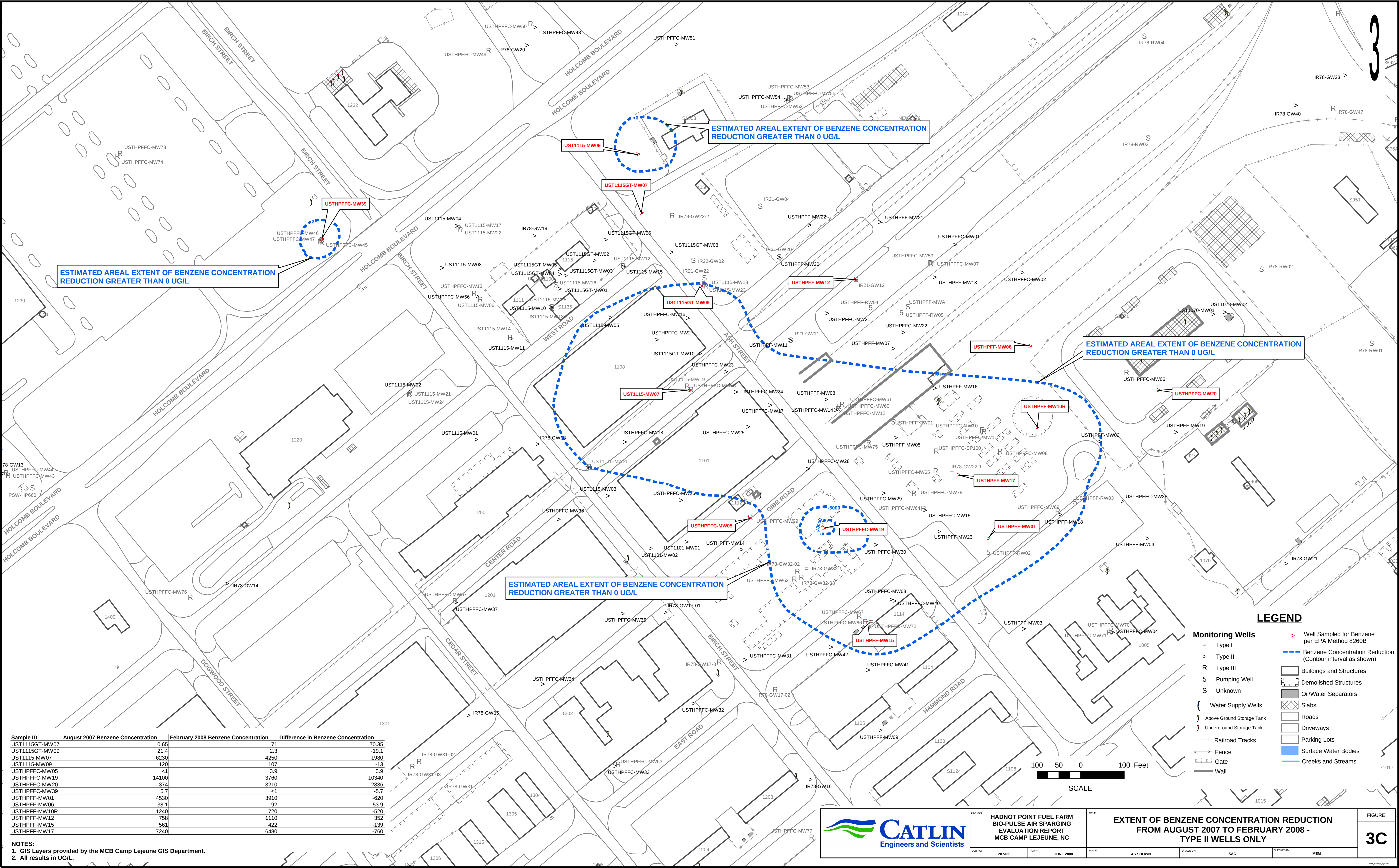
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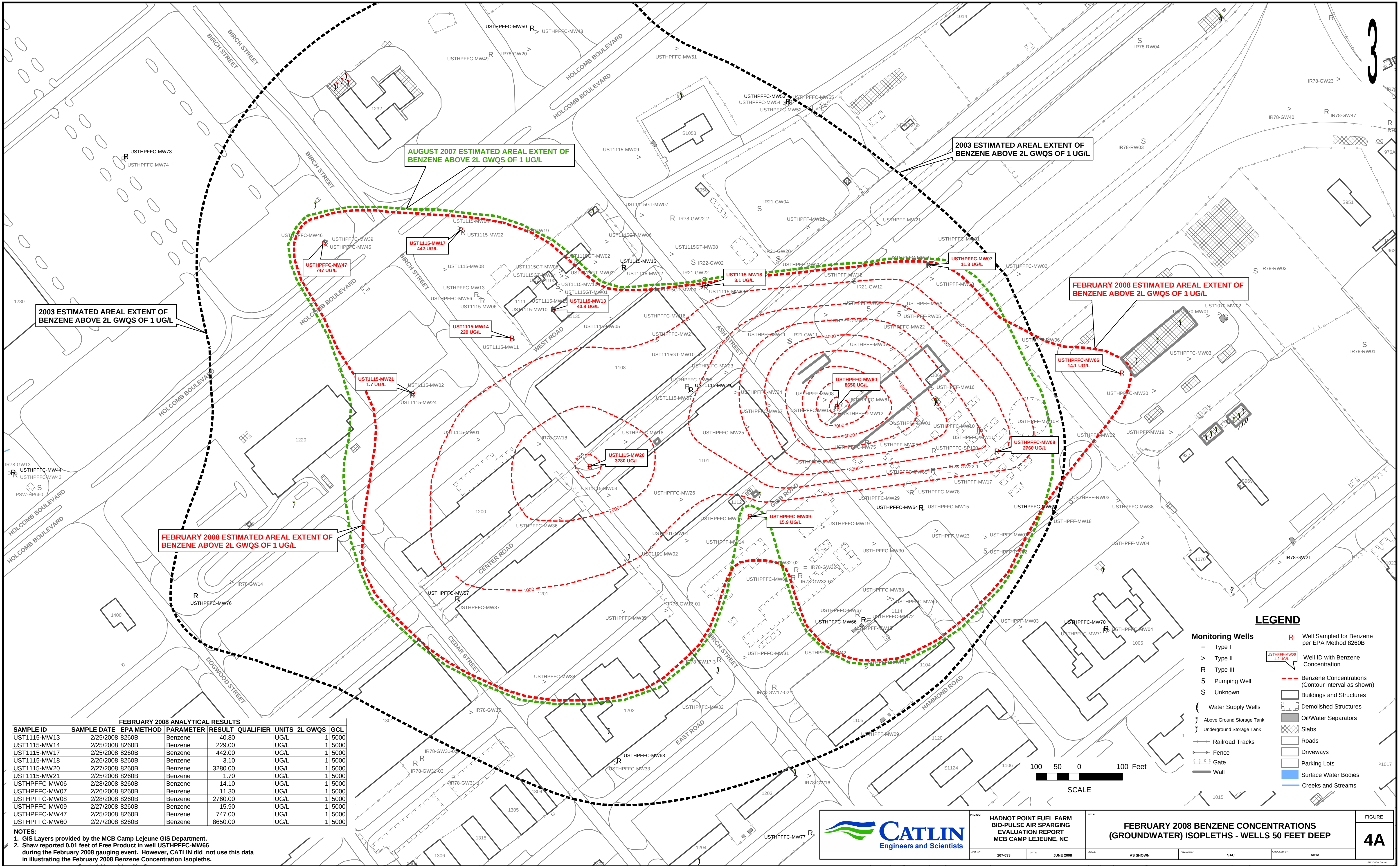
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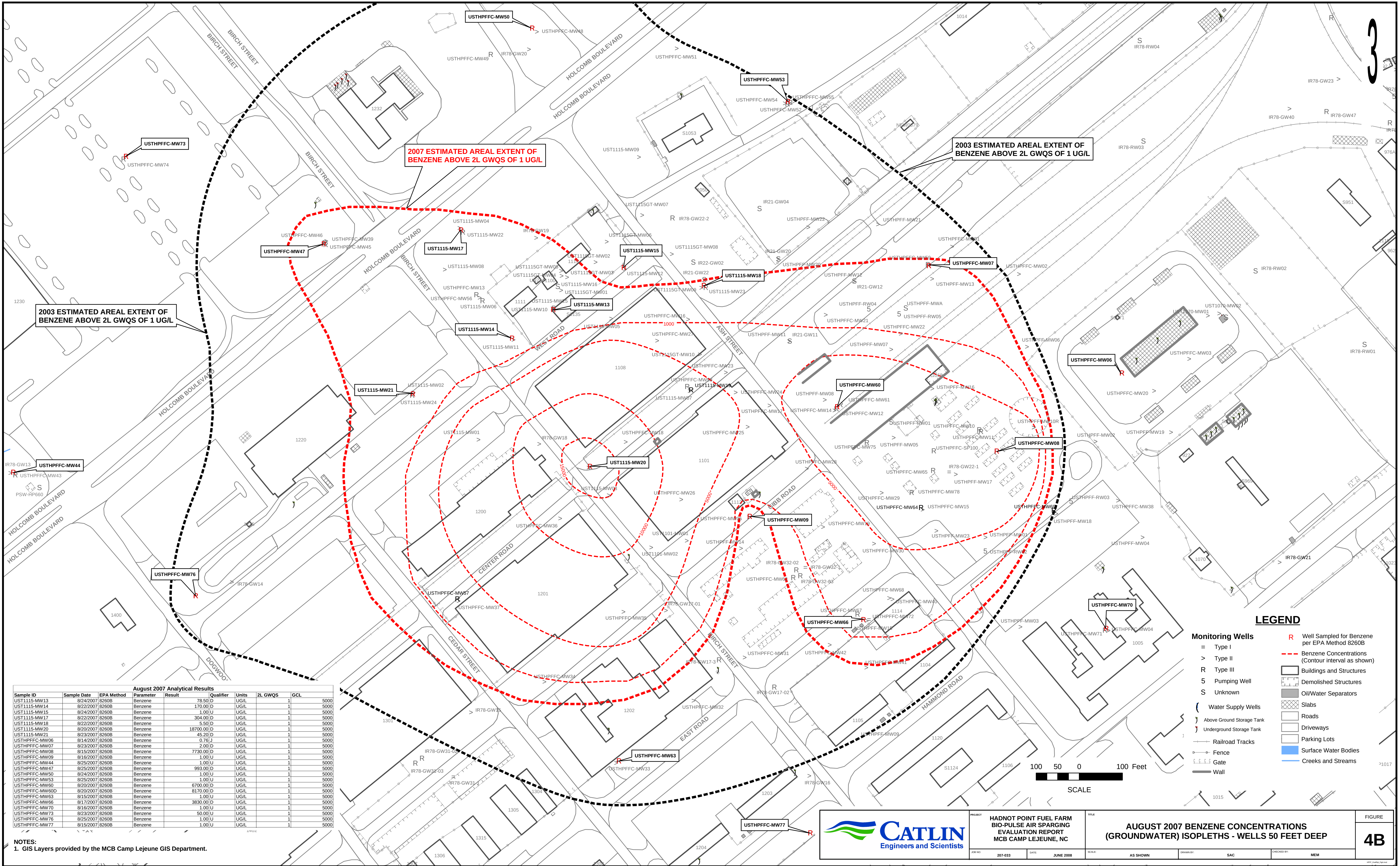
SAC

CHECKED BY

MEM







August 2007 Analytical Results									
Sample ID	Sample Date	EPA Method	Parameter	Result	Qualifier	Units	2L GWQS	GCL	
UST1115-MW13	8/24/2007	8260B	Benzene	78.50	D	UG/L	1	5000	
UST1115-MW14	8/22/2007	8260B	Benzene	170.00	D	UG/L	1	5000	
UST1115-MW15	8/24/2007	8260B	Benzene	1.00	U	UG/L	1	5000	
UST1115-MW17	8/22/2007	8260B	Benzene	304.00	D	UG/L	1	5000	
UST1115-MW18	8/22/2007	8260B	Benzene	5.50	D	UG/L	1	5000	
UST1115-MW20	8/20/2007	8260B	Benzene	18700.00	D	UG/L	1	5000	
UST1115-MW21	8/23/2007	8260B	Benzene	45.20	D	UG/L	1	5000	
USTHPFFC-MW06	8/14/2007	8260B	Benzene	0.76	J	UG/L	1	5000	
USTHPFFC-MW07	8/23/2007	8260B	Benzene	2.00	D	UG/L	1	5000	
USTHPFFC-MW08	8/15/2007	8260B	Benzene	7730.00	D	UG/L	1	5000	
USTHPFFC-MW09	8/16/2007	8260B	Benzene	1.00	U	UG/L	1	5000	
USTHPFFC-MW44	8/25/2007	8260B	Benzene	1.00	U	UG/L	1	5000	
USTHPFFC-MW47	8/25/2007	8260B	Benzene	993.00	D	UG/L	1	5000	
USTHPFFC-MW50	8/24/2007	8260B	Benzene	1.00	U	UG/L	1	5000	
USTHPFFC-MW53	8/25/2007	8260B	Benzene	1.00	U	UG/L	1	5000	
USTHPFFC-MW60	8/20/2007	8260B	Benzene	6700.00	D	UG/L	1	5000	
USTHPFFC-MW60D	8/20/2007	8260B	Benzene	8170.00	D	UG/L	1	5000	
USTHPFFC-MW63	8/15/2007	8260B	Benzene	1.00	U	UG/L	1	5000	
USTHPFFC-MW66	8/17/2007	8260B	Benzene	3830.00	D	UG/L	1	5000	
USTHPFFC-MW70	8/16/2007	8260B	Benzene	1.00	U	UG/L	1	5000	
USTHPFFC-MW73	8/23/2007	8260B	Benzene	50.00	D	UG/L	1	5000	
USTHPFFC-MW76	8/25/2007	8260B	Benzene	1.00	U	UG/L	1	5000	
USTHPFFC-MW77	8/15/2007	8260B	Benzene	1.00	U	UG/L	1	5000	

NOTES:
1. GIS Layers provided by the MCB Camp Lejeune GIS Department.



PROJECT

HADNOT POINT FUEL FARM
BIO-PULSE AIR SPARGING
EVALUATION REPORT
MCB CAMP LEJEUNE, NC

DATE

JUNE 2008

SCALE

AS SHOWN

DRAWN BY

SAC

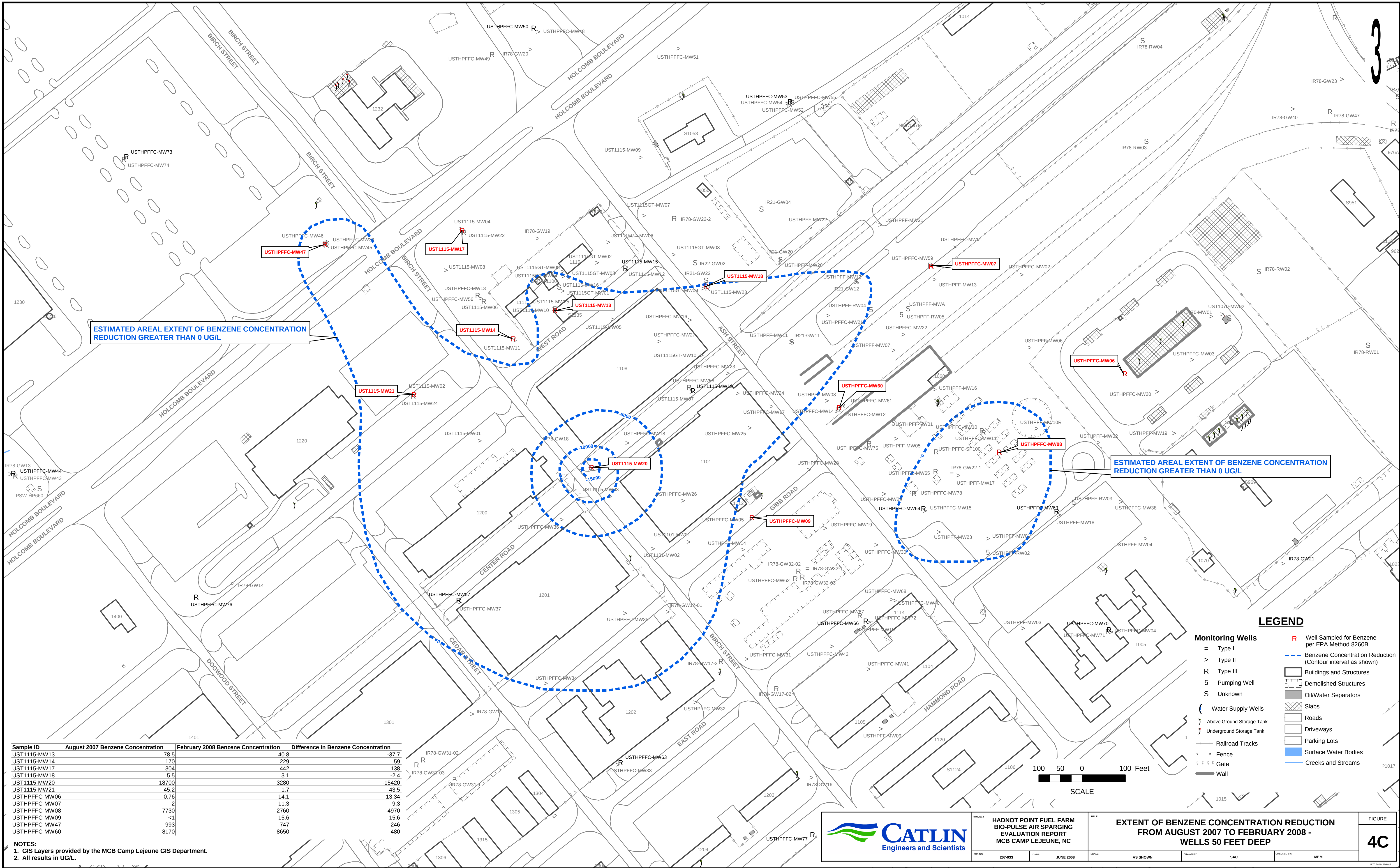
CHECKED BY

MEM

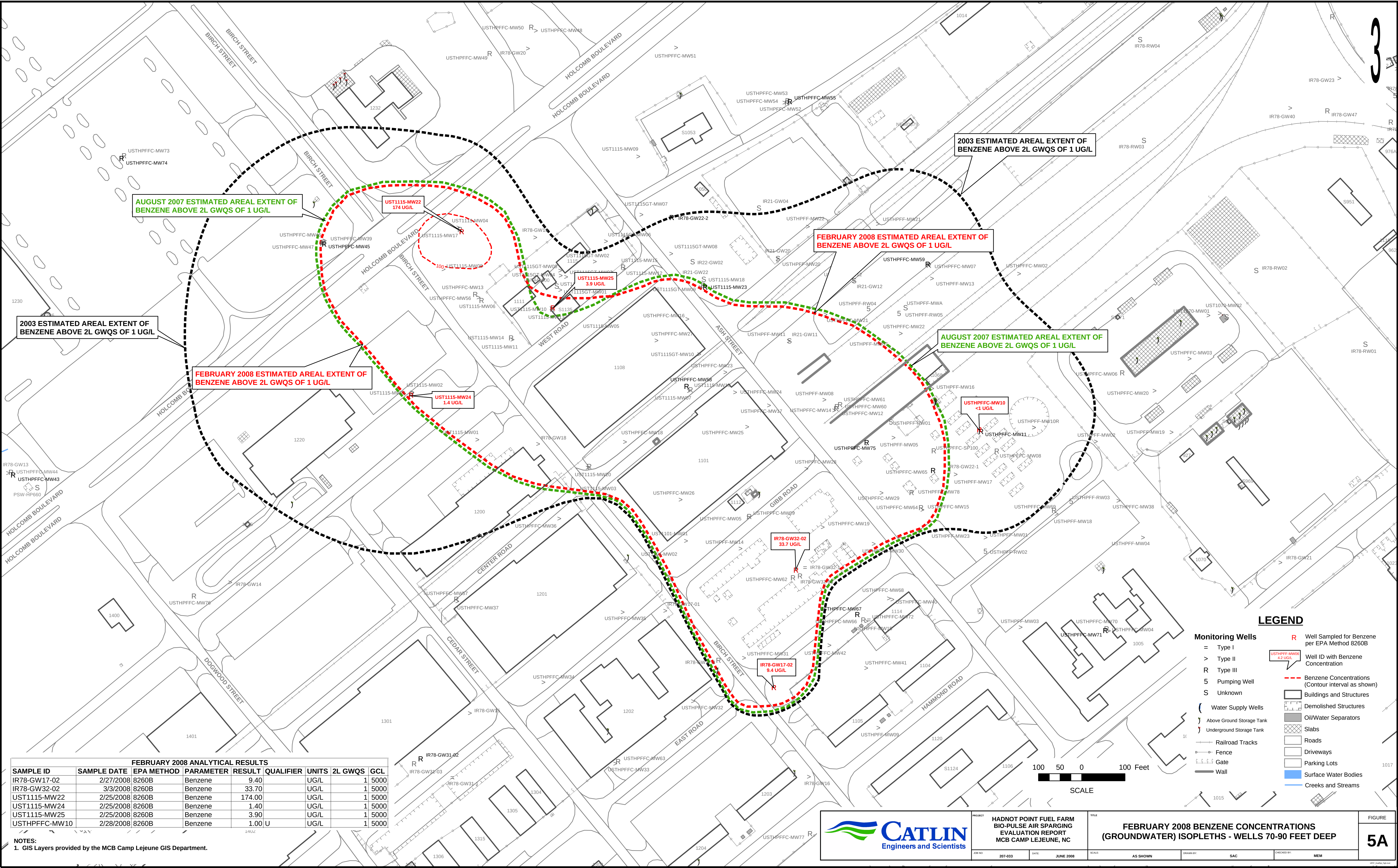
FIGURE

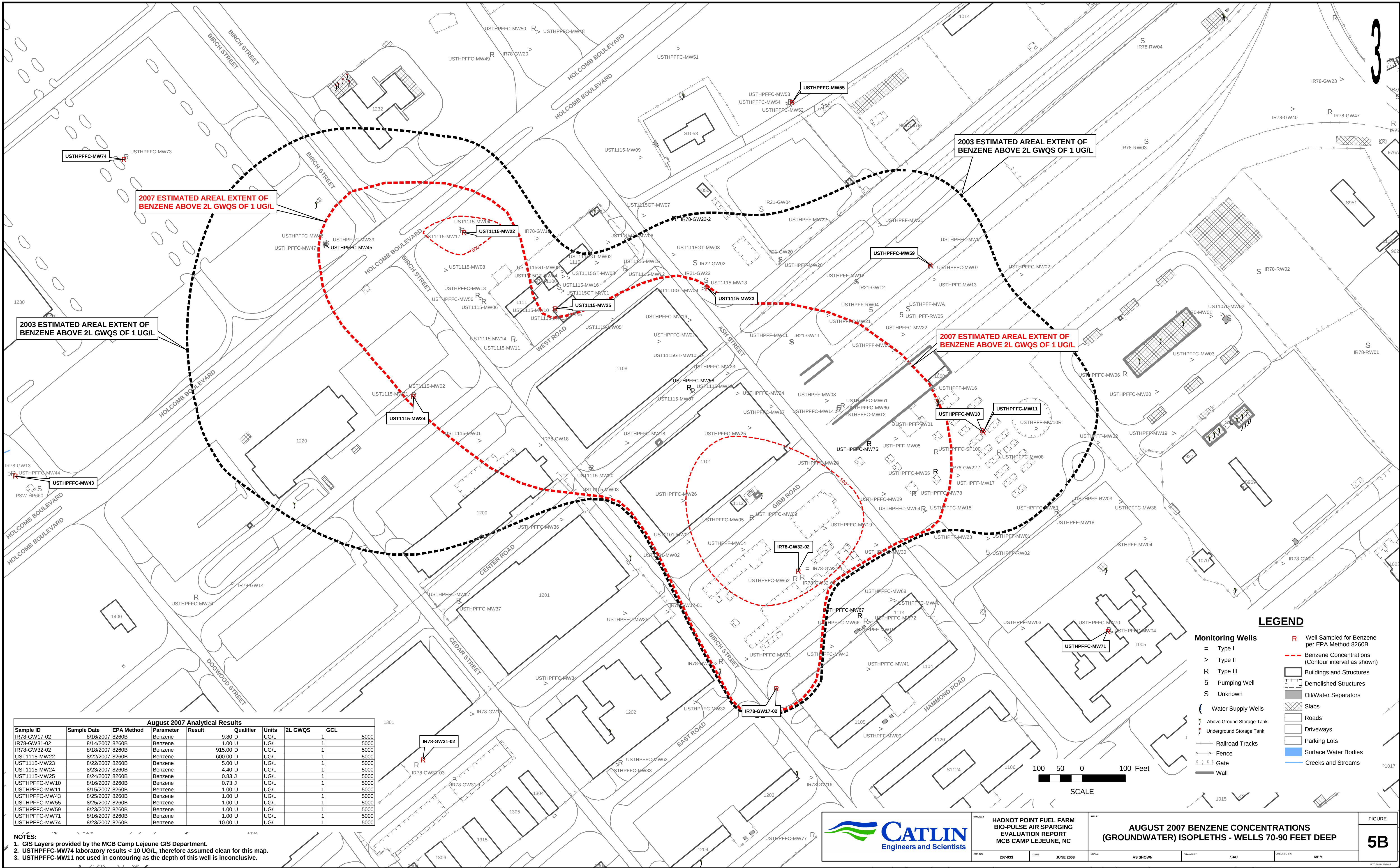
4B

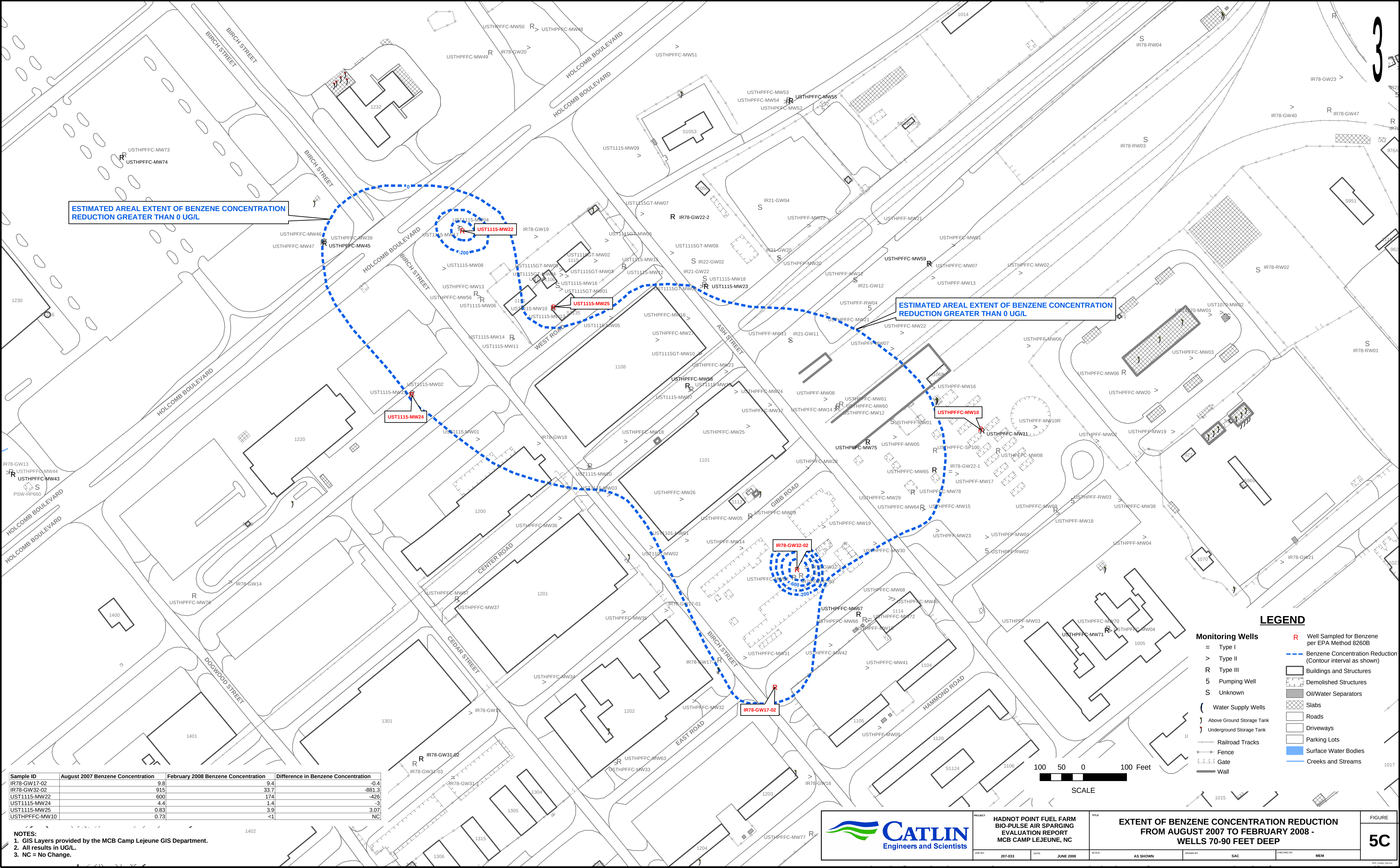
AUGUST 2007 BENZENE CONCENTRATIONS
(GROUNDWATER) ISOPLETHS - WELLS 50 FEET DEEP

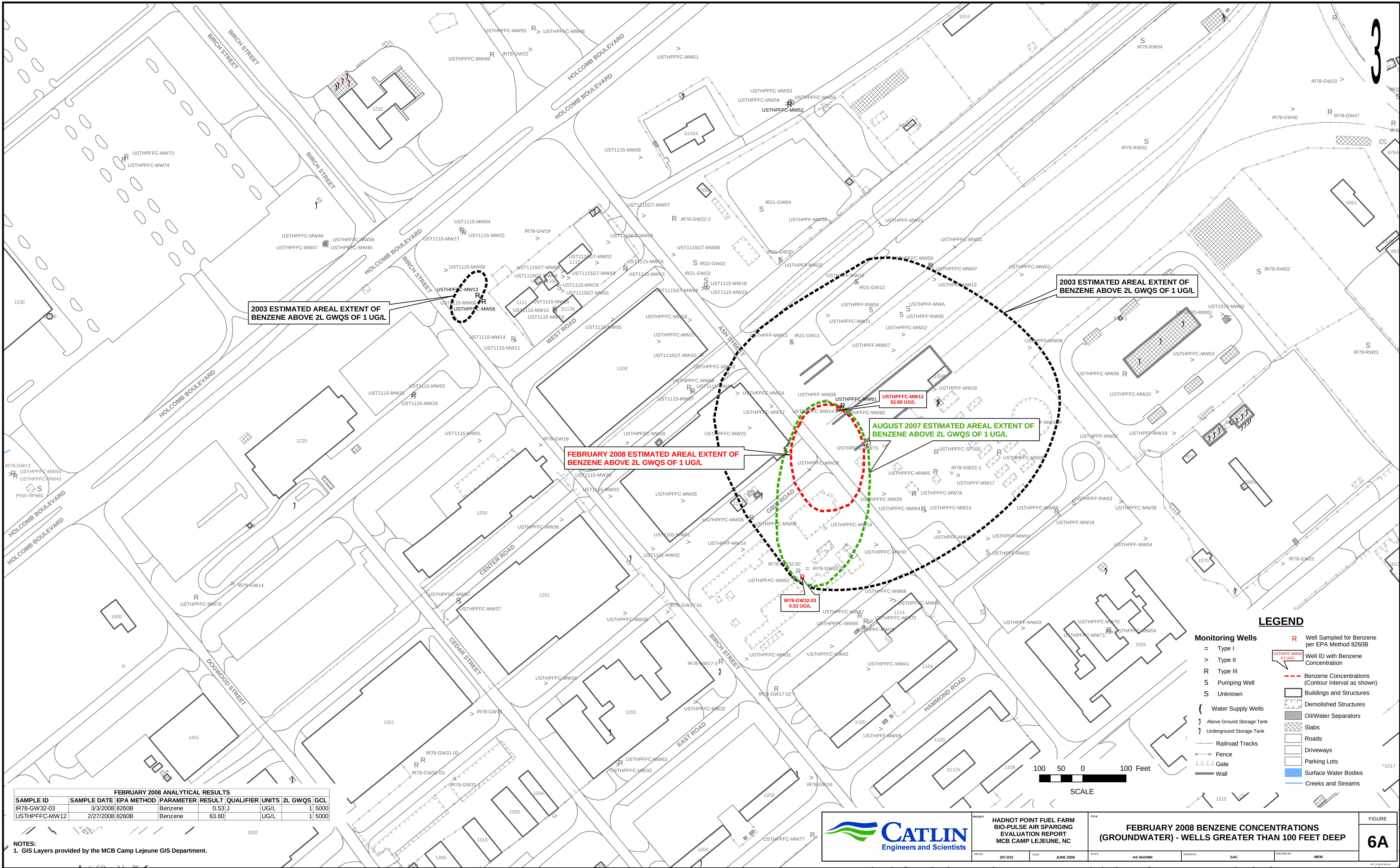


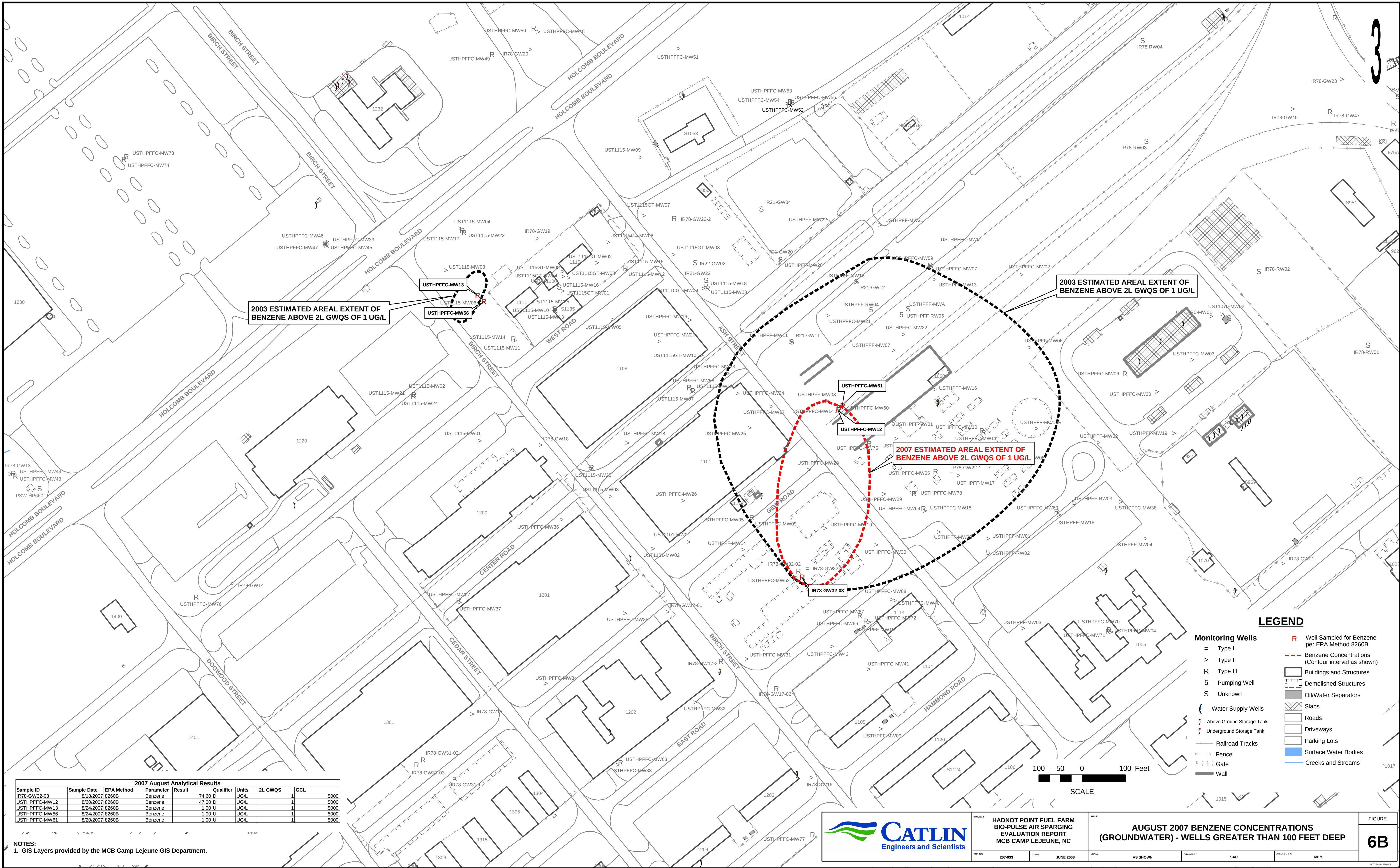
Sample ID	August 2007 Benzene Concentration	February 2008 Benzene Concentration	Difference in Benzene Concentration
UST1115-MW13	78.5	40.8	-37.7
UST1115-MW14	1.70	2.29	0.59
UST1115-MW17	304	442	138
UST1115-MW18	5.5	3.1	-2.4
UST1115-MW20	18700	3280	-15420
UST1115-MW21	45.2	1.7	-43.5
USTHPFFC-MW06	0.76	14.1	13.34
USTHPFFC-MW07	2	11.3	9.3
USTHPFFC-MW08	7730	2760	-4970
USTHPFFC-MW09	<1	15.6	15.6
USTHPFFC-MW47	993	747	-246
USTHPFFC-MW60	8170	8650	480

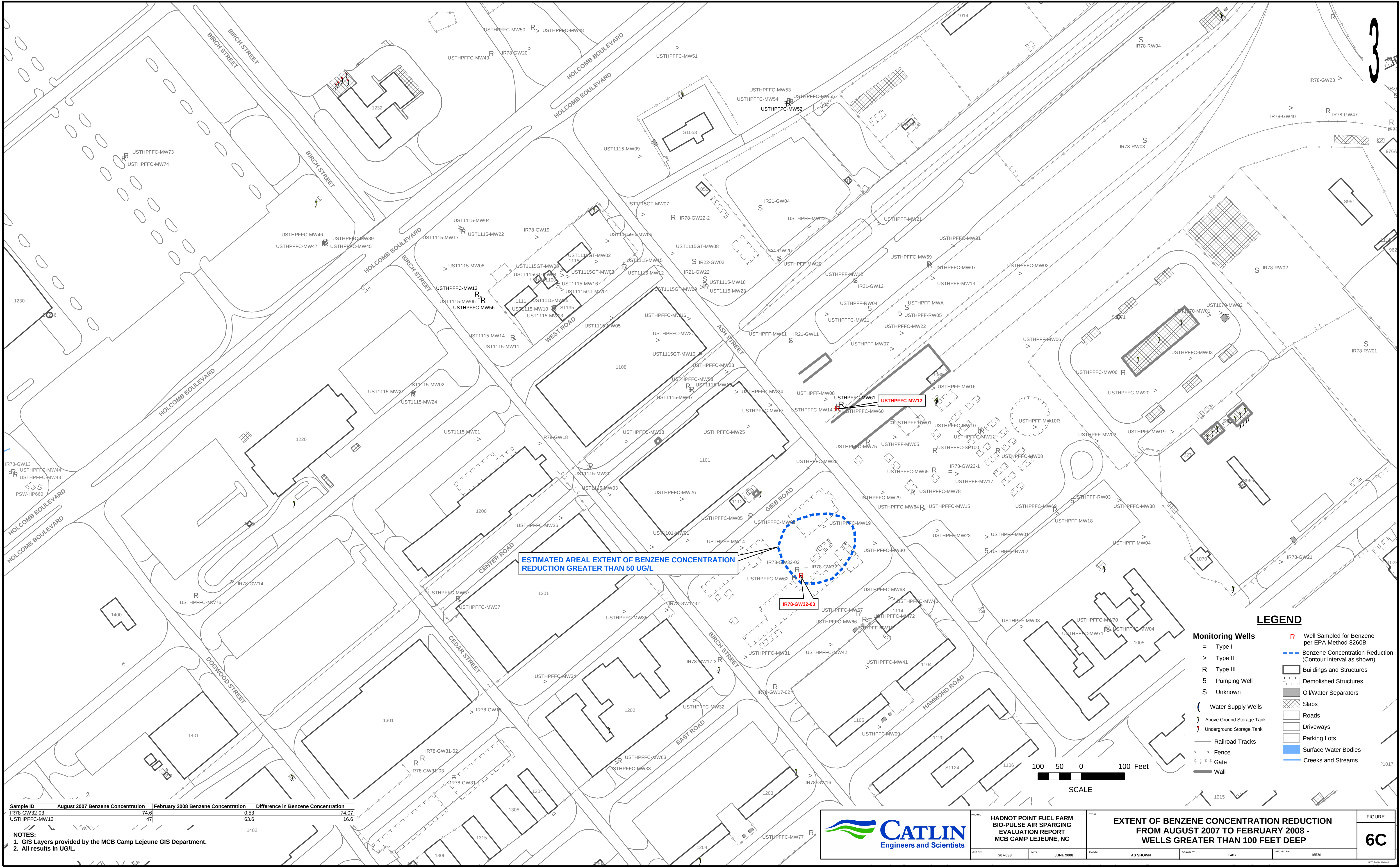












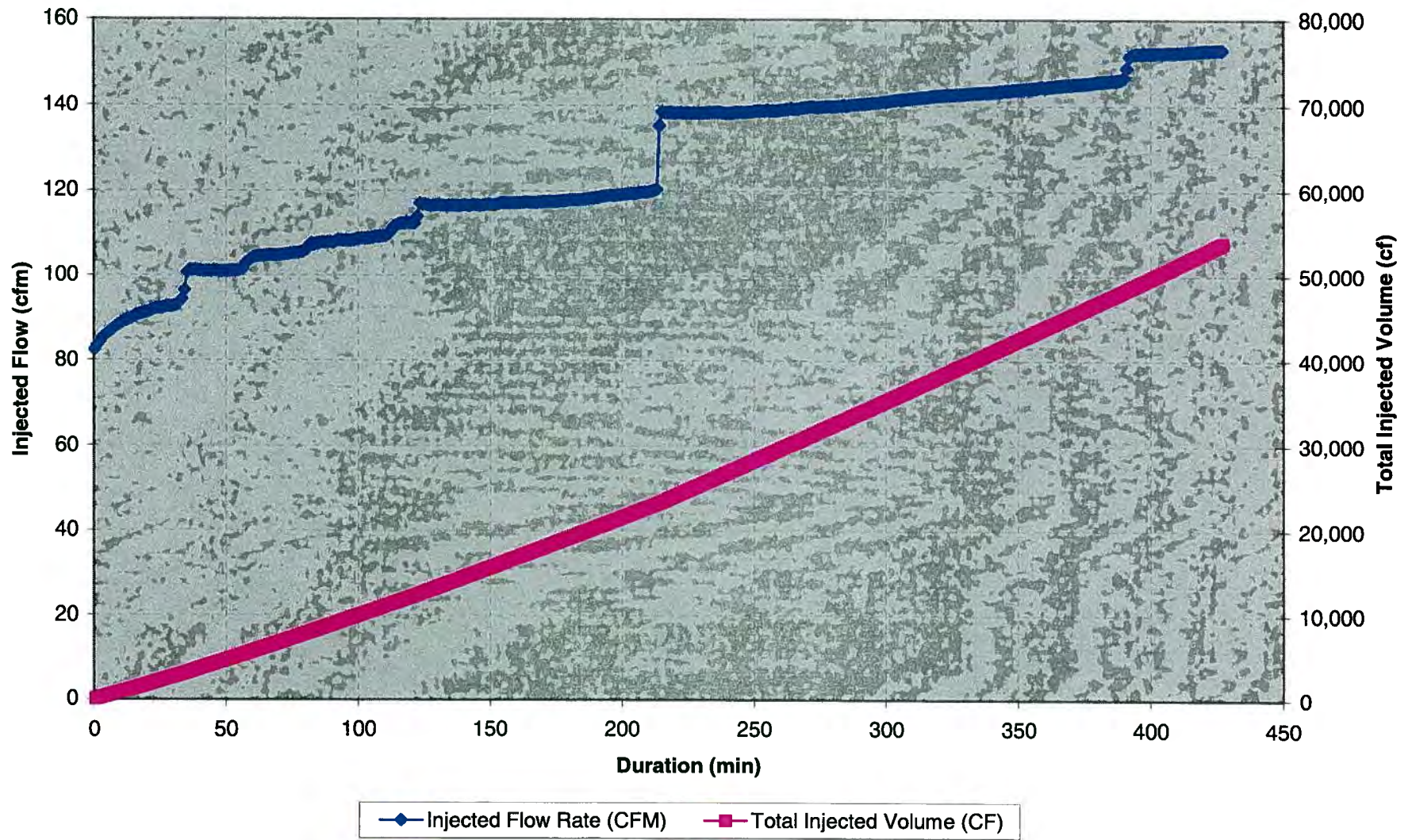
APPENDICES

APPENDIX A

AIR FLOW VS. TIME GRAPHS FOURTH ROUND OF BIO-PULSE SPARGING

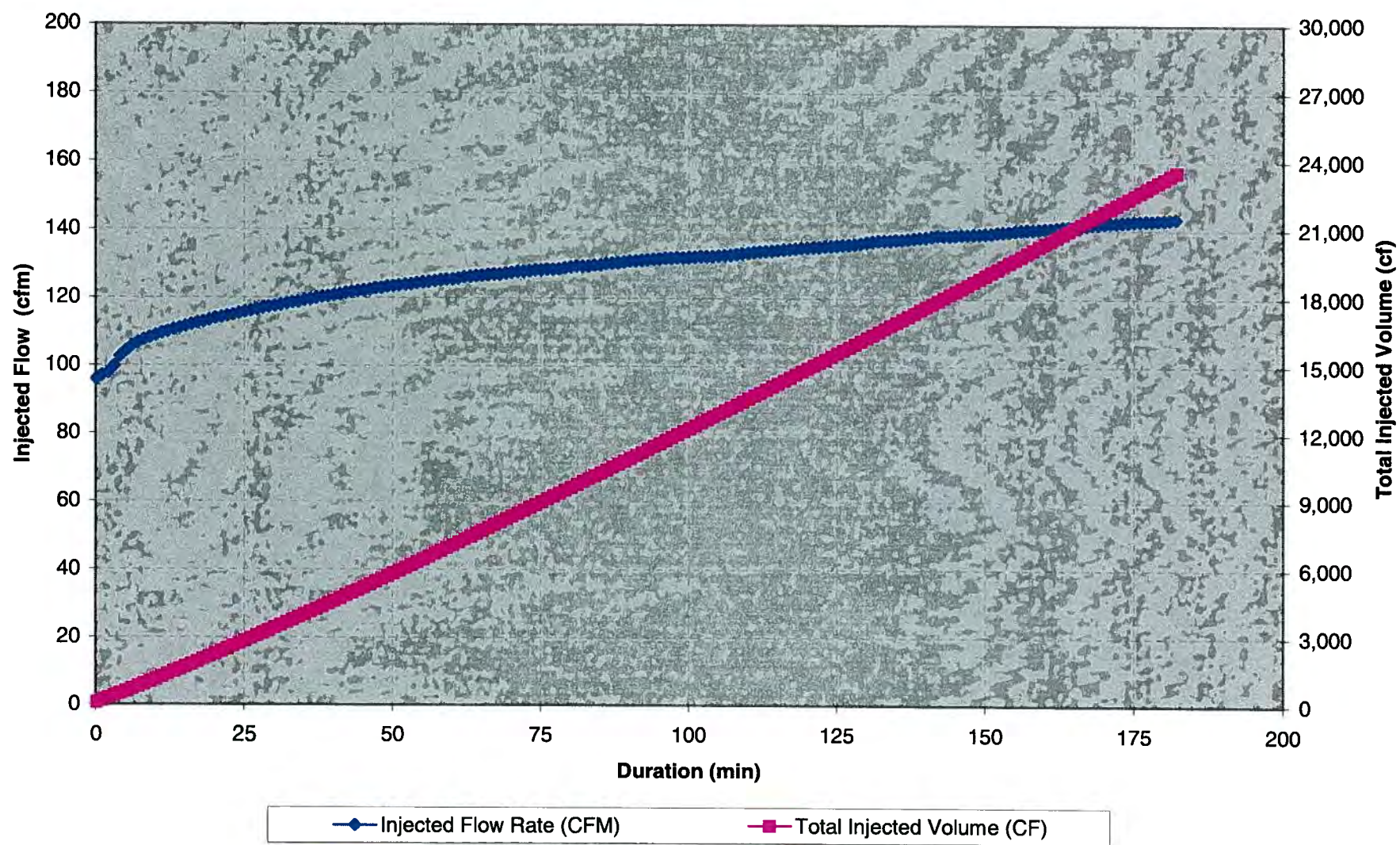
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-1
11/1/2007**



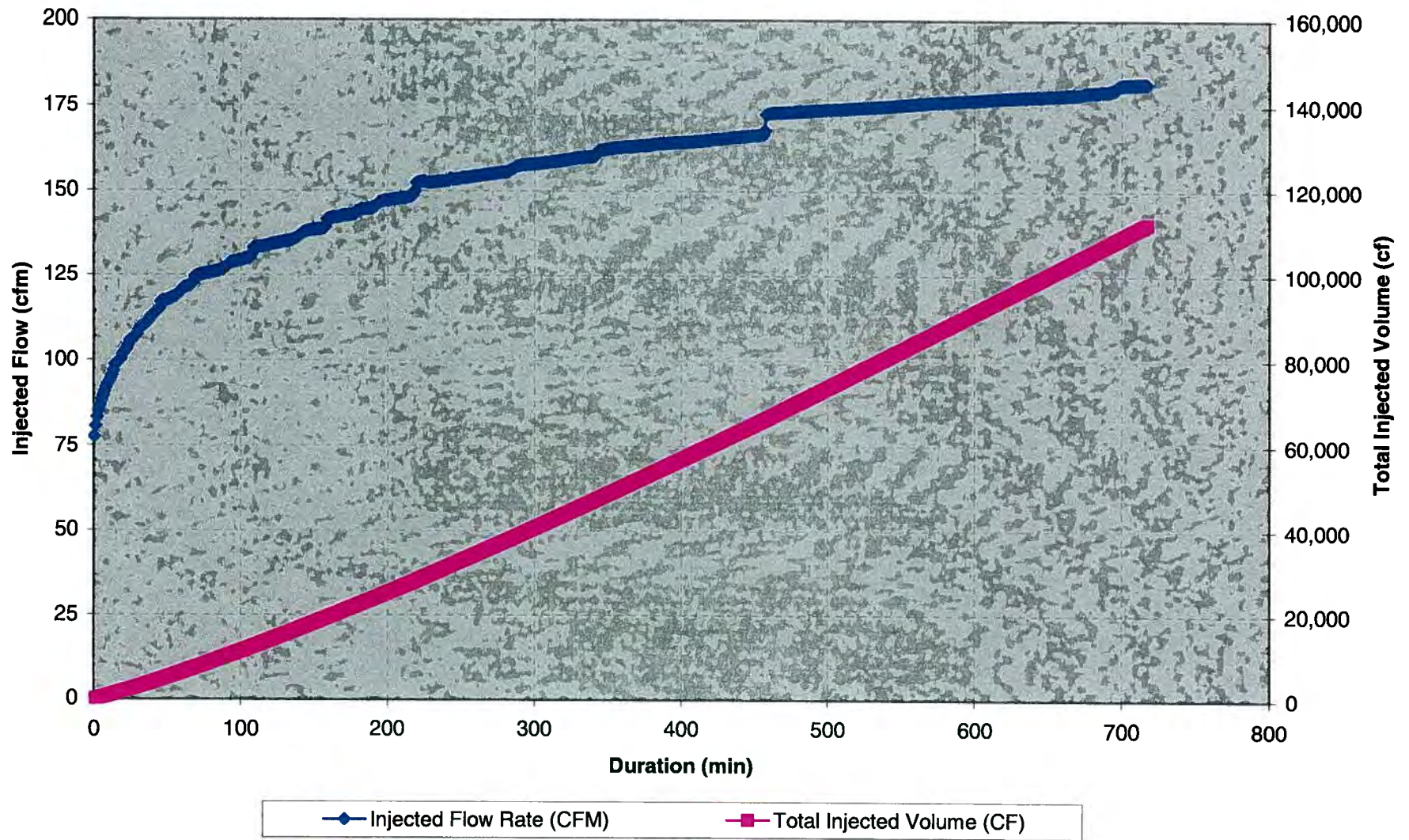
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-2
11/16/2007**



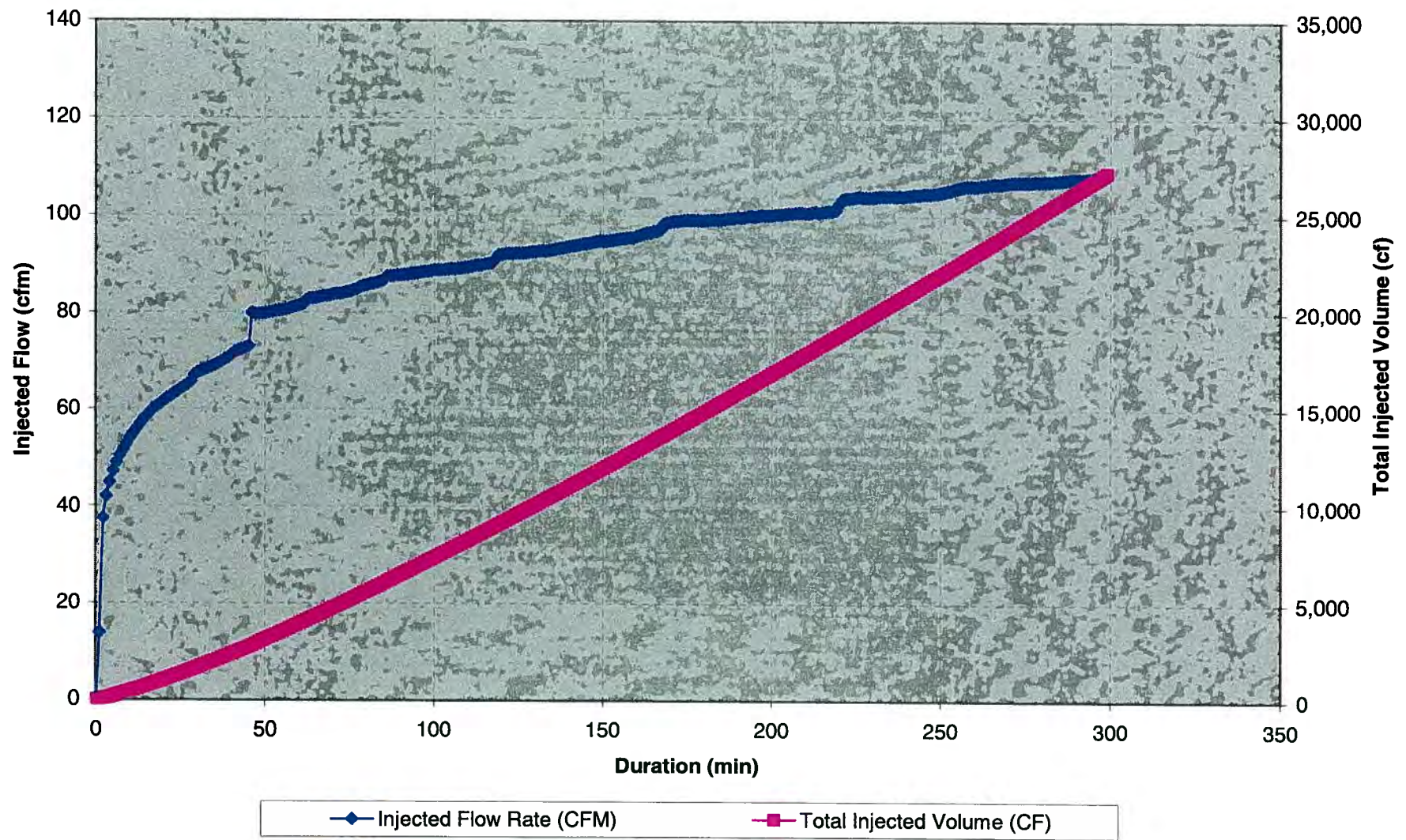
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-3
12/12/2007**



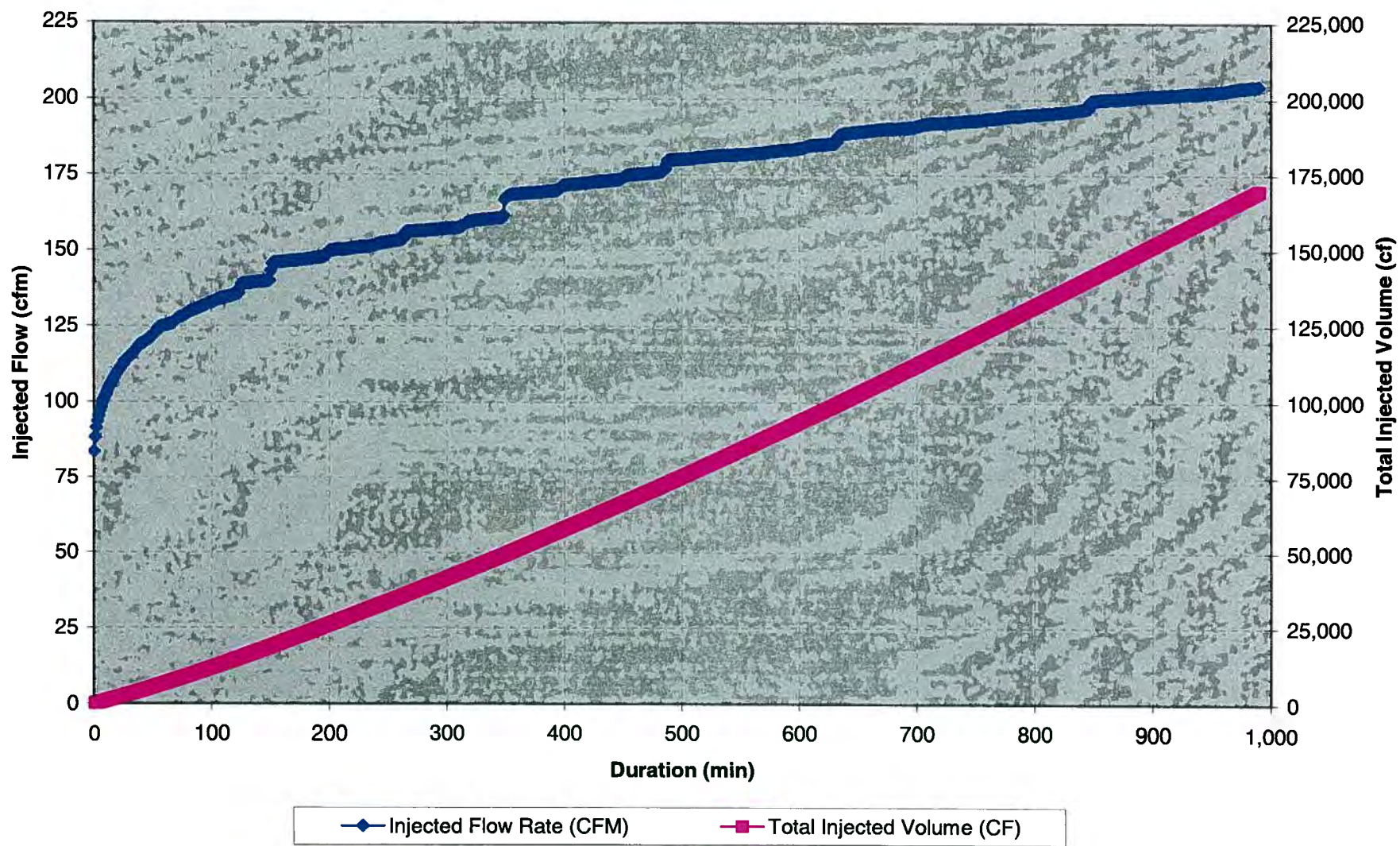
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-4
11/13/2007**



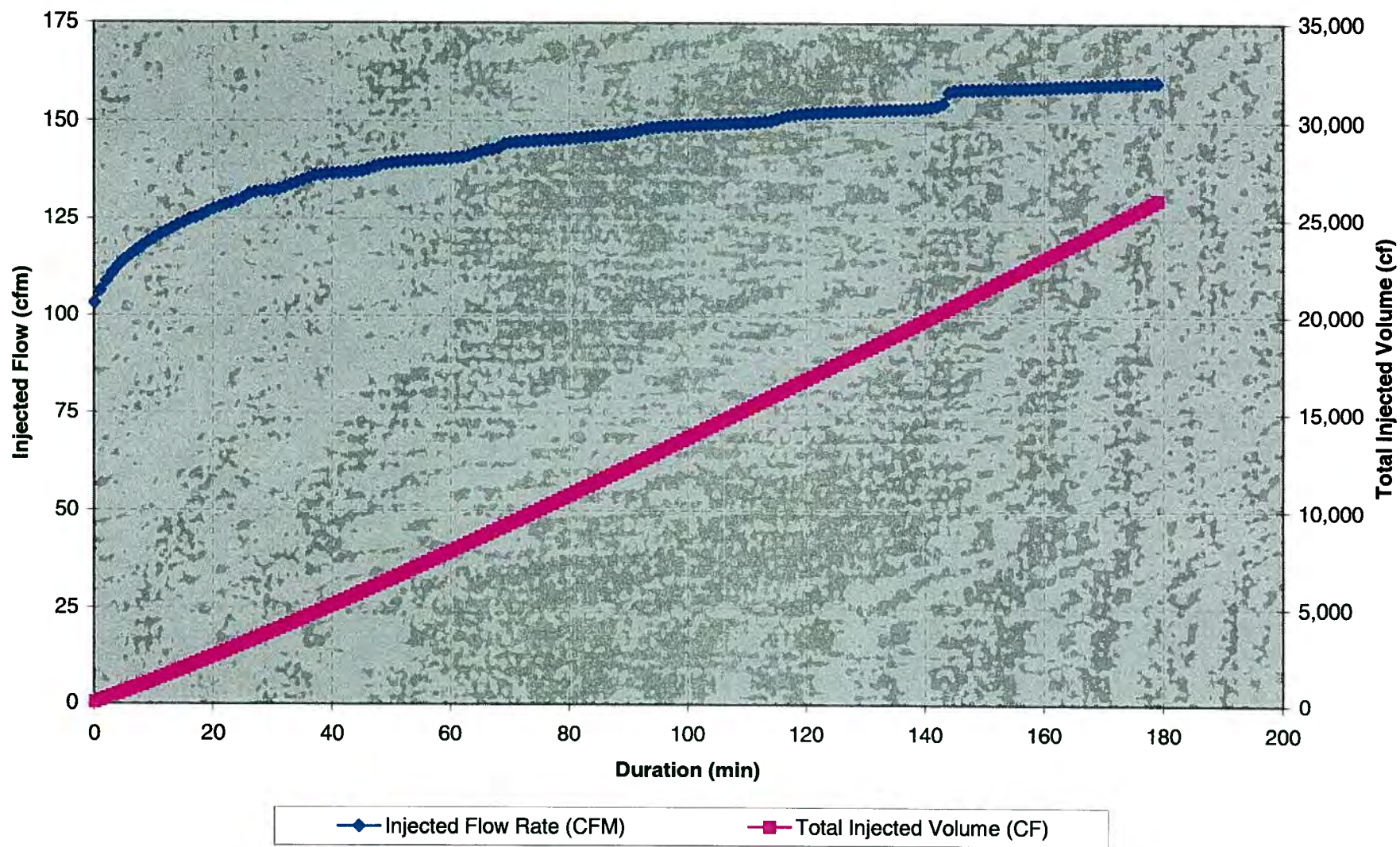
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-5
11/30/2007**



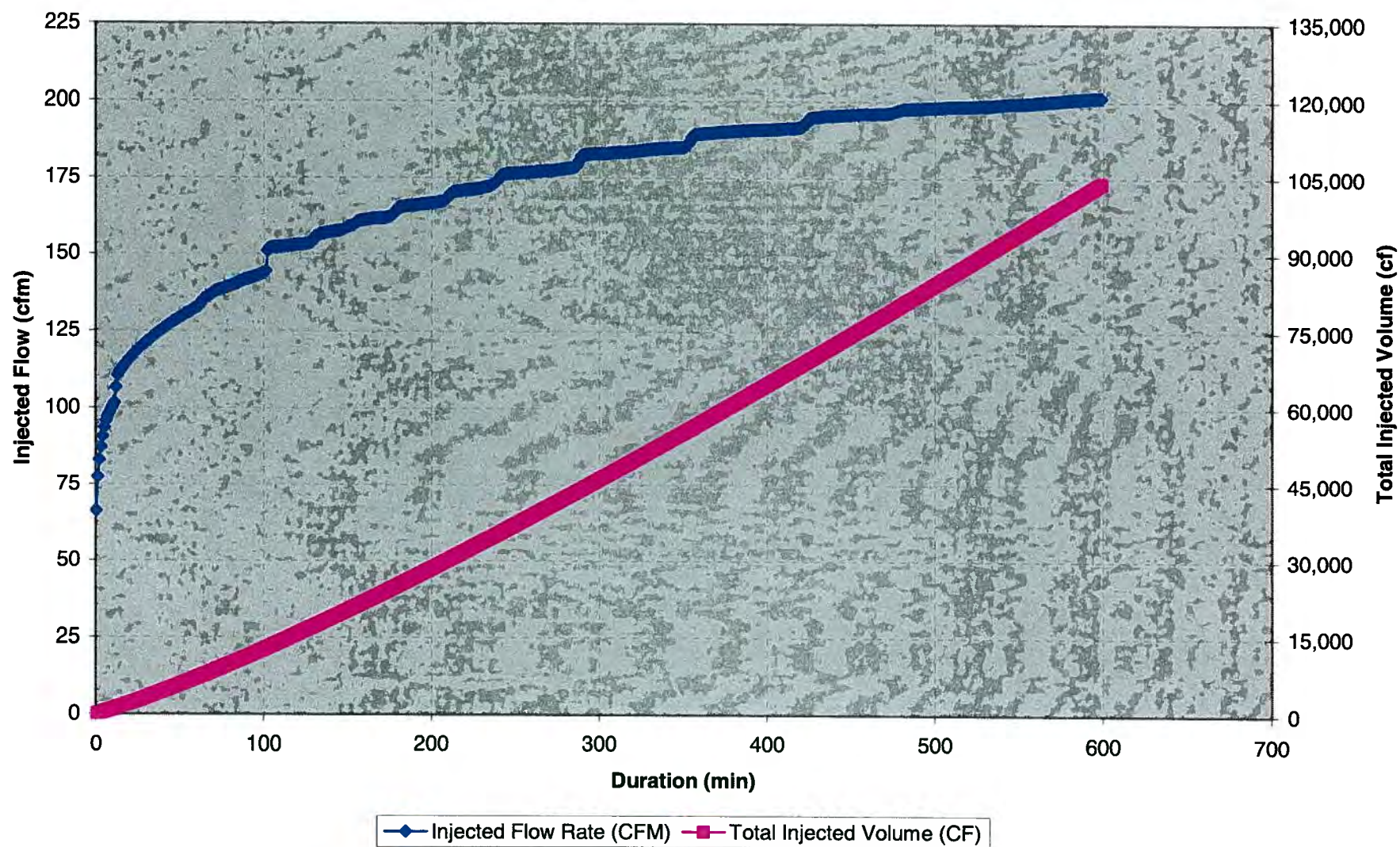
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-6
12/5/2007**



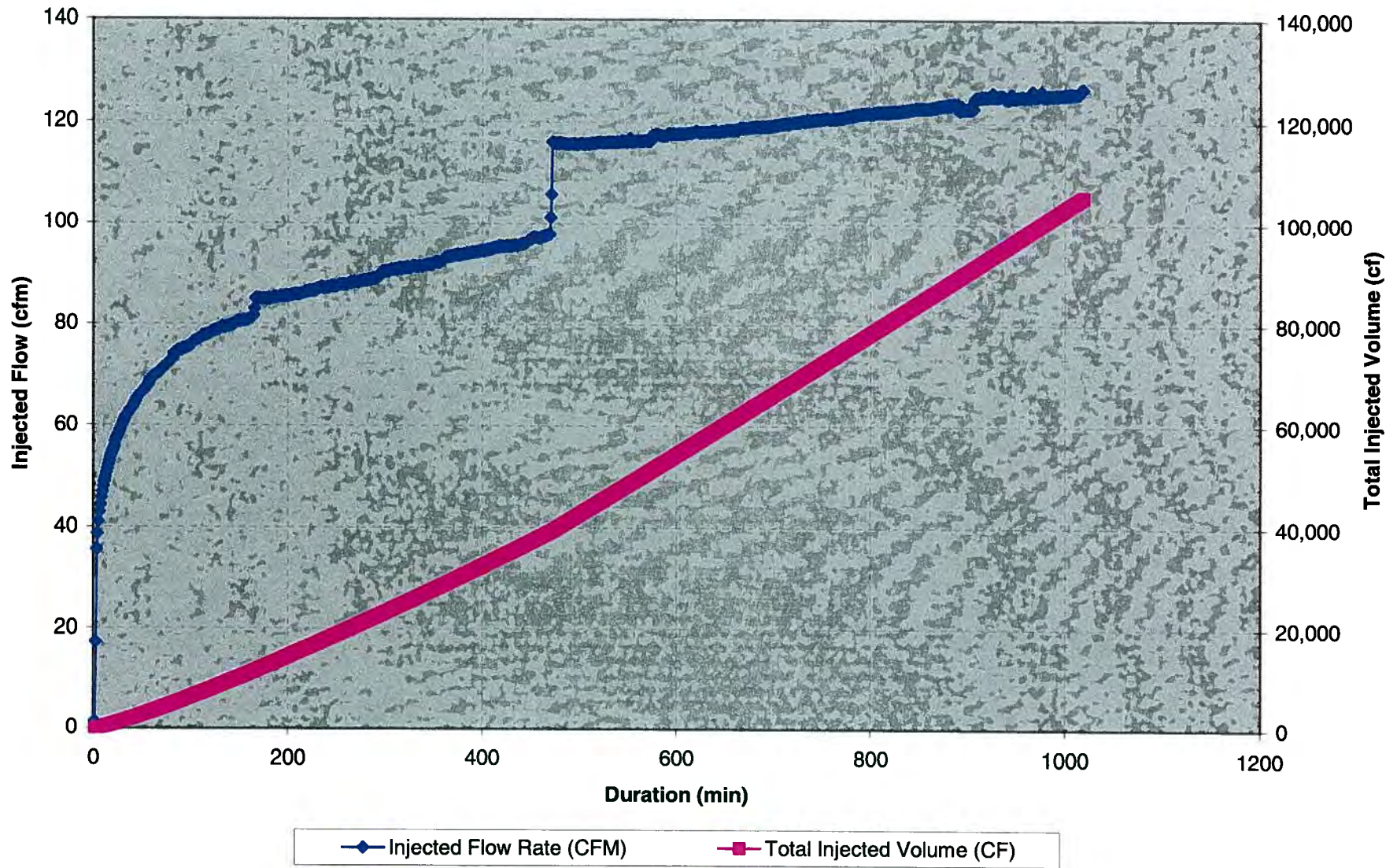
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-7
11/8/2007**



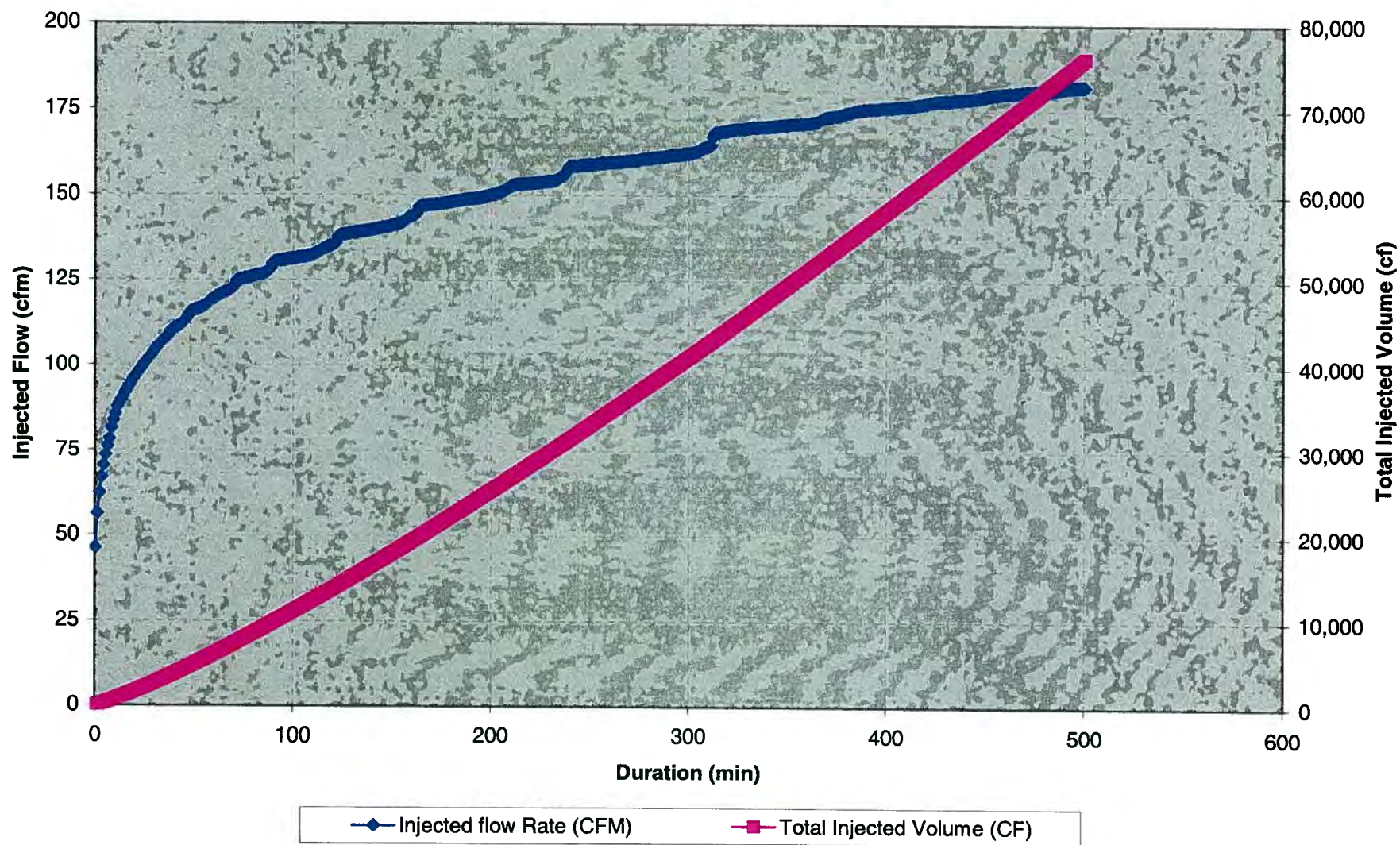
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-8
12/11/2007**



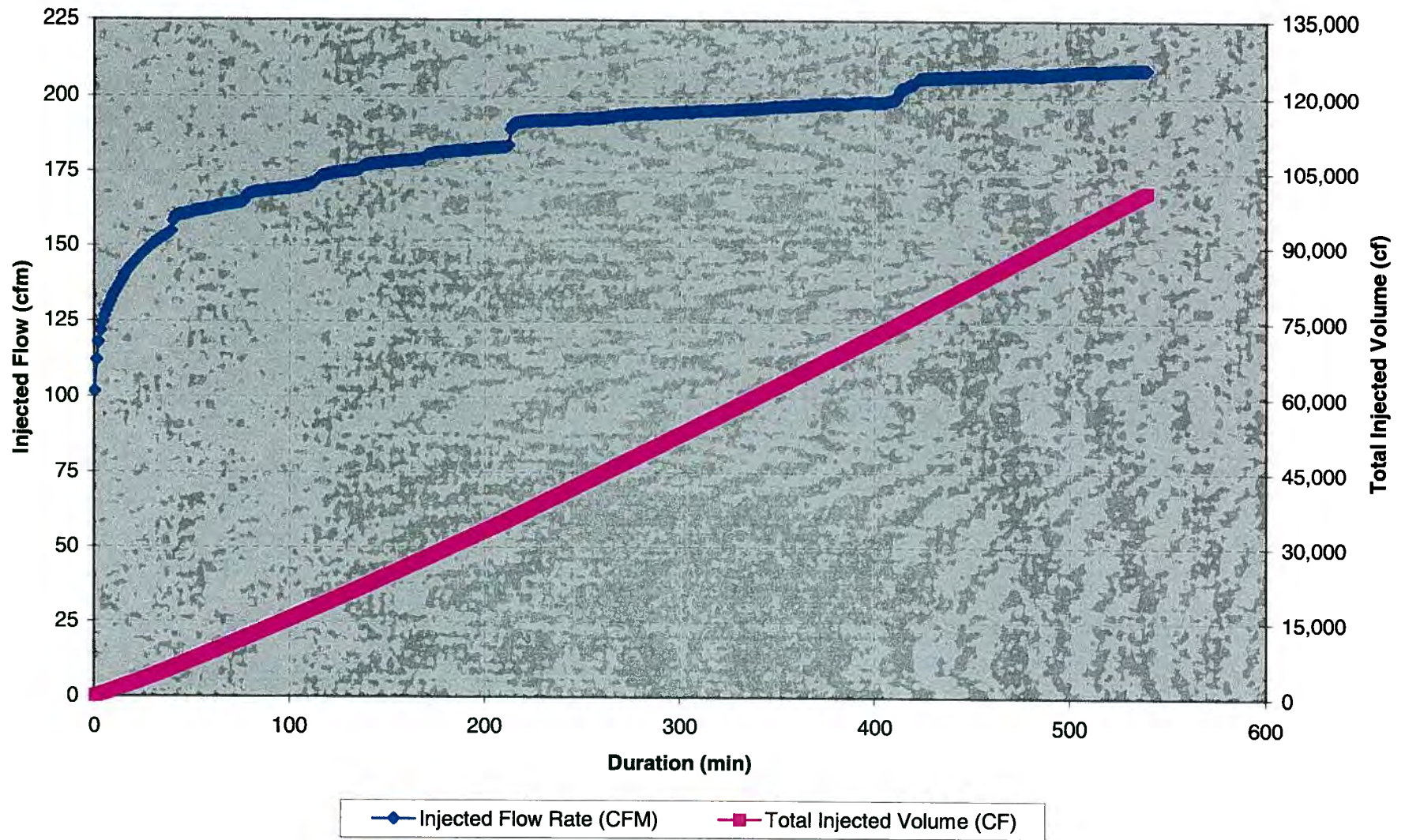
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-9
11/28/2007**



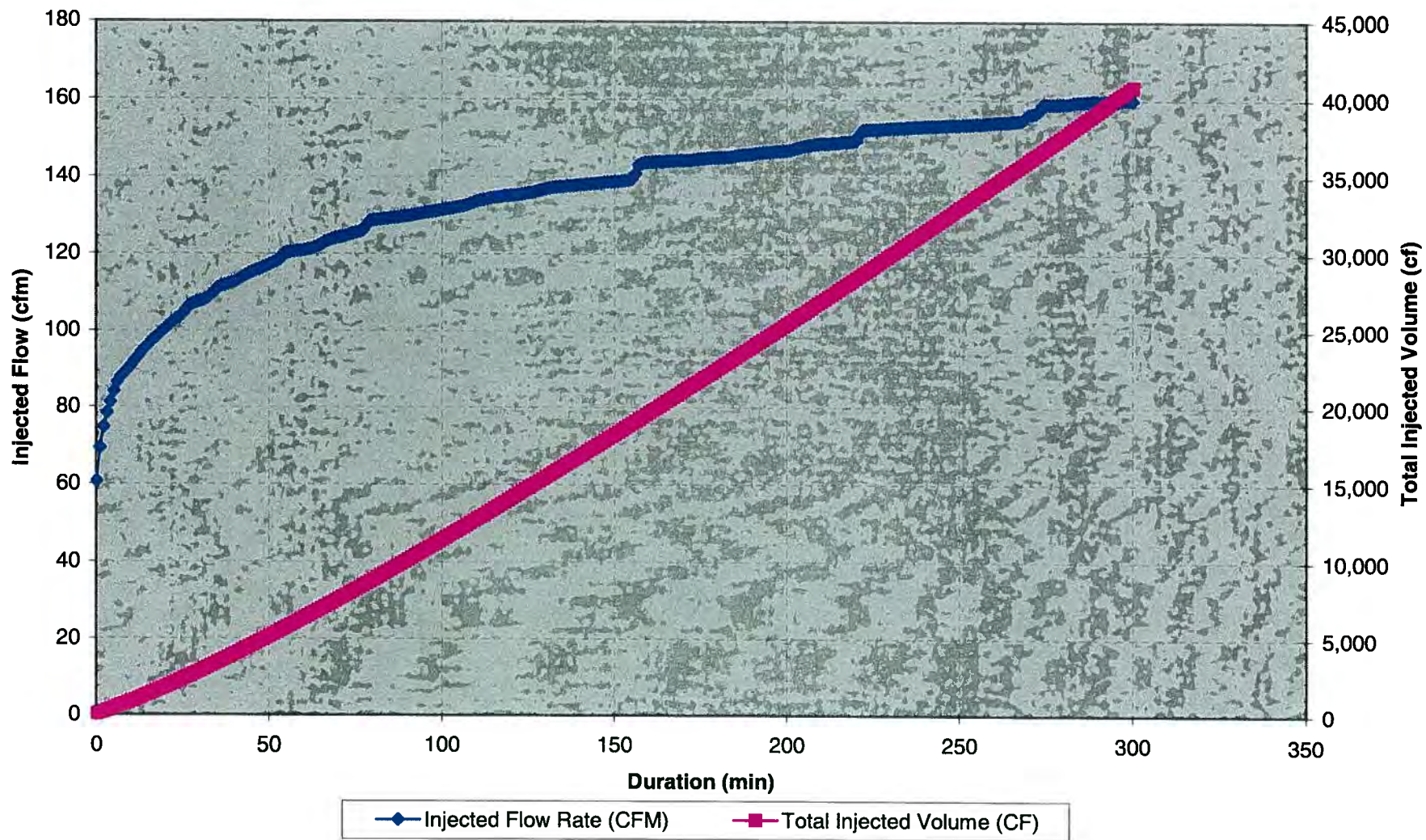
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-10
11/26/2007**



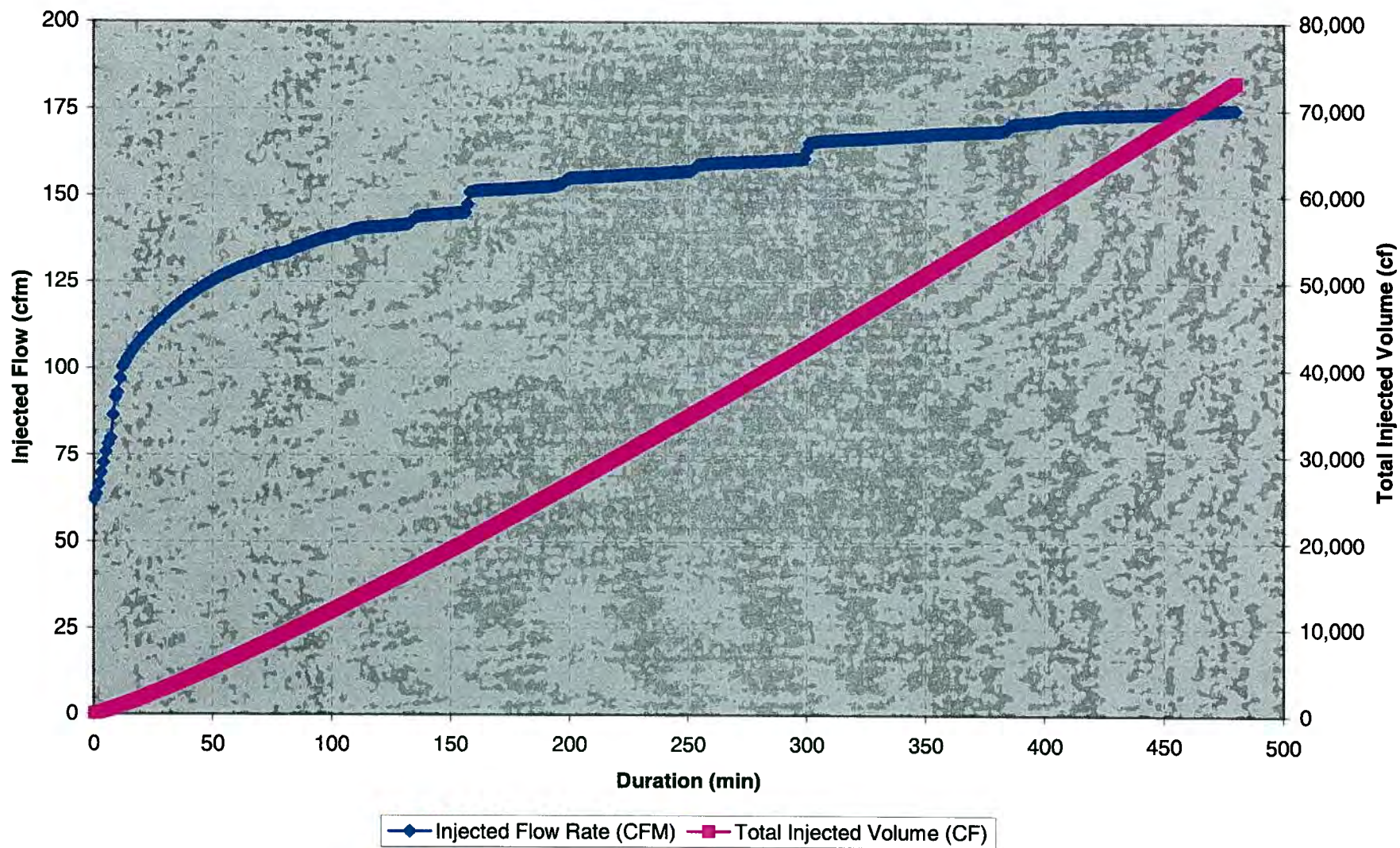
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-11
11/29/2007**



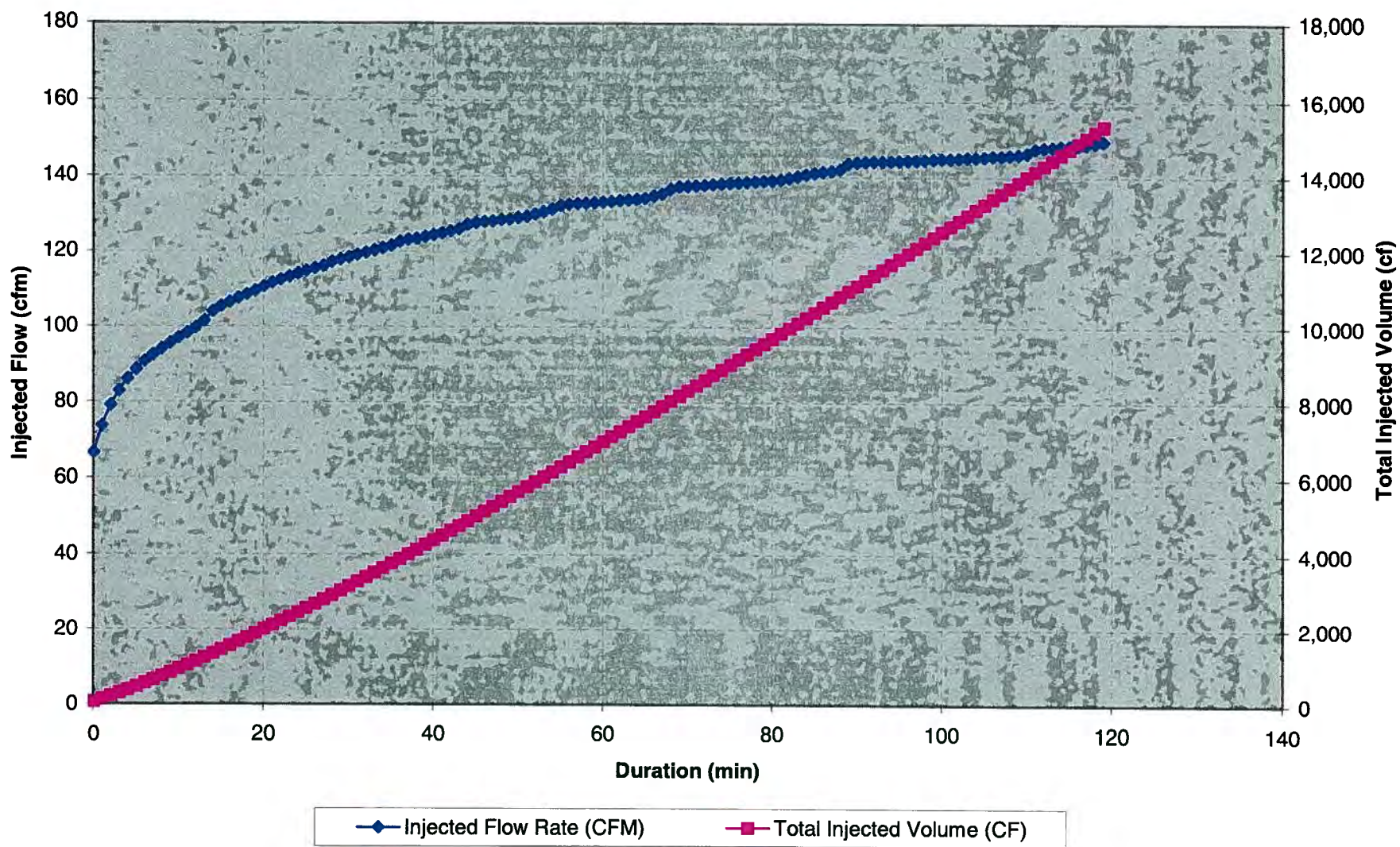
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-12
11/7/2007**



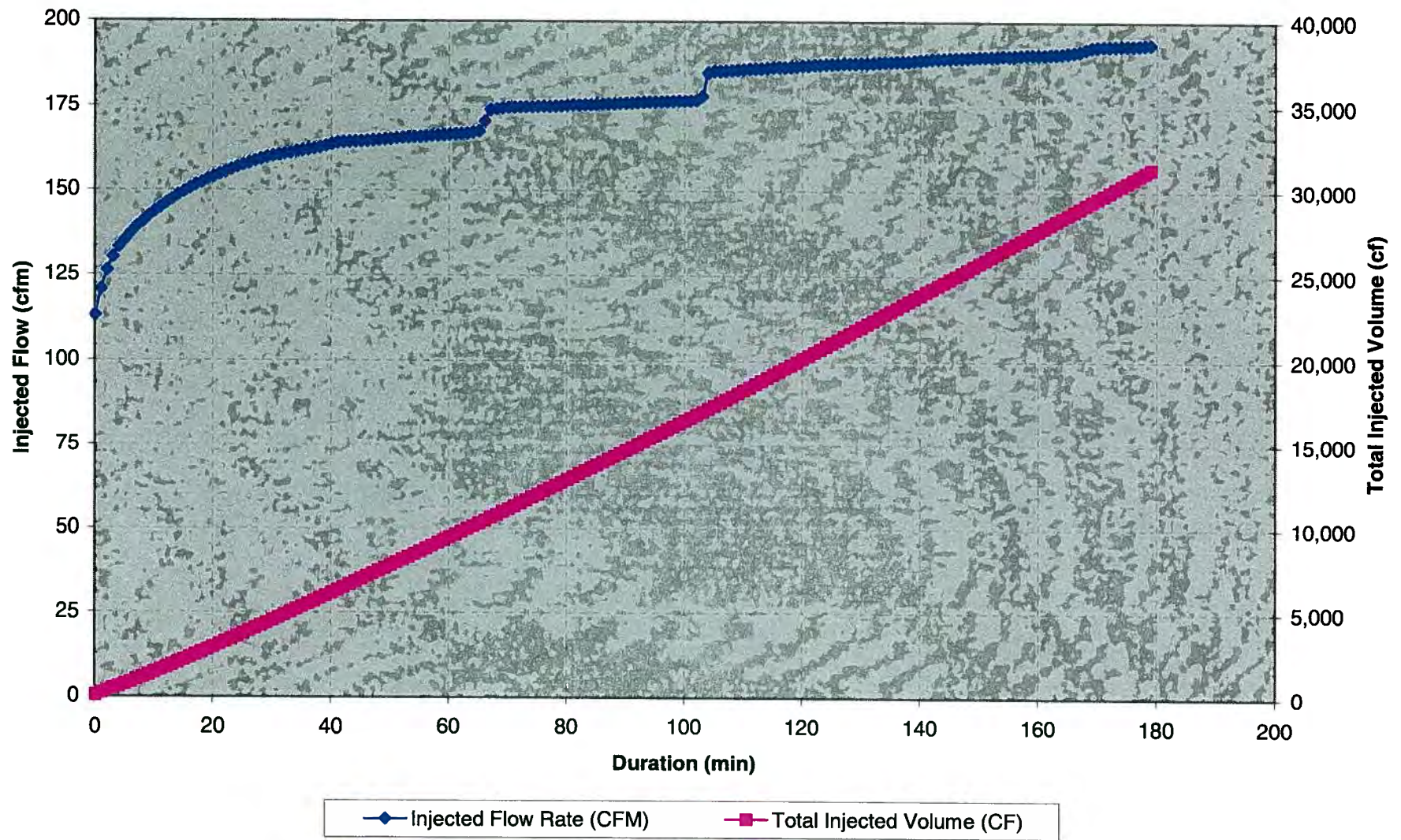
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-13
12/7/2007**



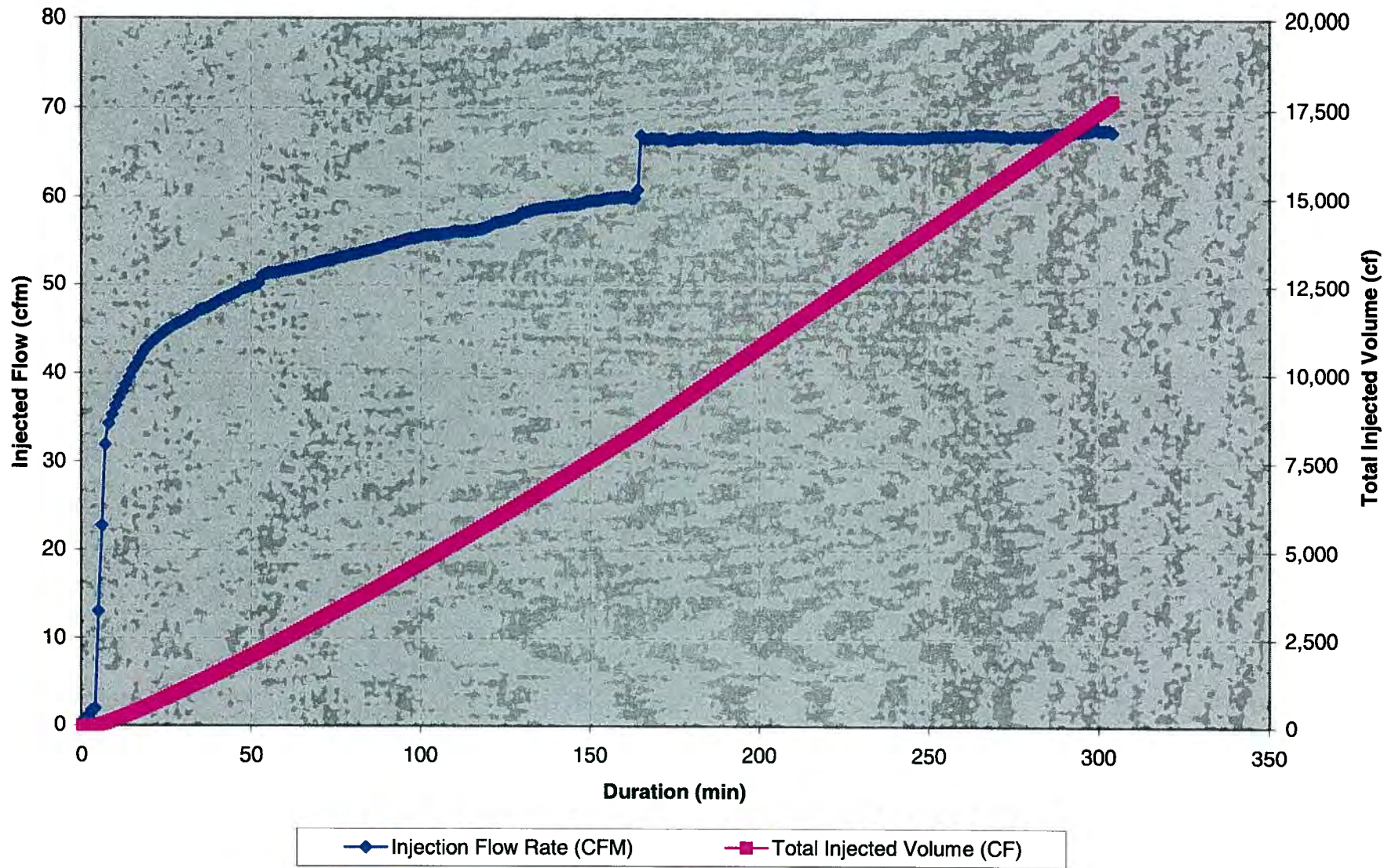
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-14
11/20/2007**



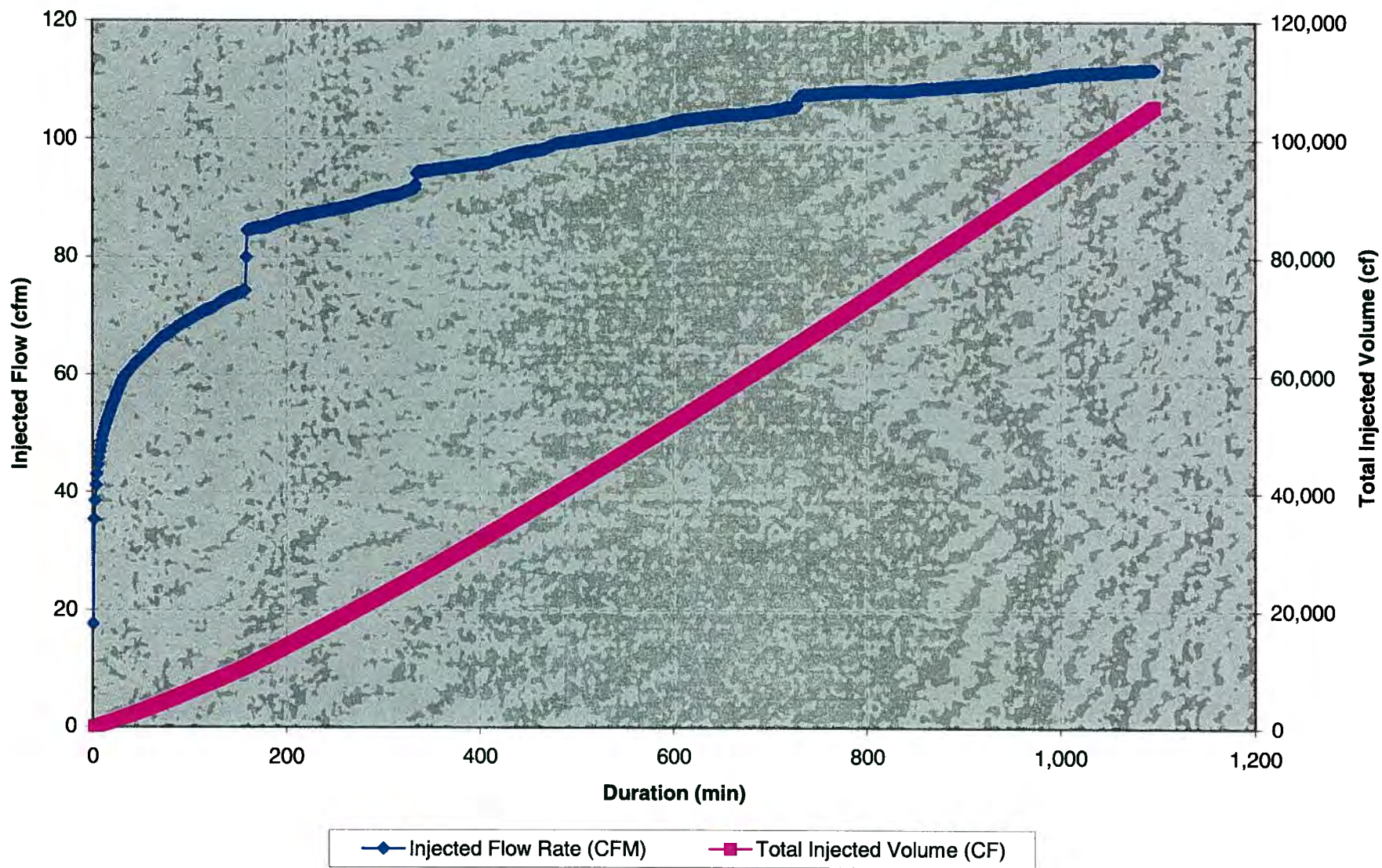
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-15
11/14/2007**



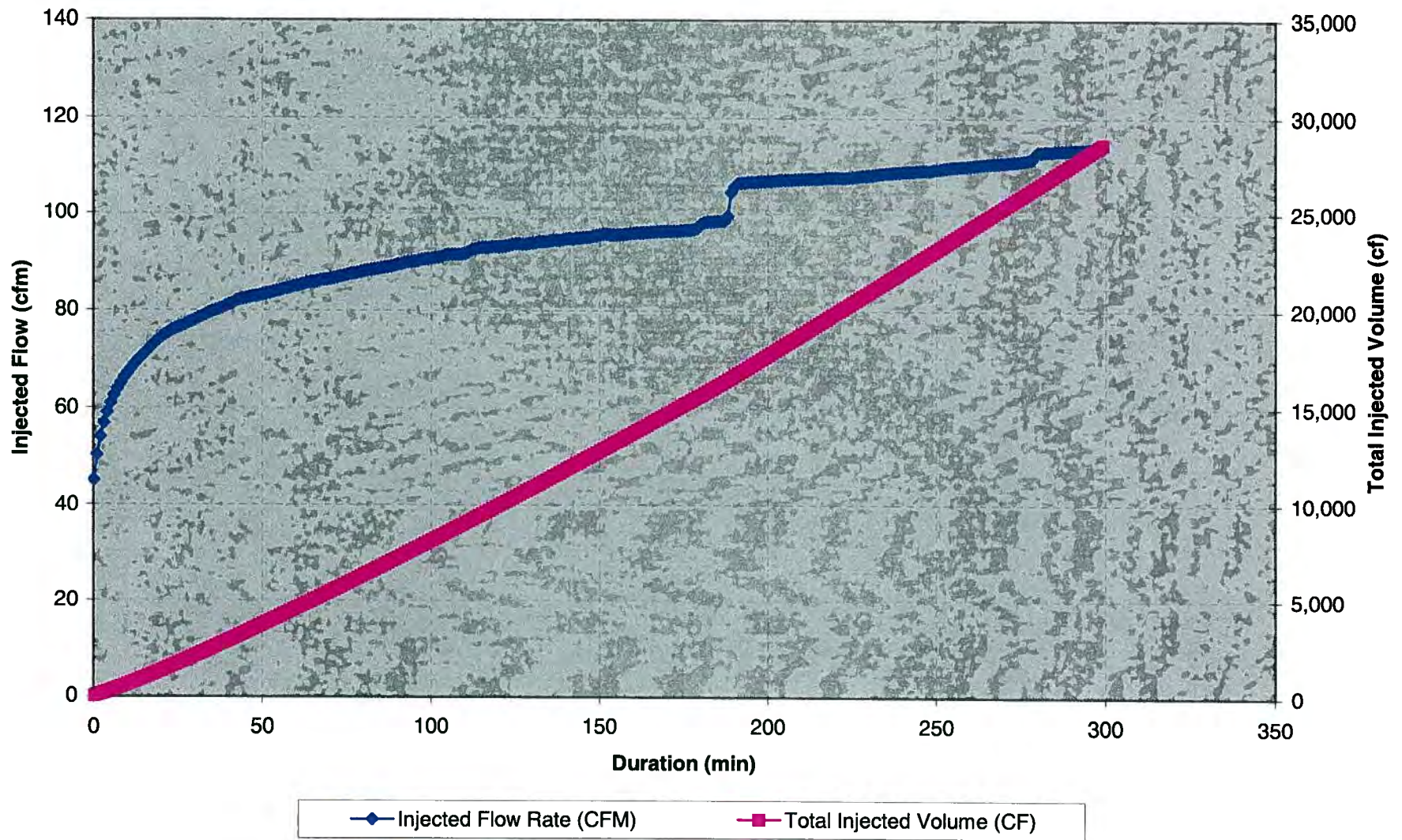
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-16
12/4/2007**



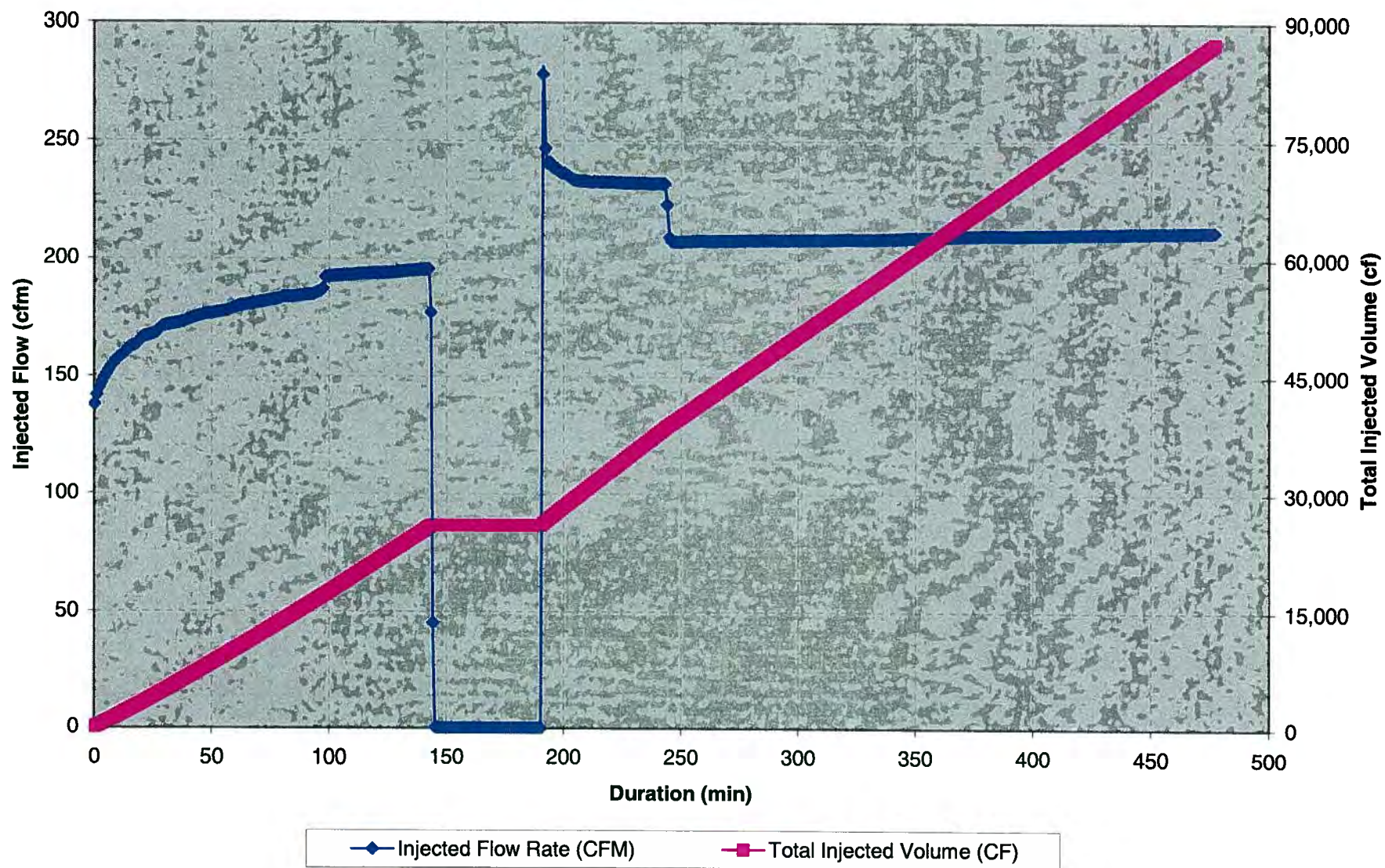
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-17
12/6/2007**



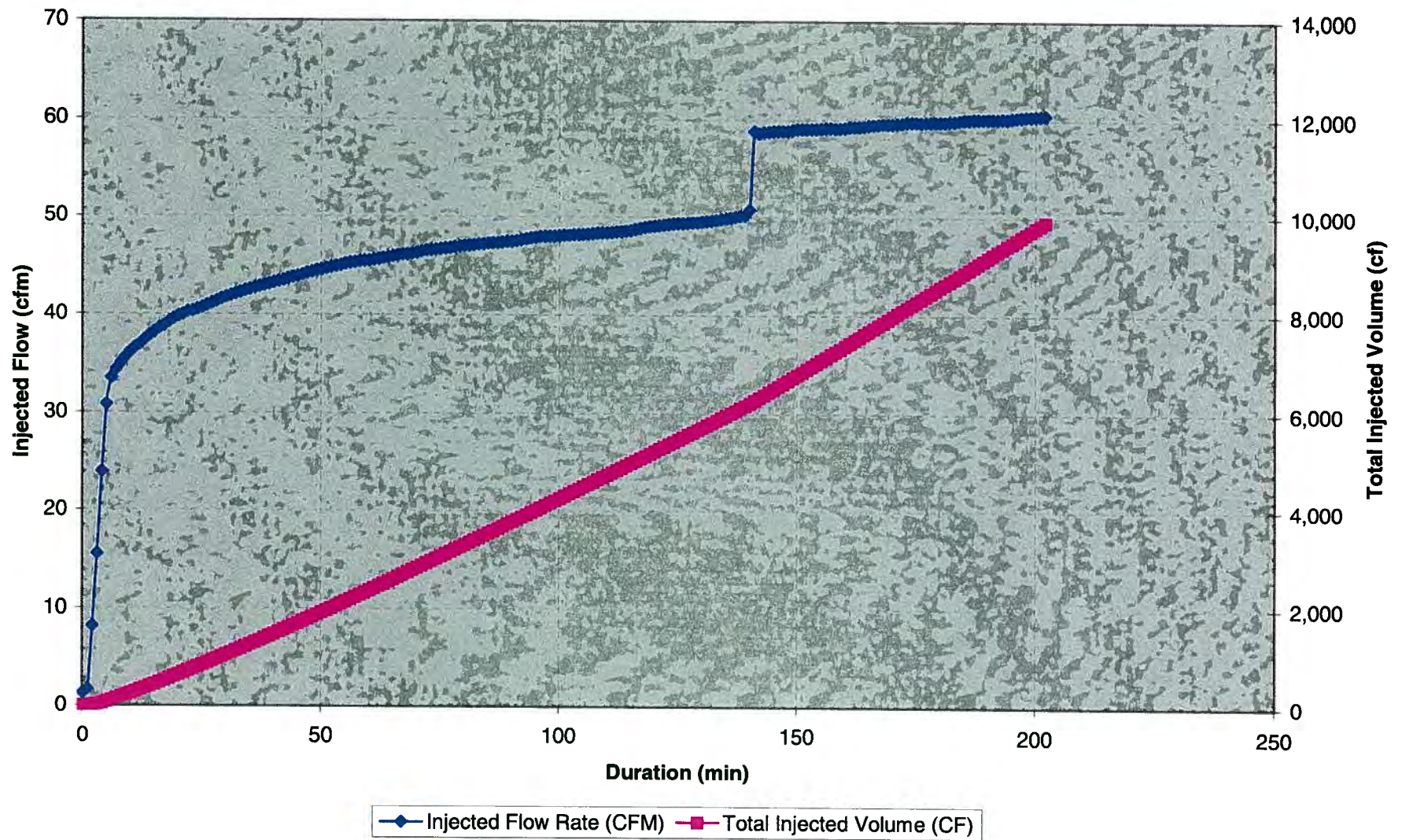
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-18
12/10/2007**



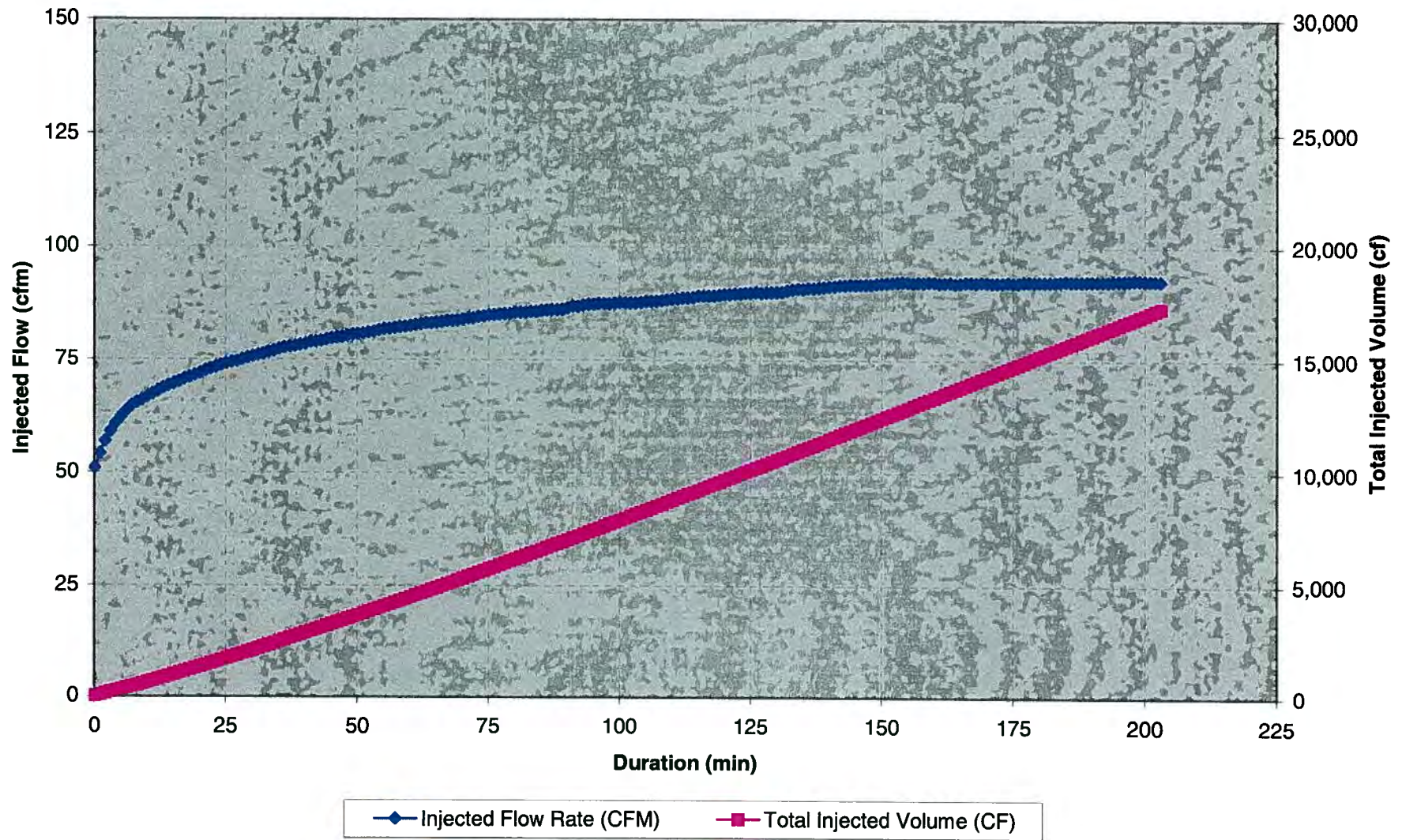
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-19
11/21/2007**



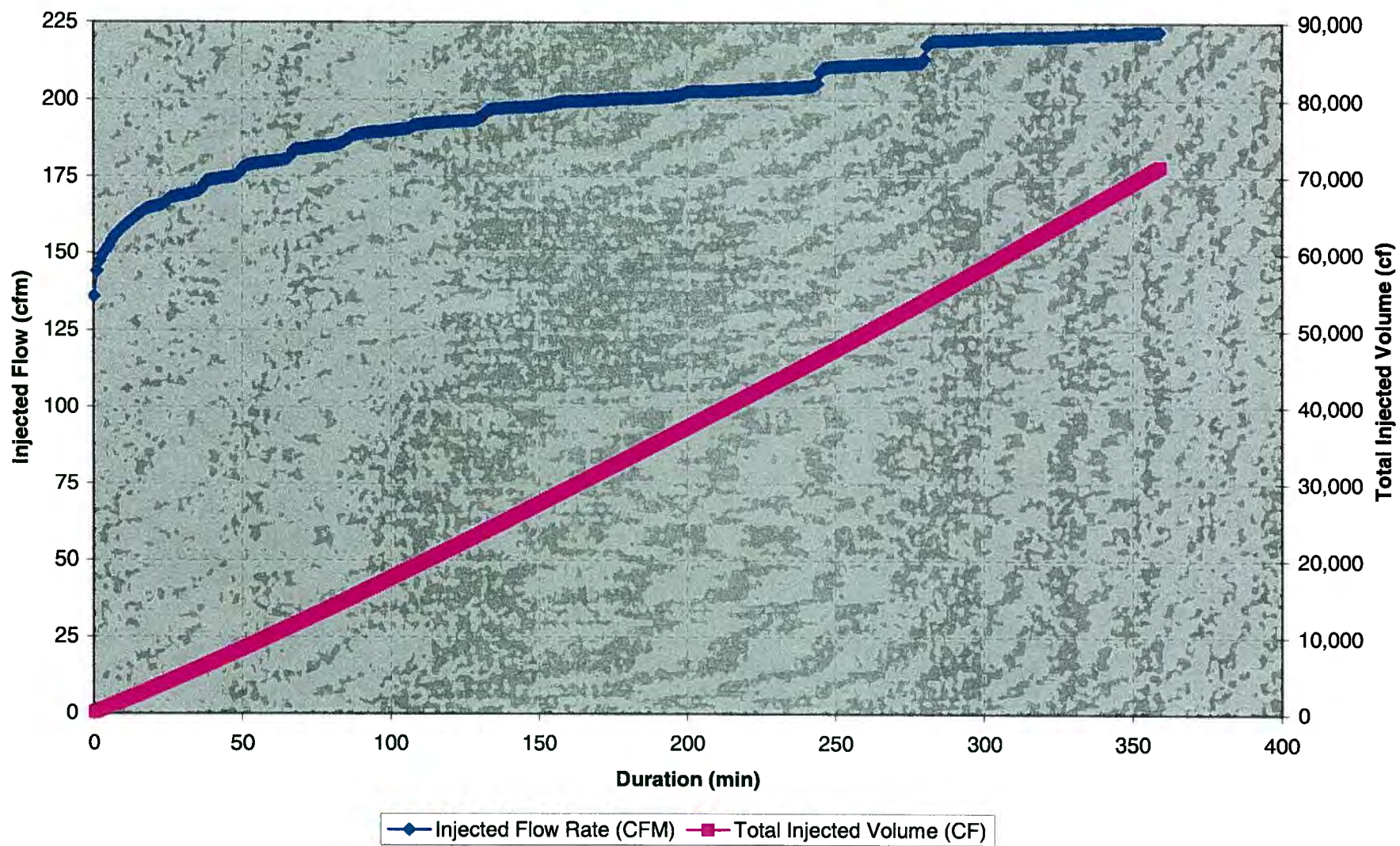
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-20
12/8/2007**



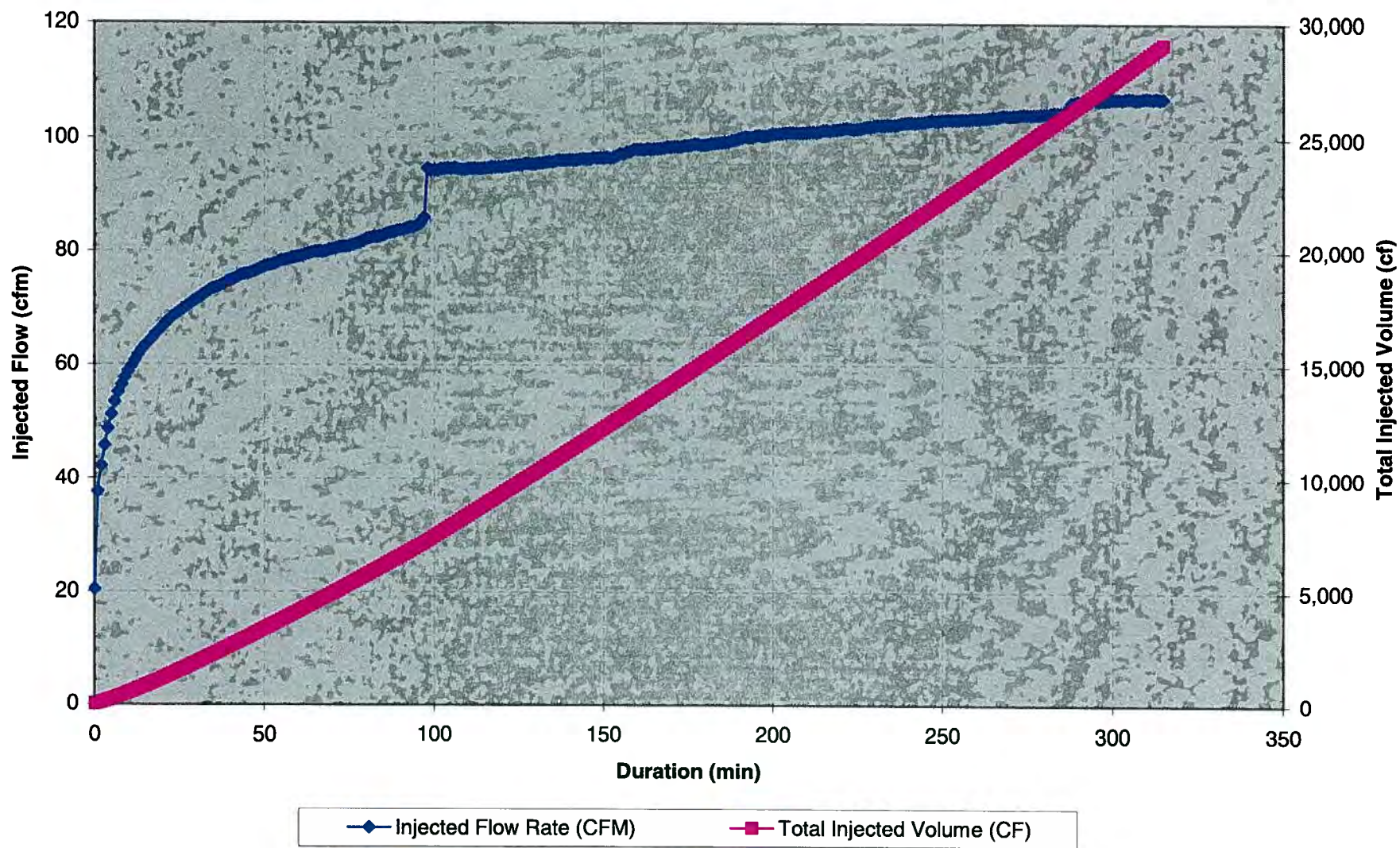
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-21
11/6/2007**



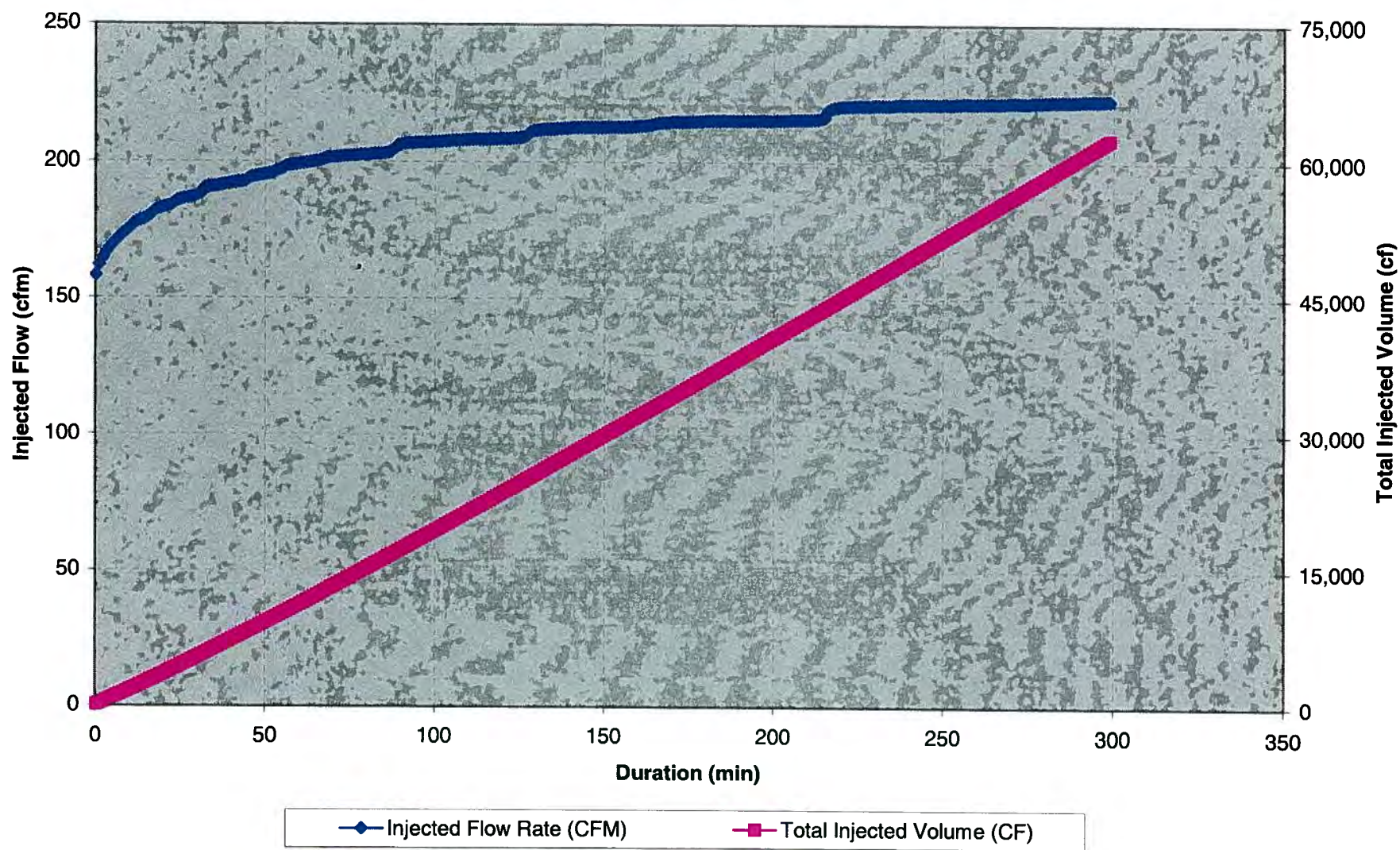
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-22
11/15/2007**



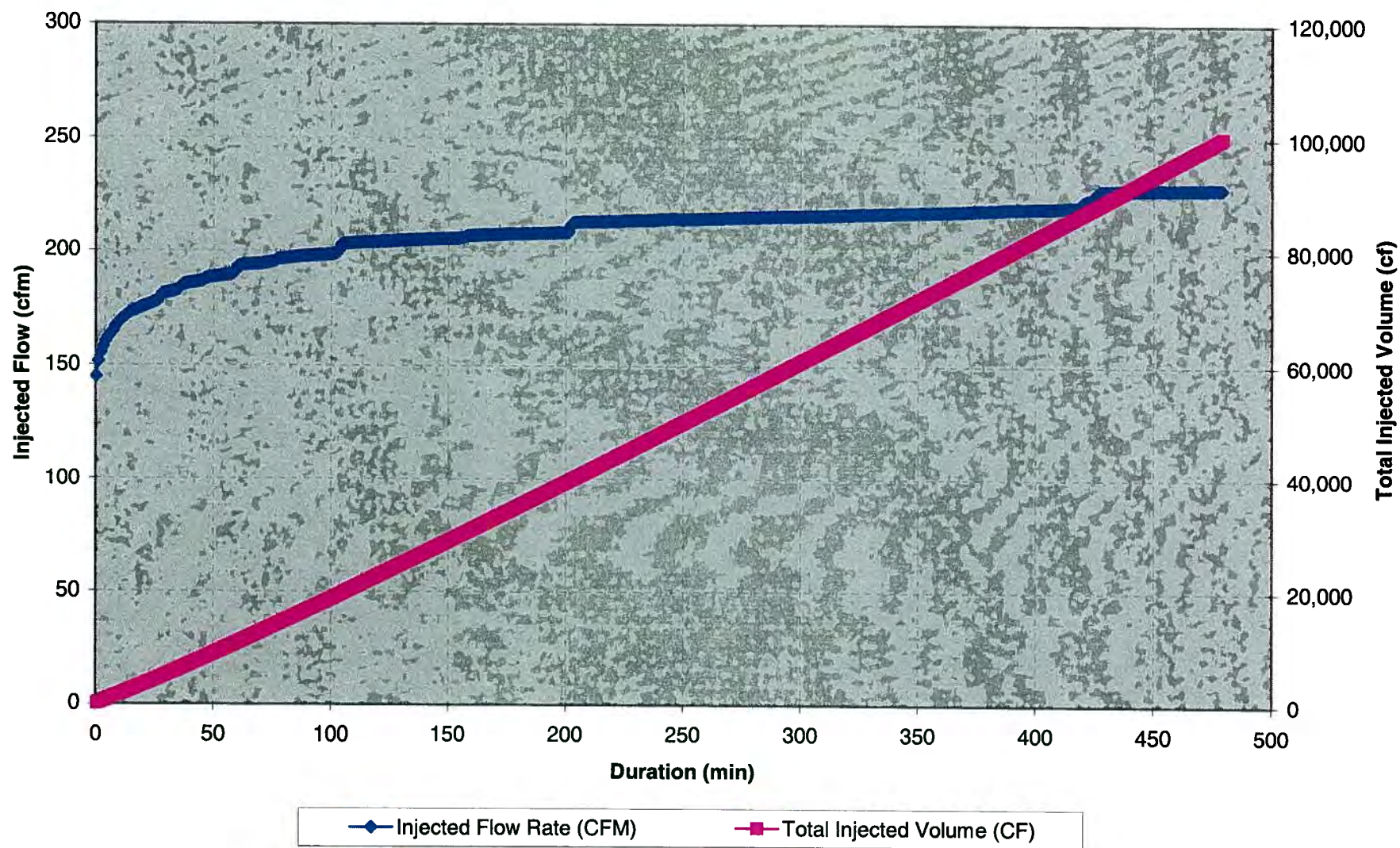
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-23
11/27/2007**



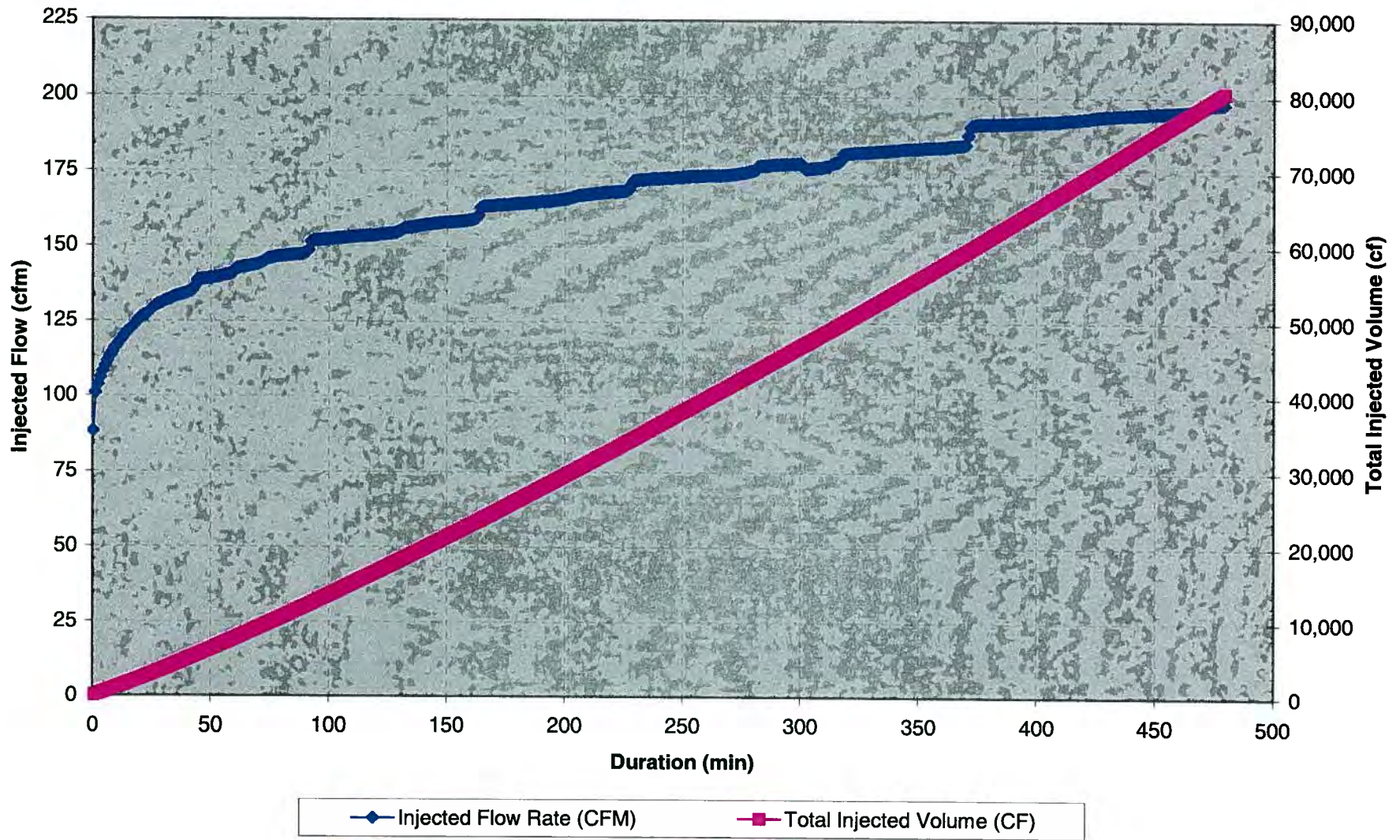
**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**BP-24
11/12/2007**



**AIR FLOW -vs- TIME GRAPH
FOURTH ROUND OF BIO-PULSE SPARGING**

**SP-100
12/3/2007**

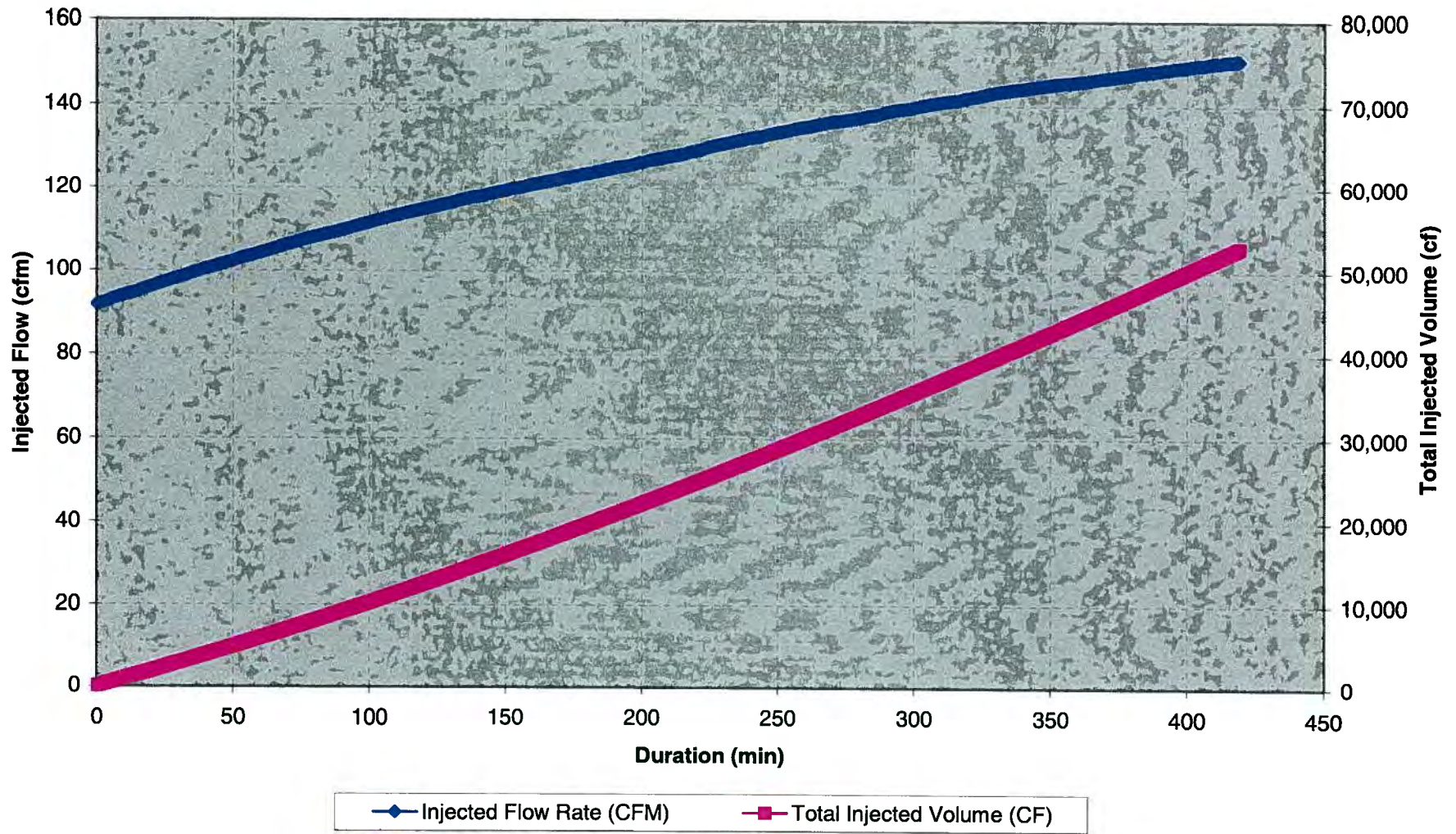


APPENDIX B

AIR FLOW VS. TIME GRAPHS FIFTH ROUND OF BIO-PULSE SPARGING

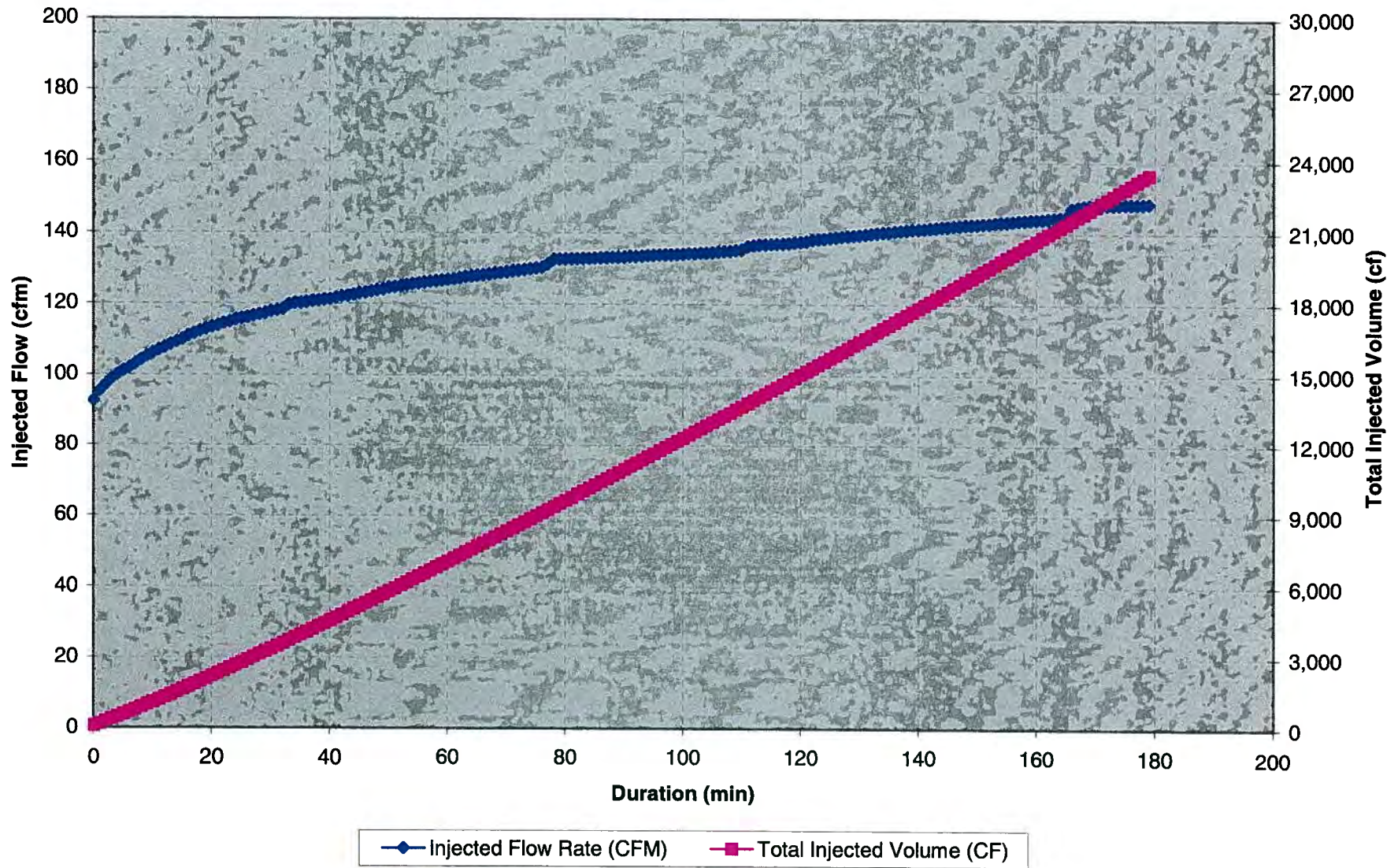
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-1
1/3/2008**



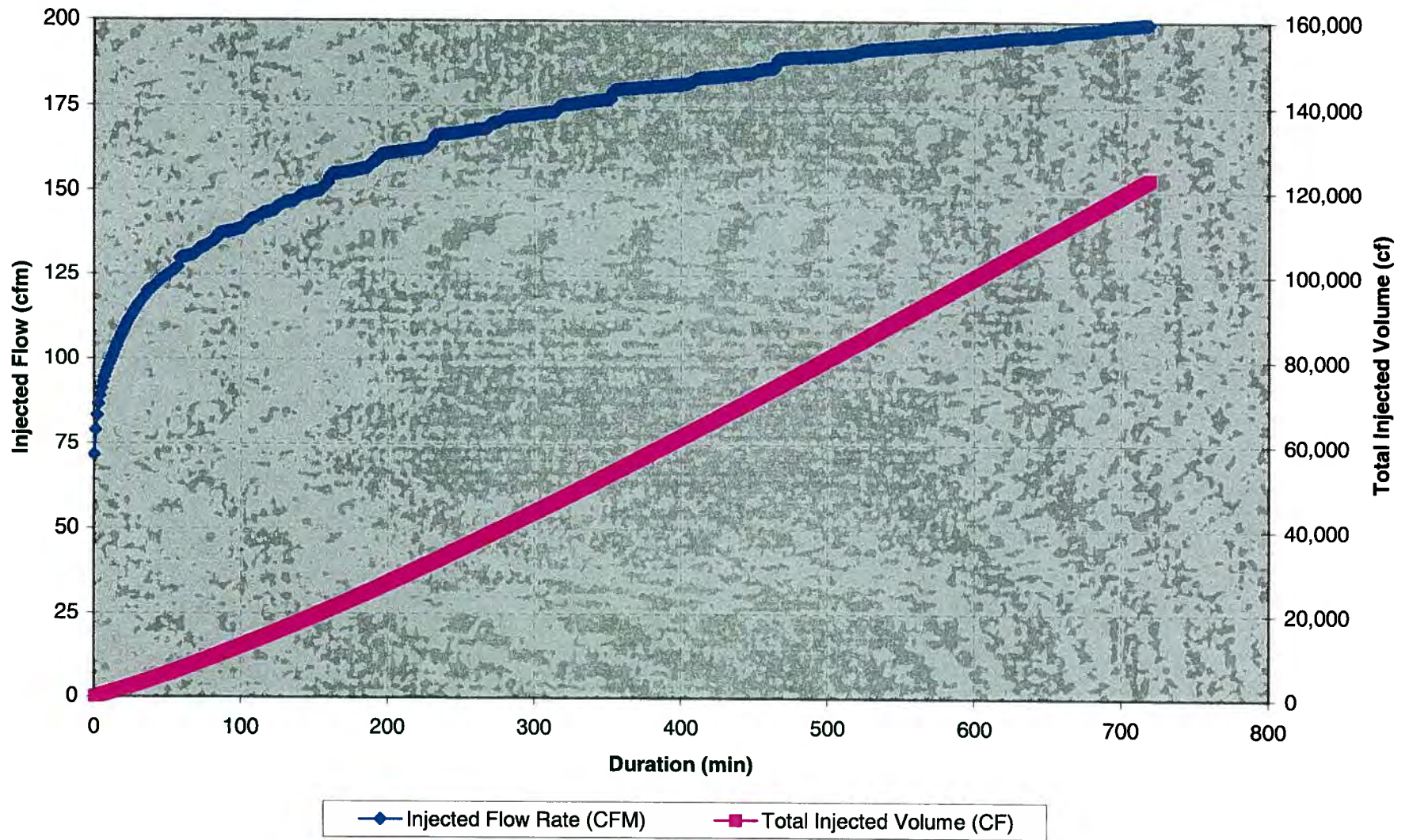
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-2
1/16/2008**



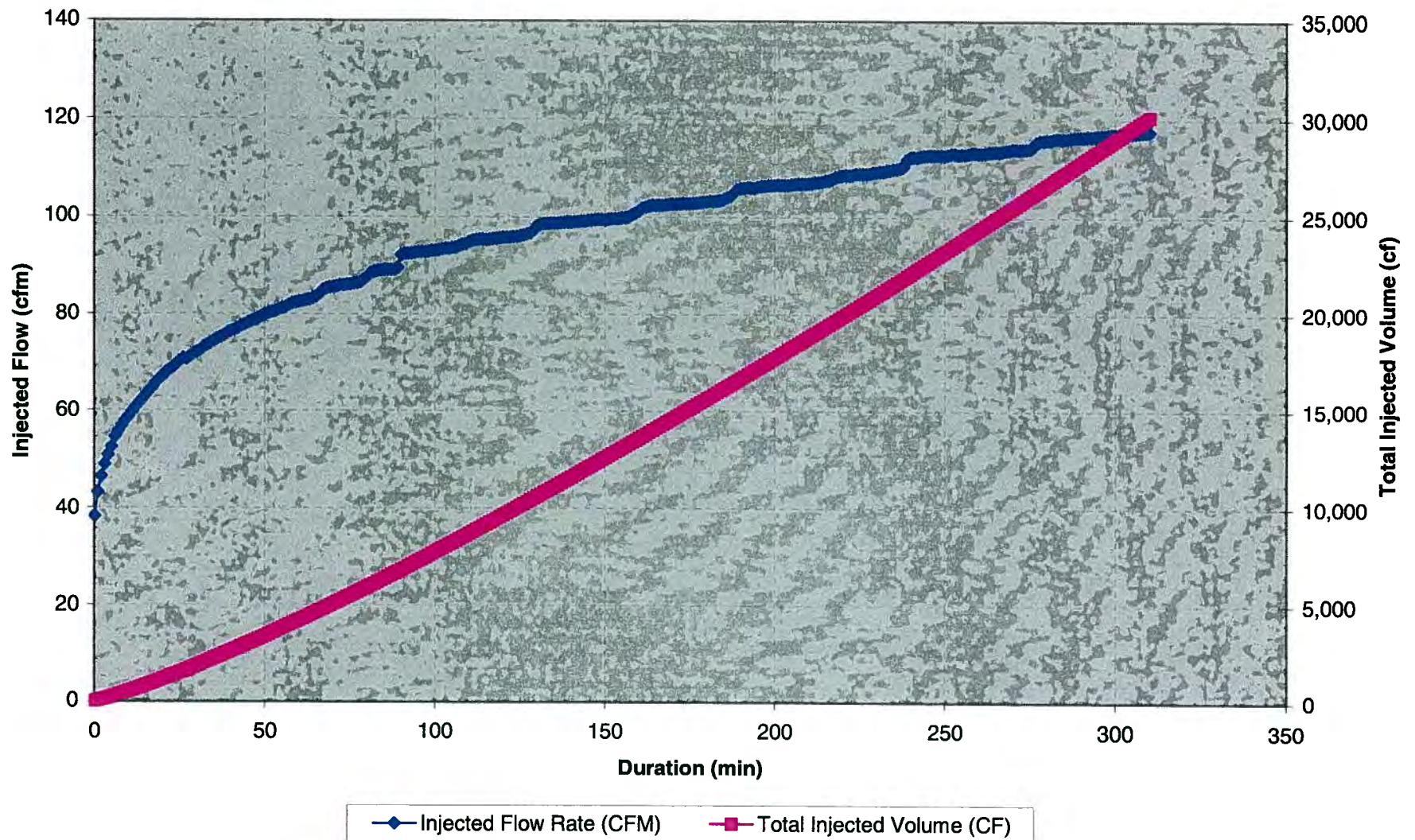
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-3
2/15/2008**



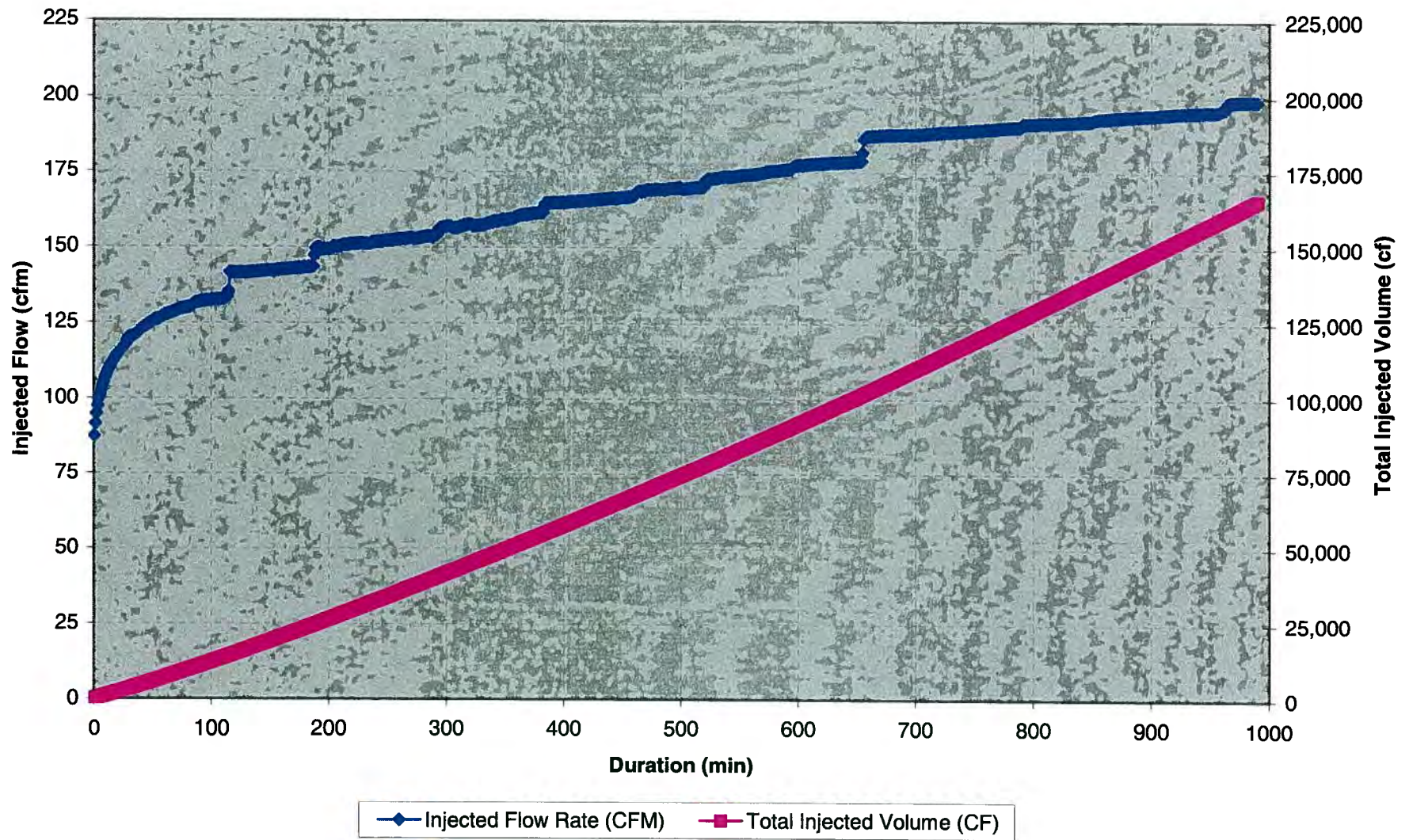
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-4
1/11/2008**



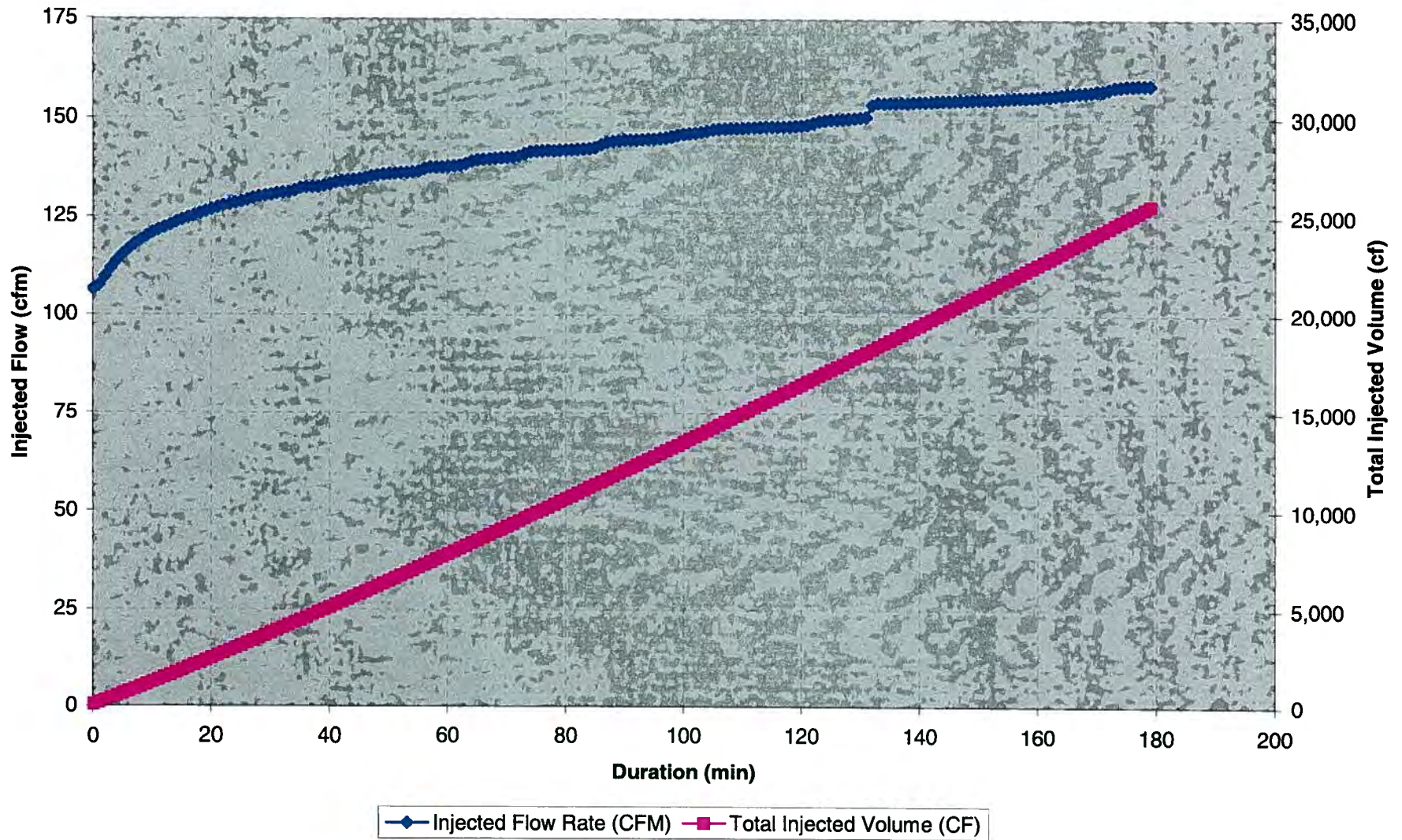
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-5
2/4/2008**



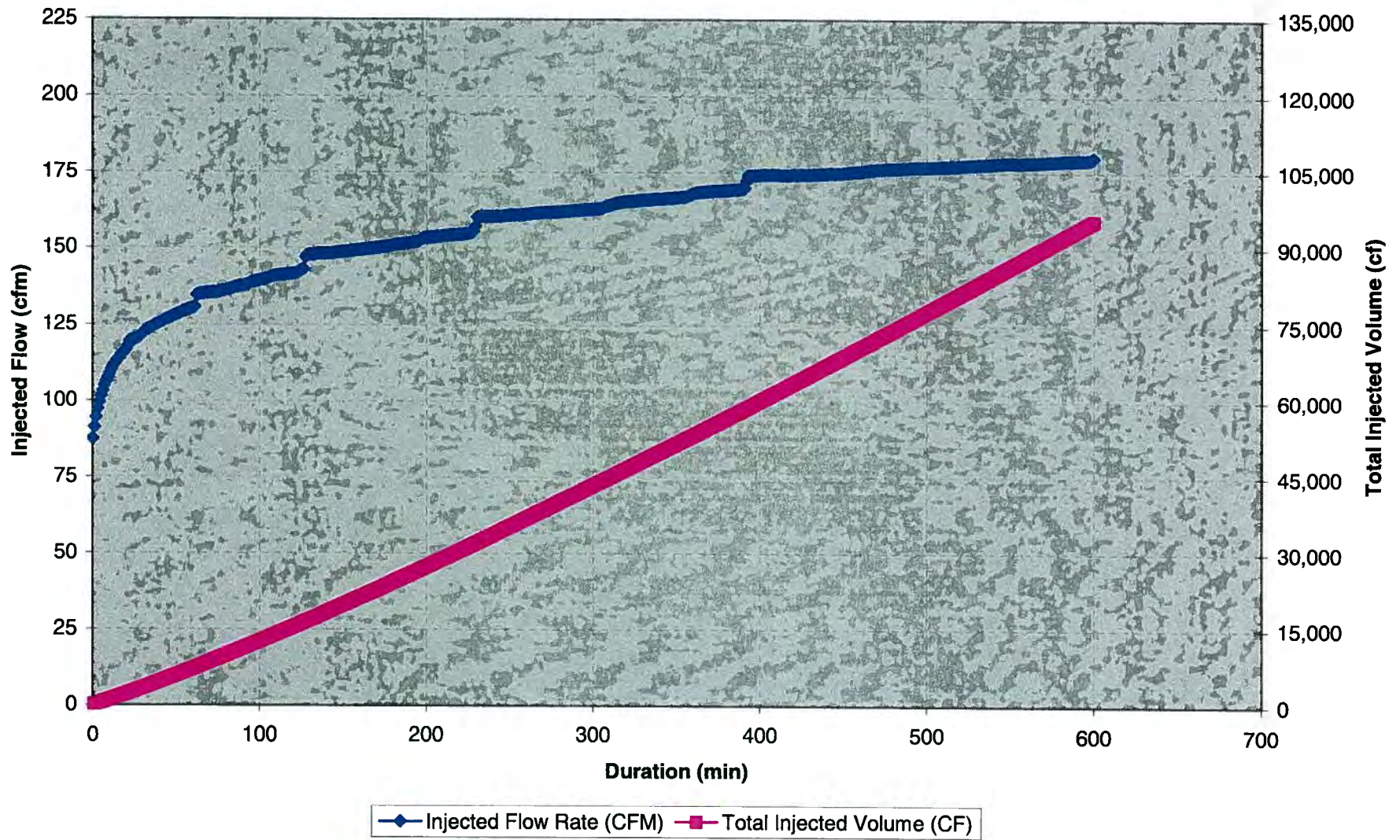
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-6
2/5/2008**



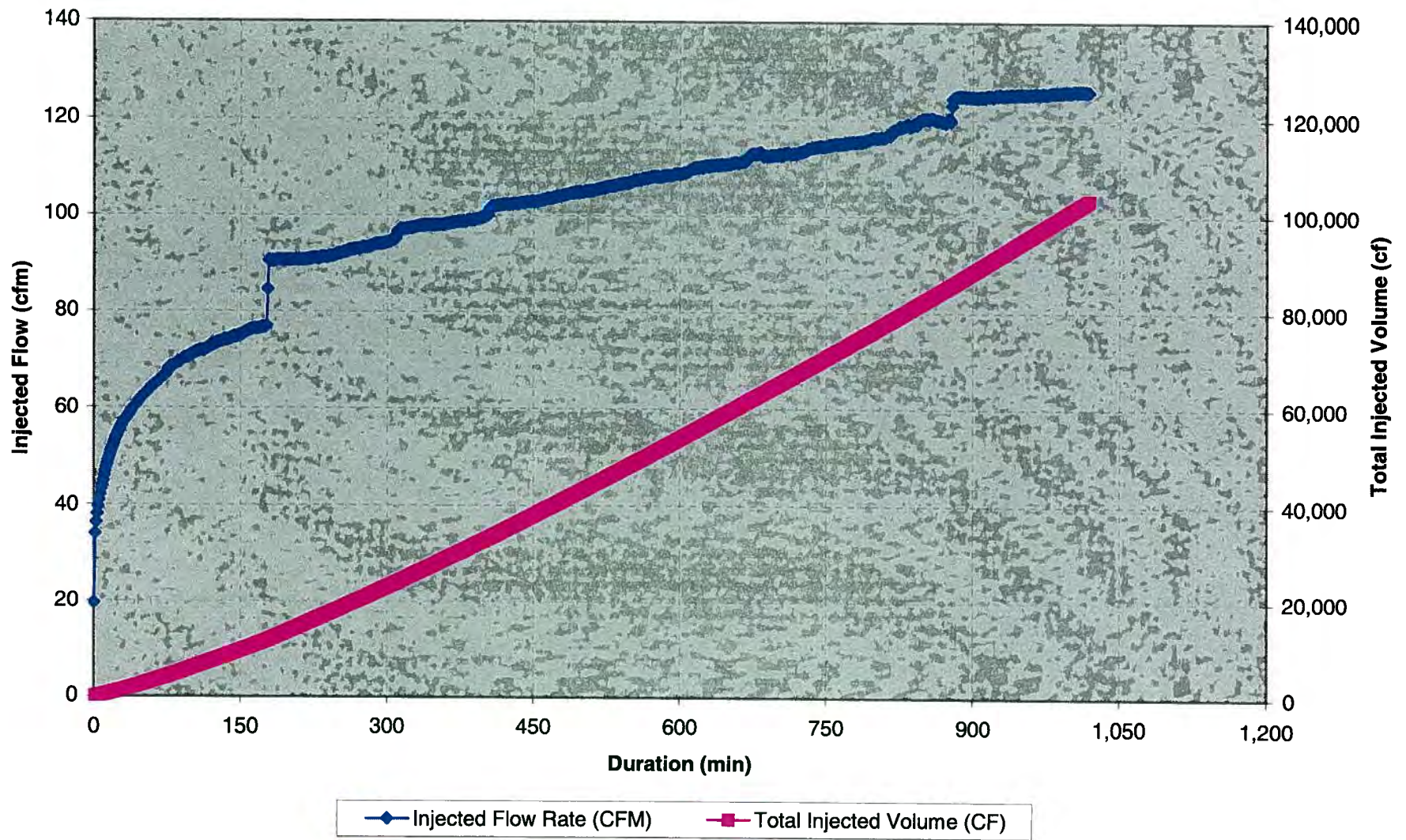
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-7
1/9/2008**



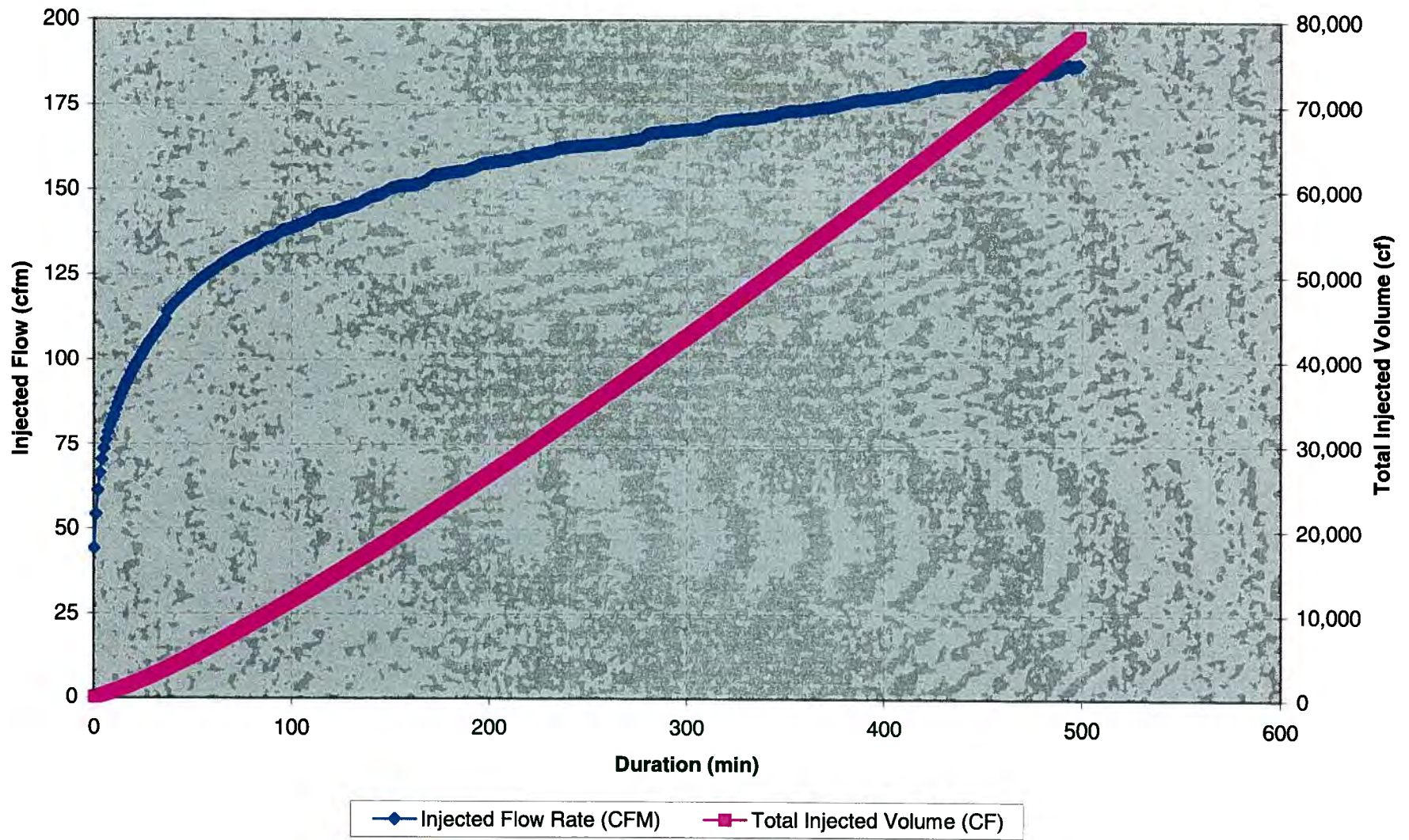
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-8
2/12/2008**



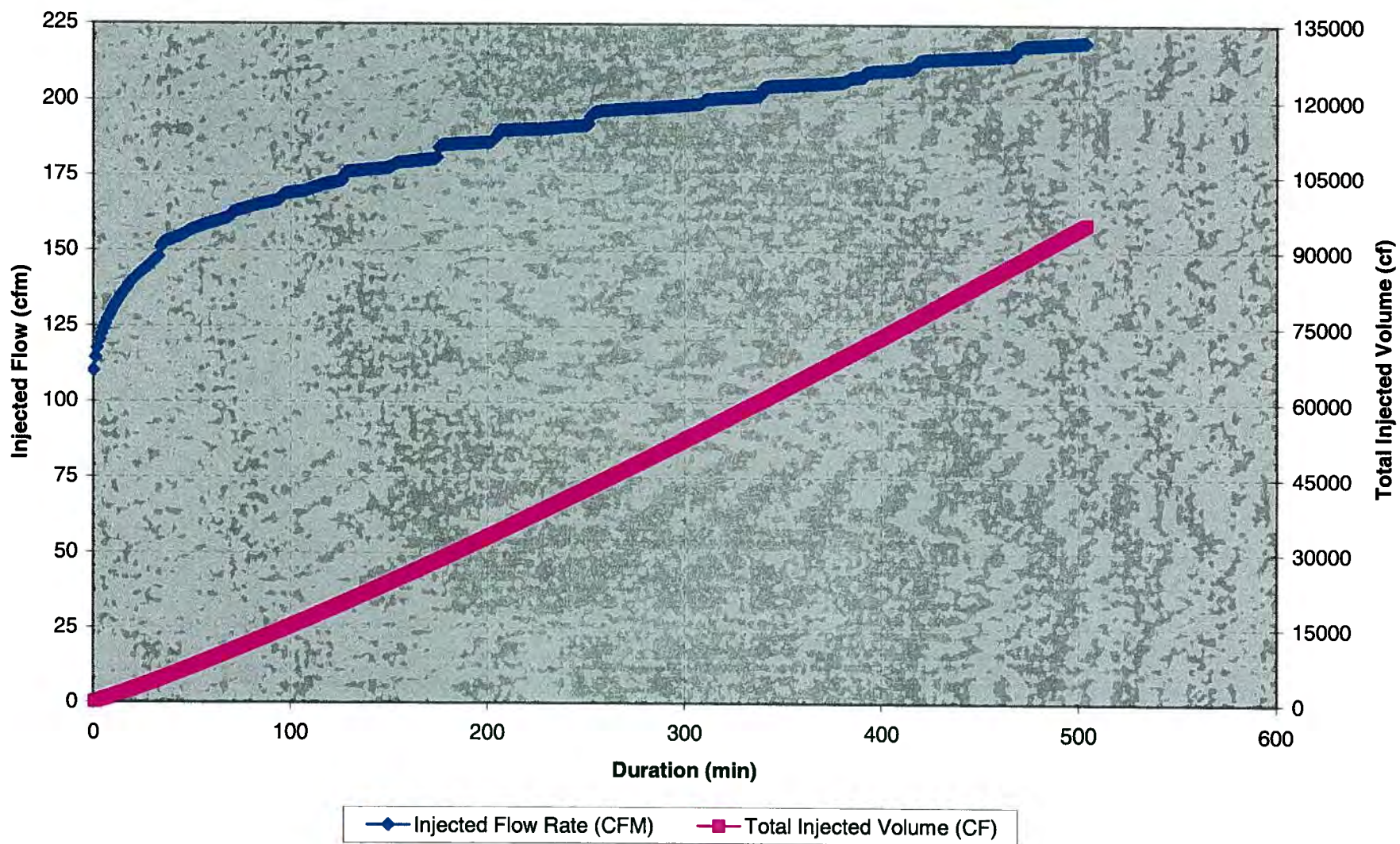
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-9
1/24/2008**



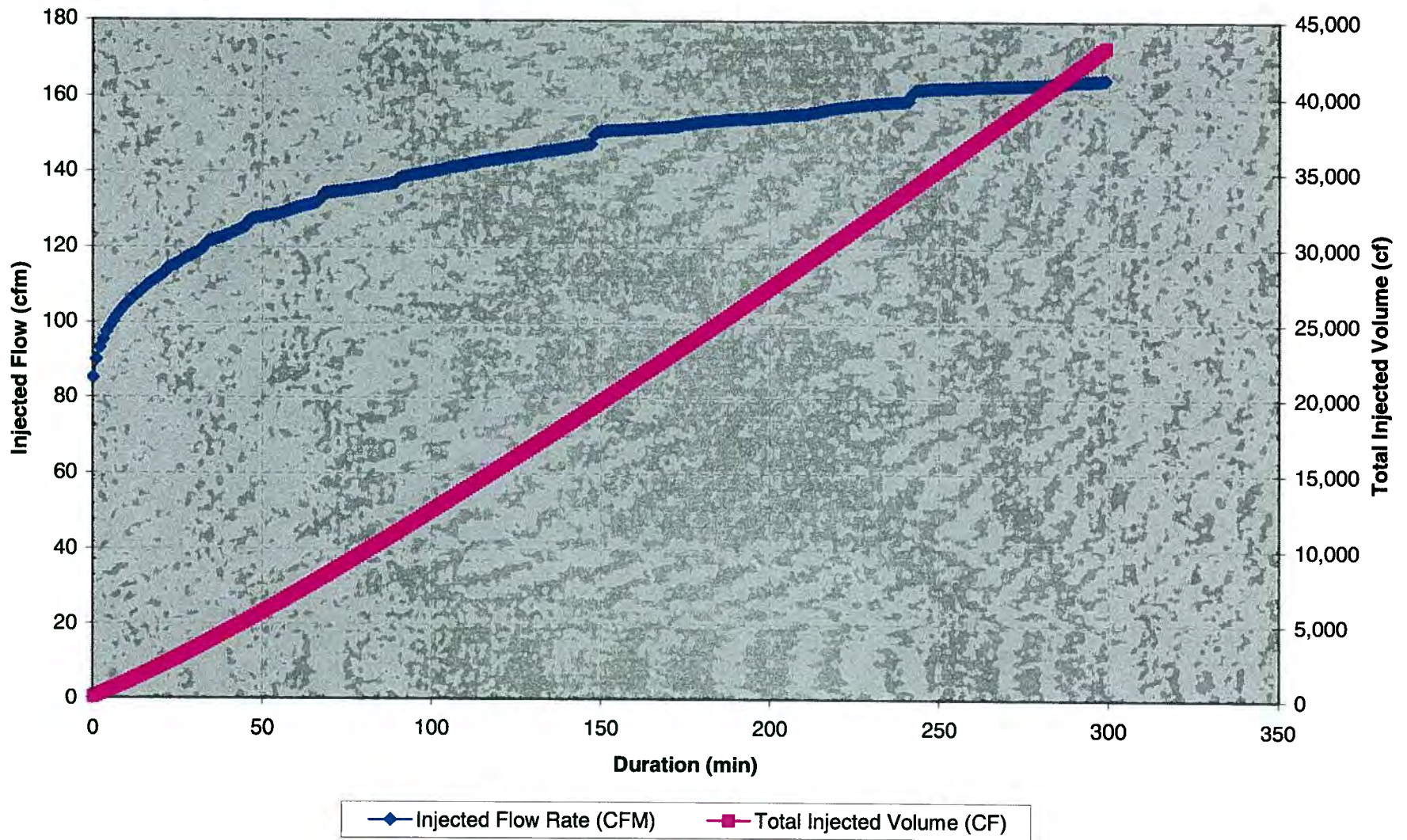
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-10
1/22/2008**



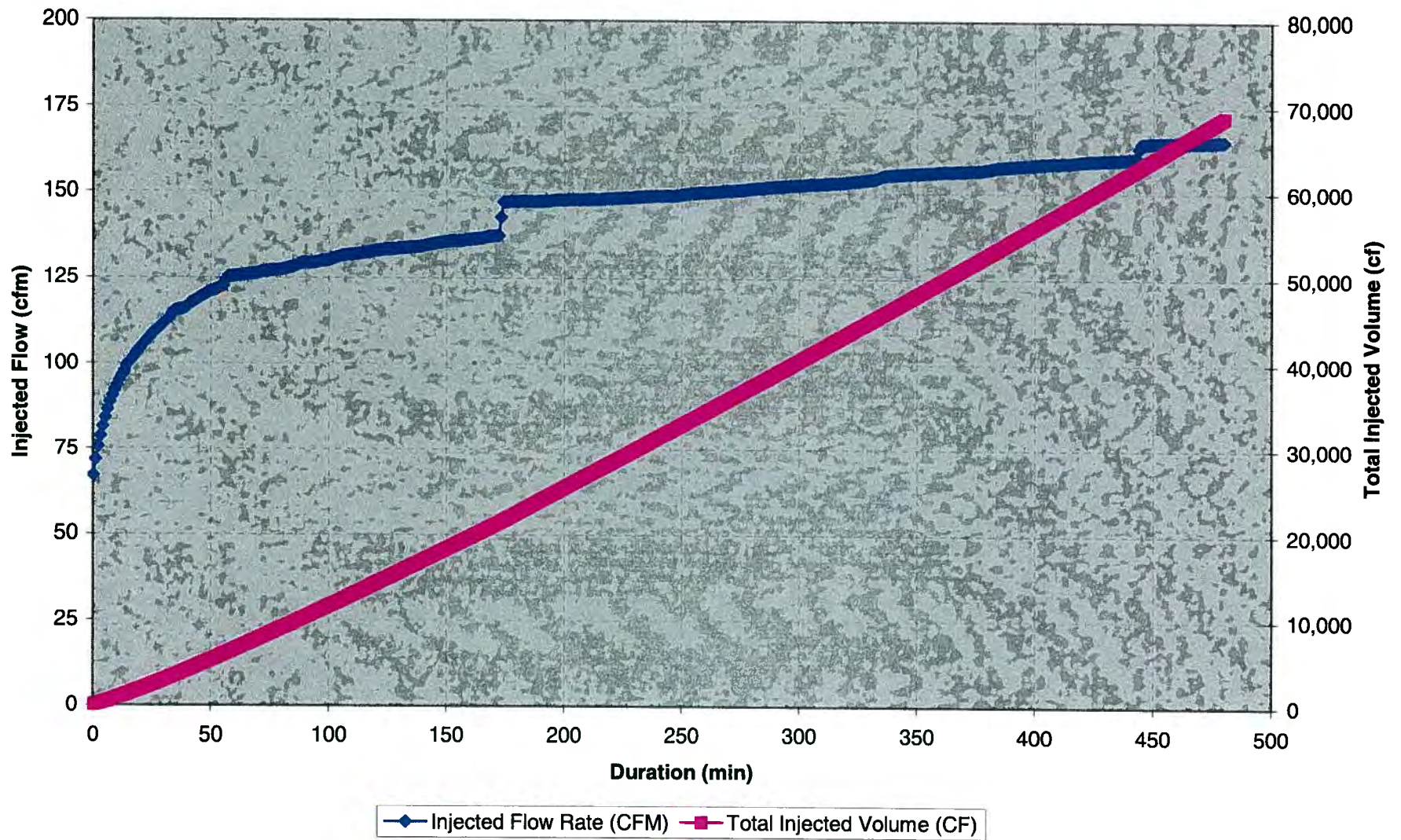
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-11
1/31/2008**



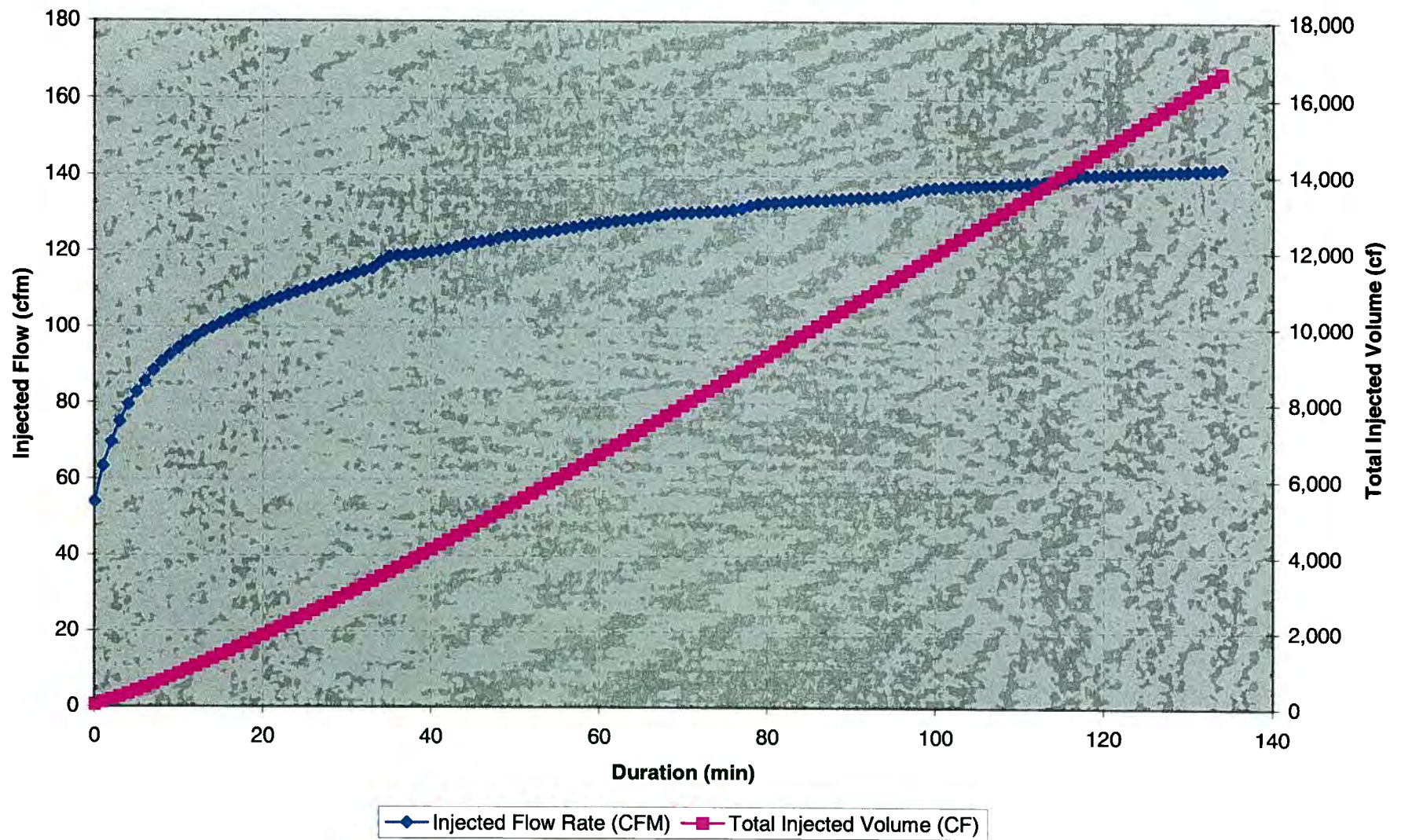
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-12
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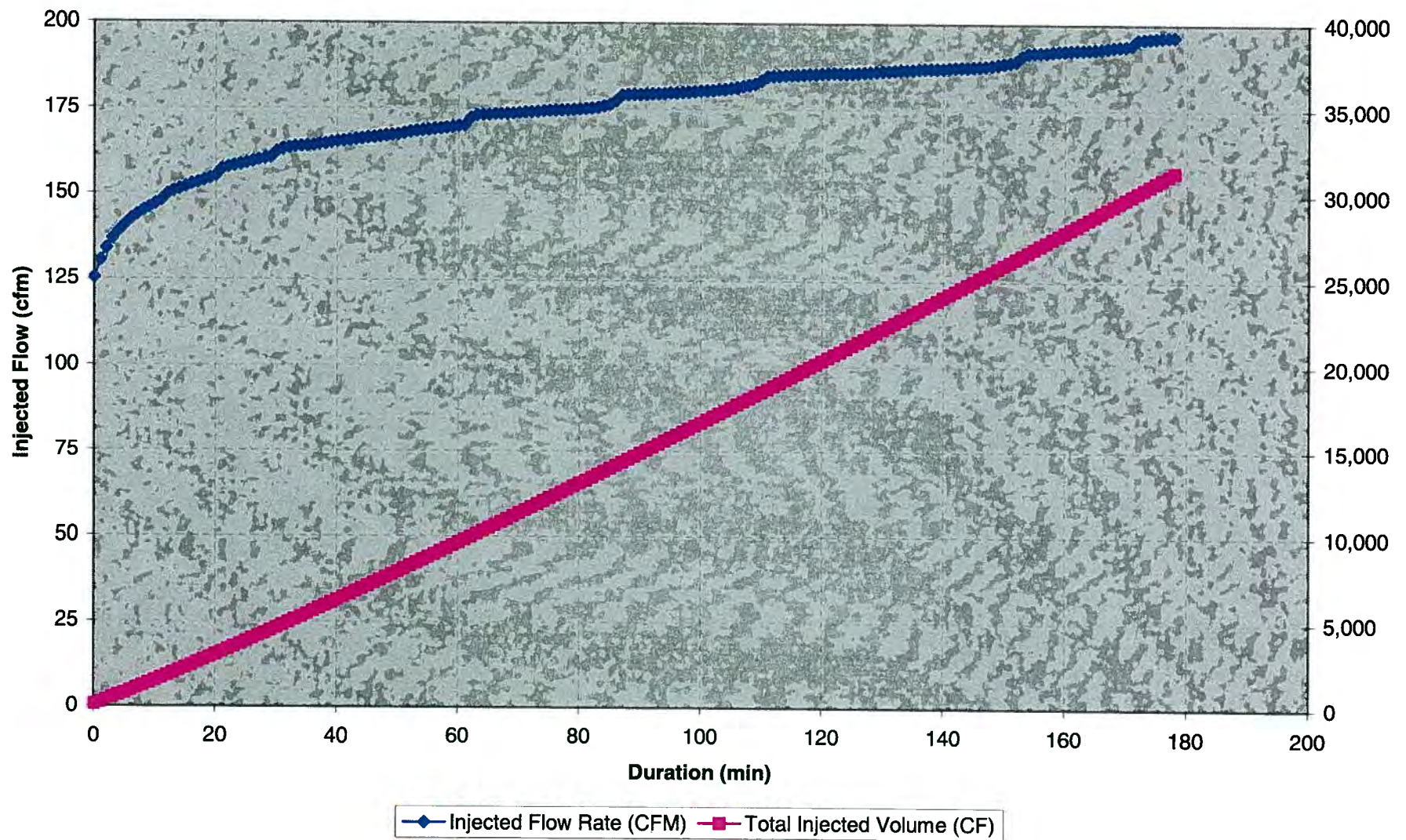
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-13
2/13/2008**



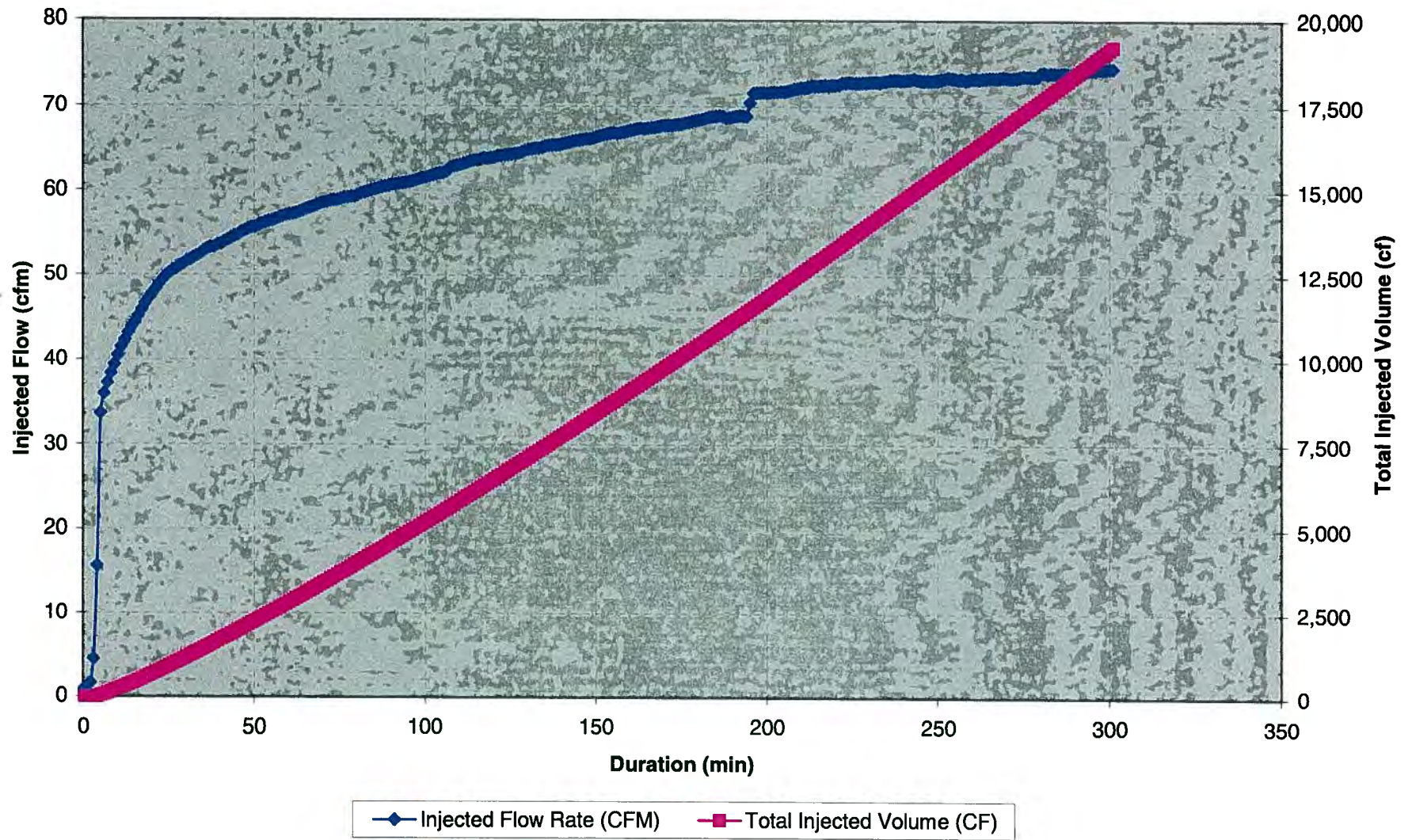
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-14
1/18/2008**



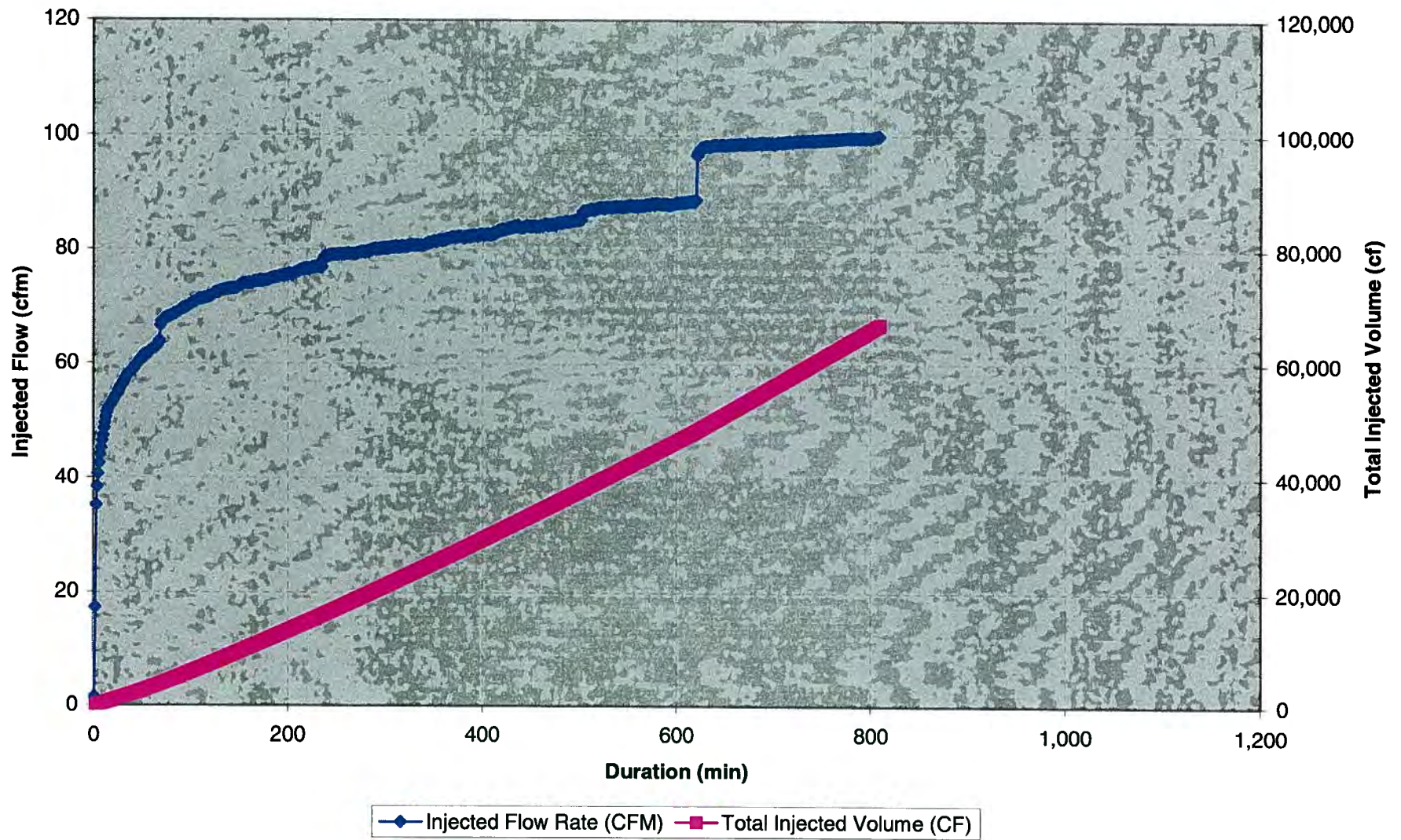
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-15
1/14/2008**



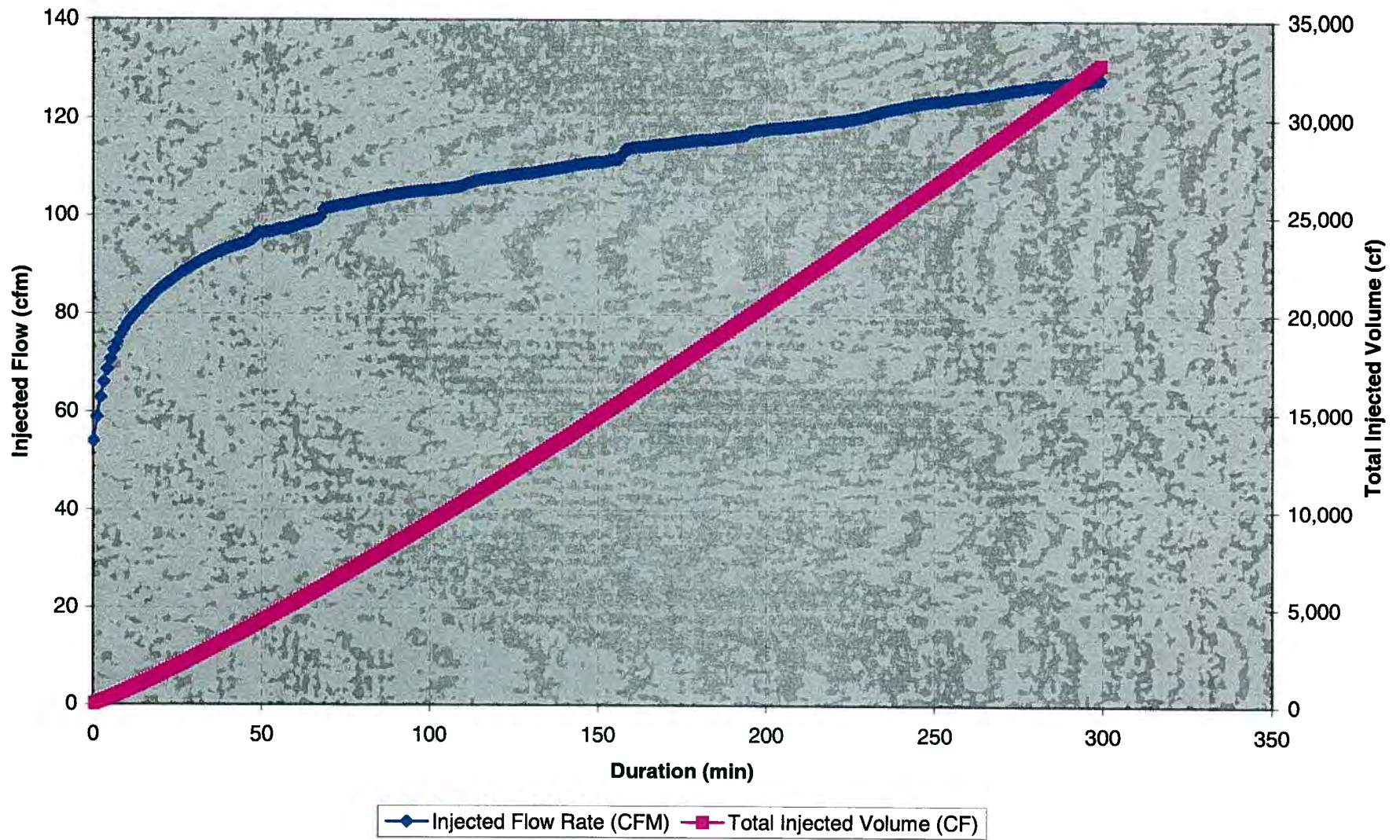
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-16
2/7/2008**



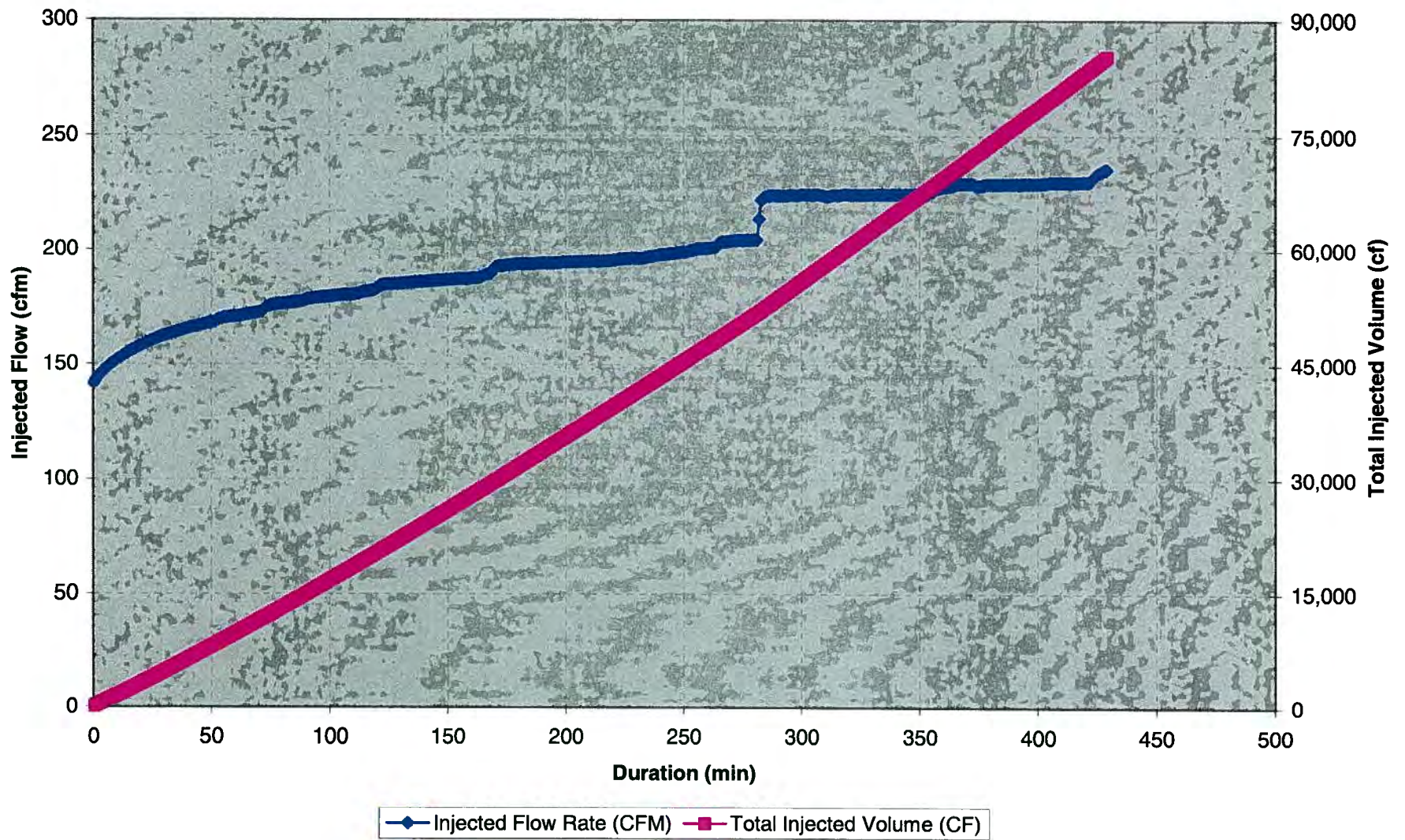
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-17
2/11/2008**



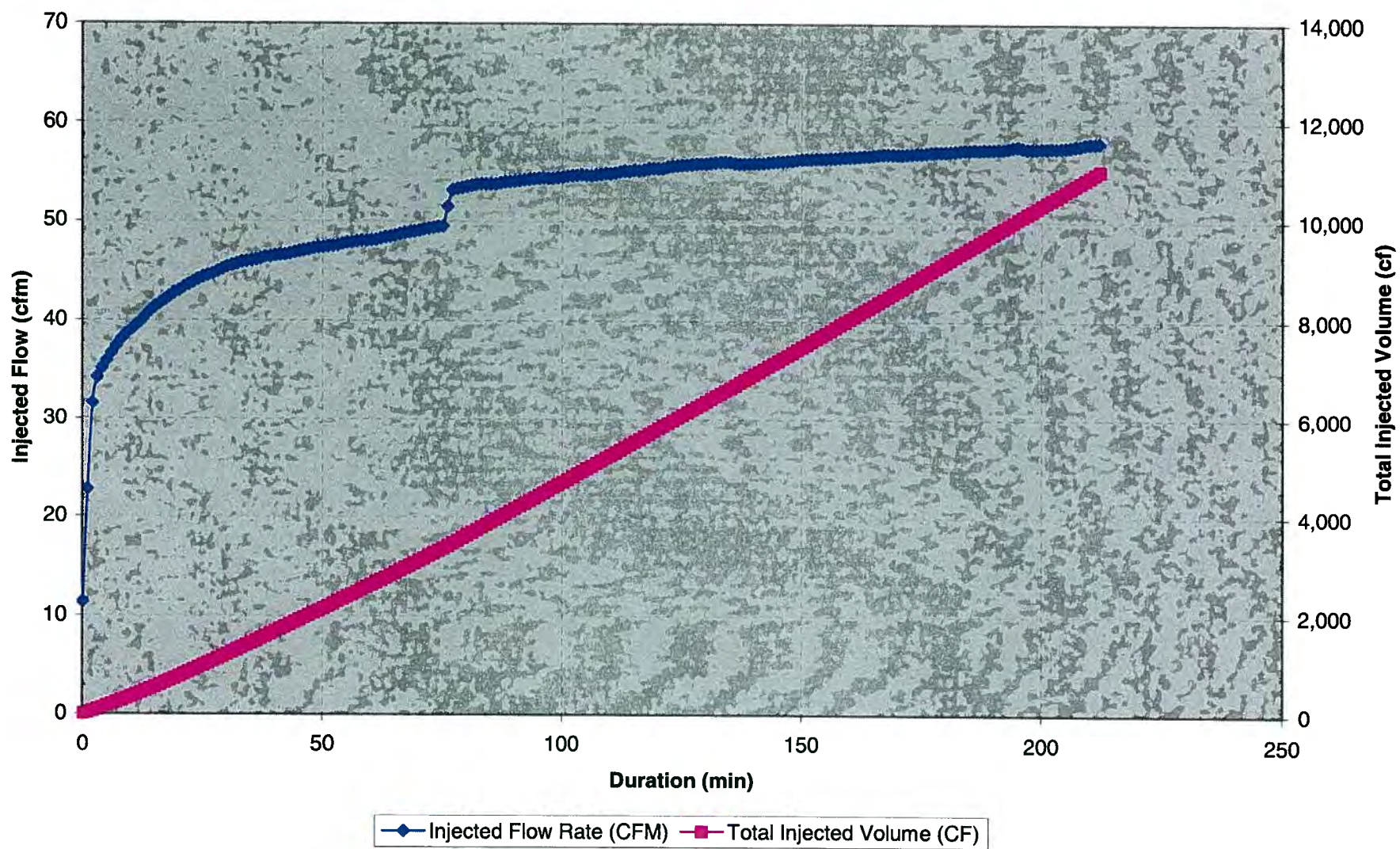
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-18
2/14/2008**



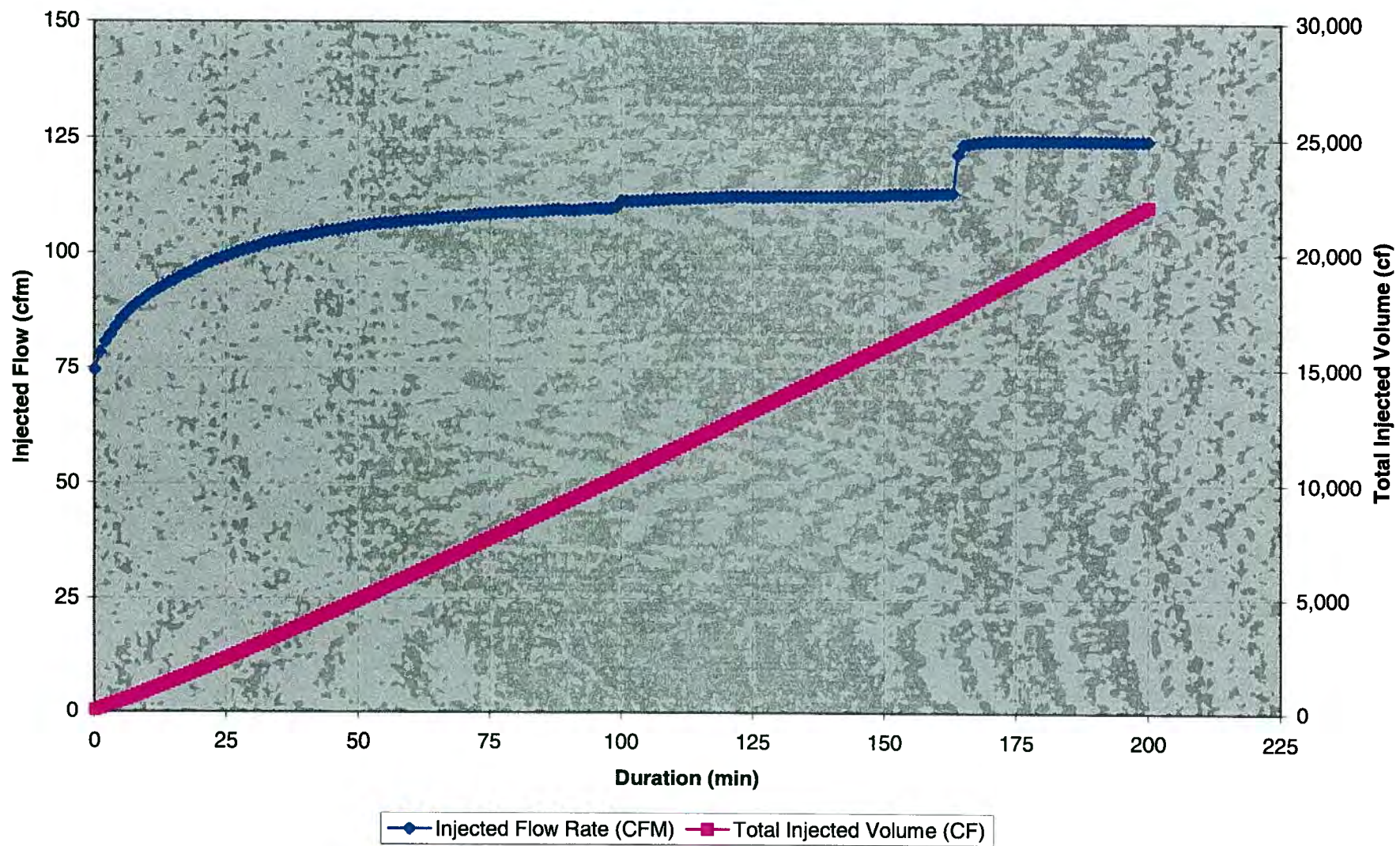
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-19
1/21/2008**



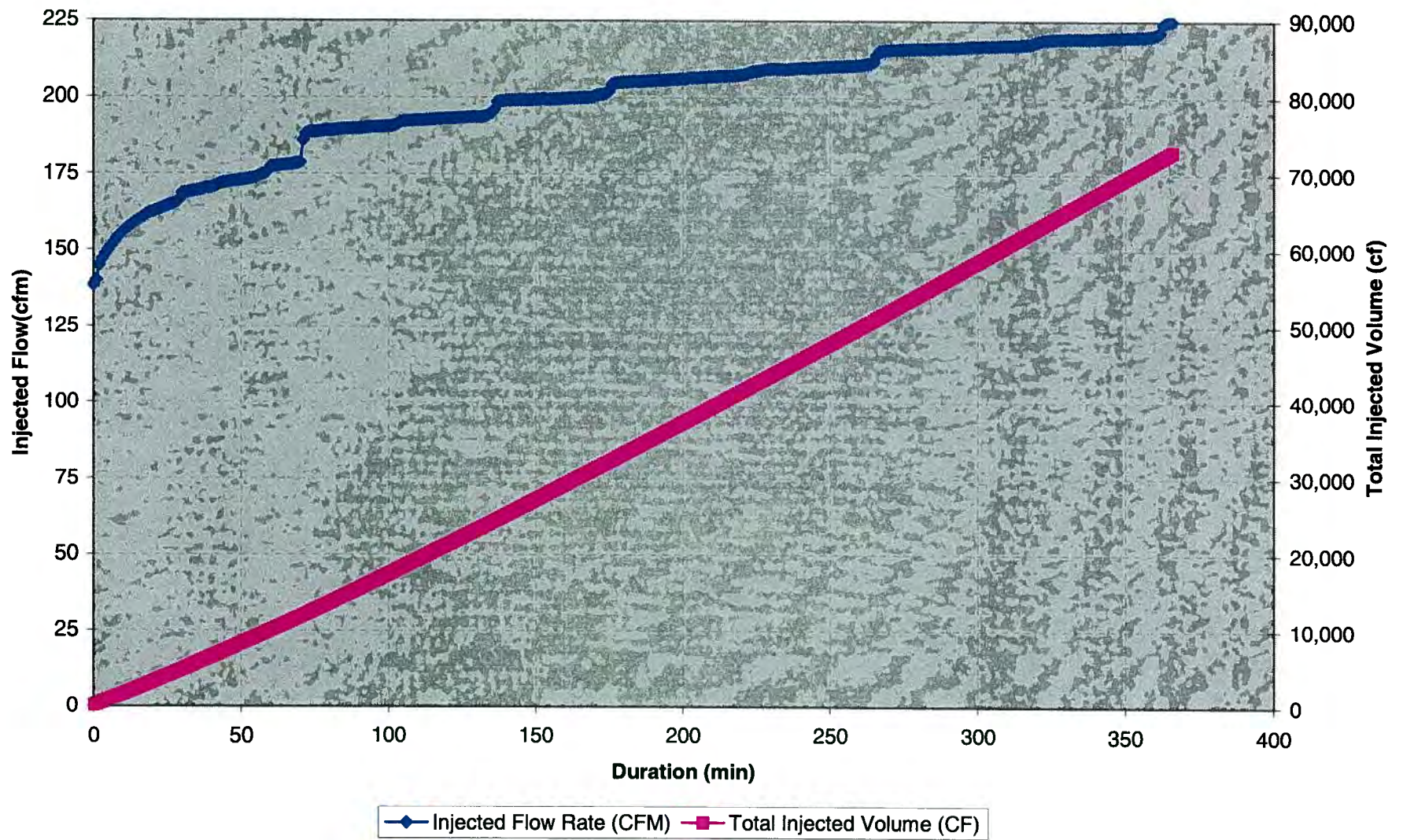
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-20
2/2/2008**



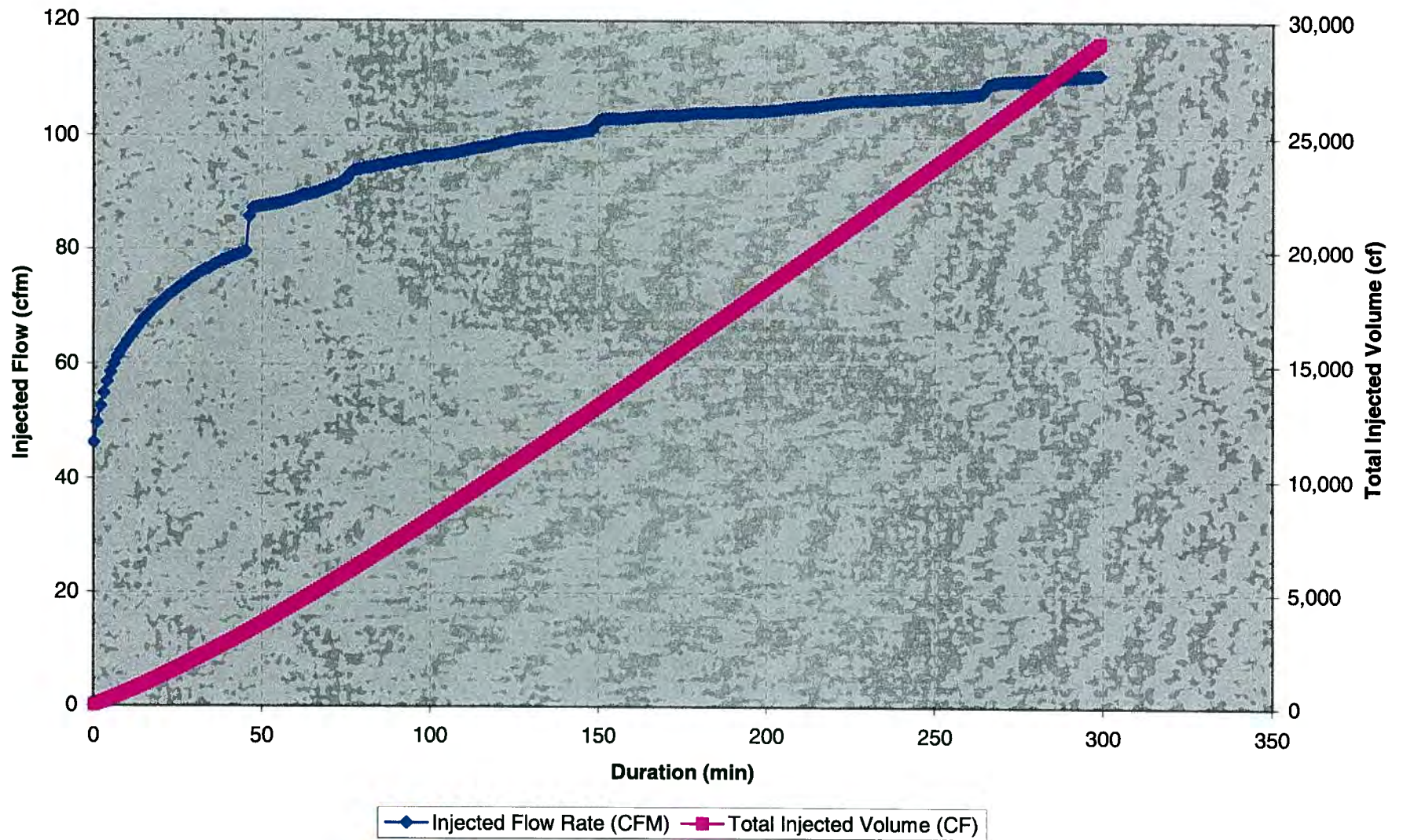
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-21
1/7/2008**



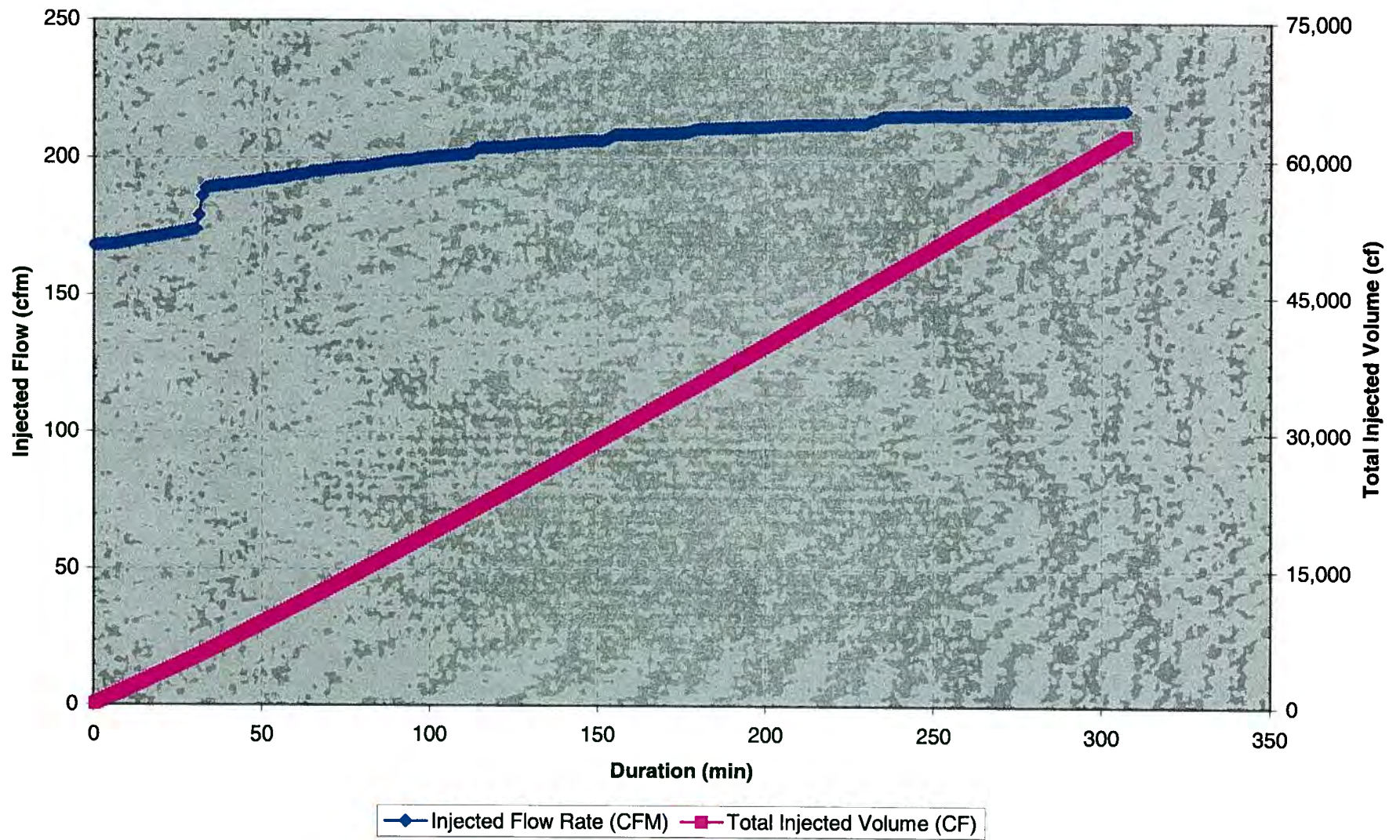
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-22
1/15/2008**



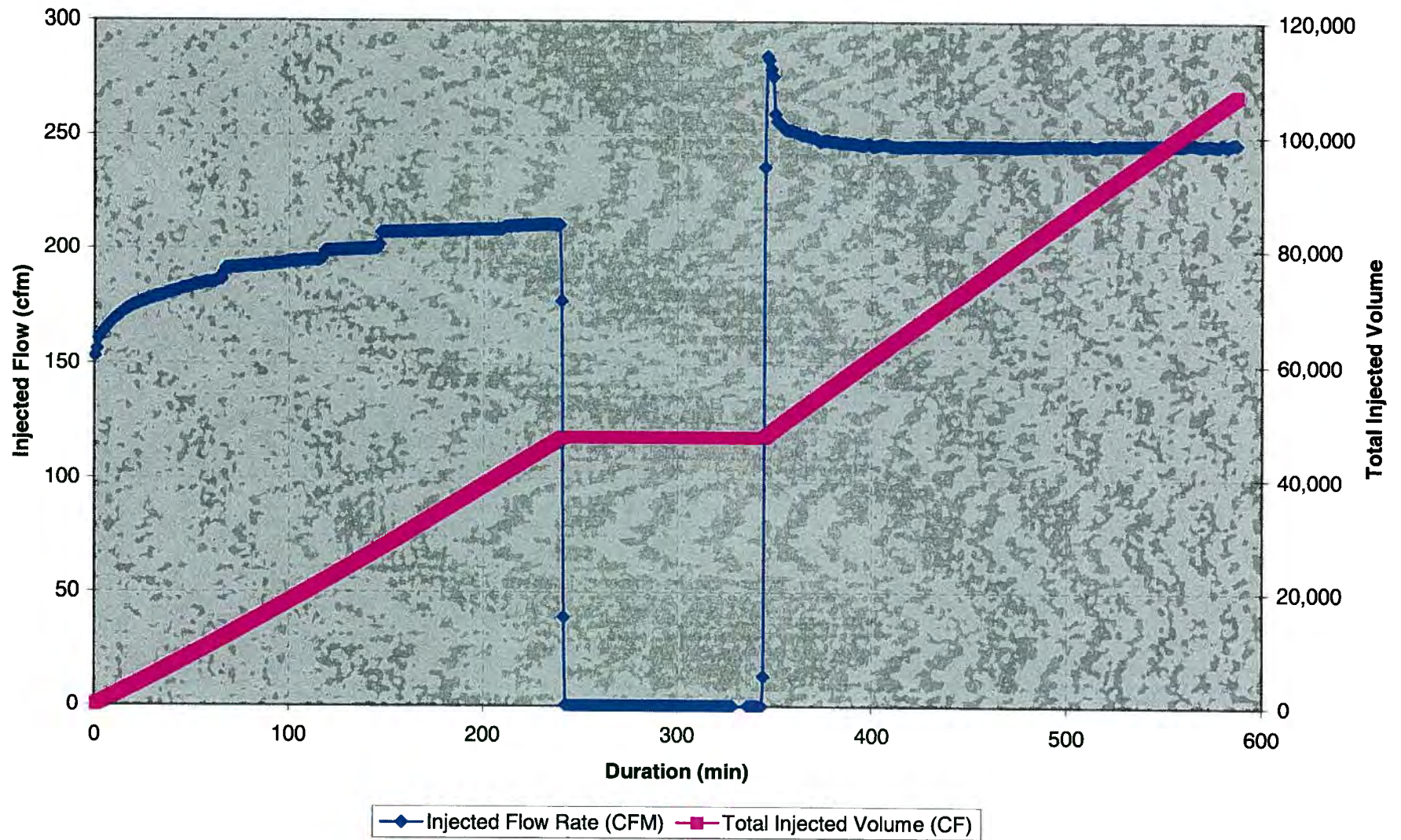
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-23
1/23/2008**



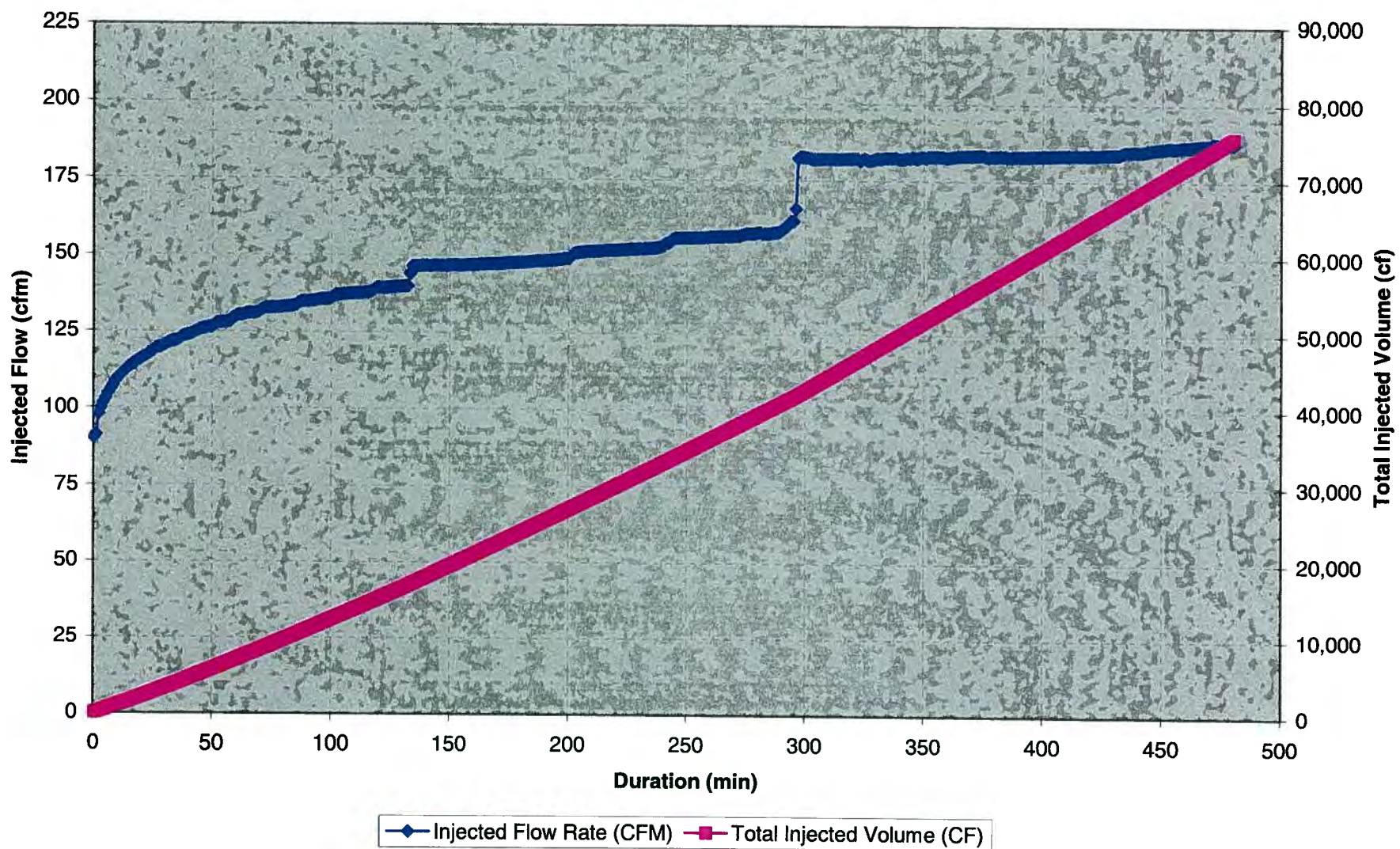
**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**BP-24
1/10/2008**



**AIR FLOW -vs- TIME GRAPH
FIFTH ROUND OF BIO-PULSE SPARGING**

**SP-100
2/6/2008**

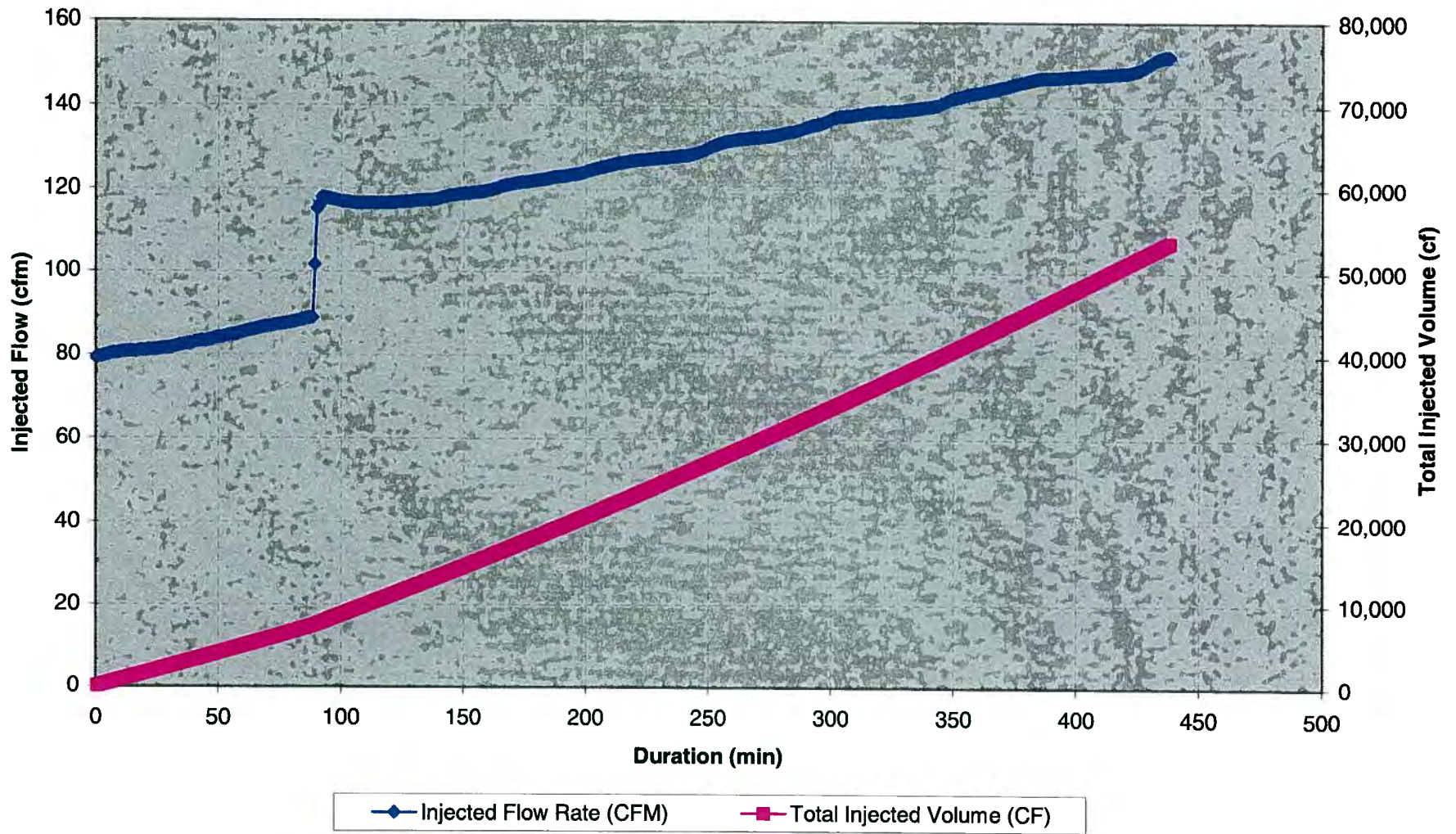


APPENDIX C

AIR FLOW VS. TIME GRAPHS SIXTH ROUND OF BIO-PULSE SPARGING

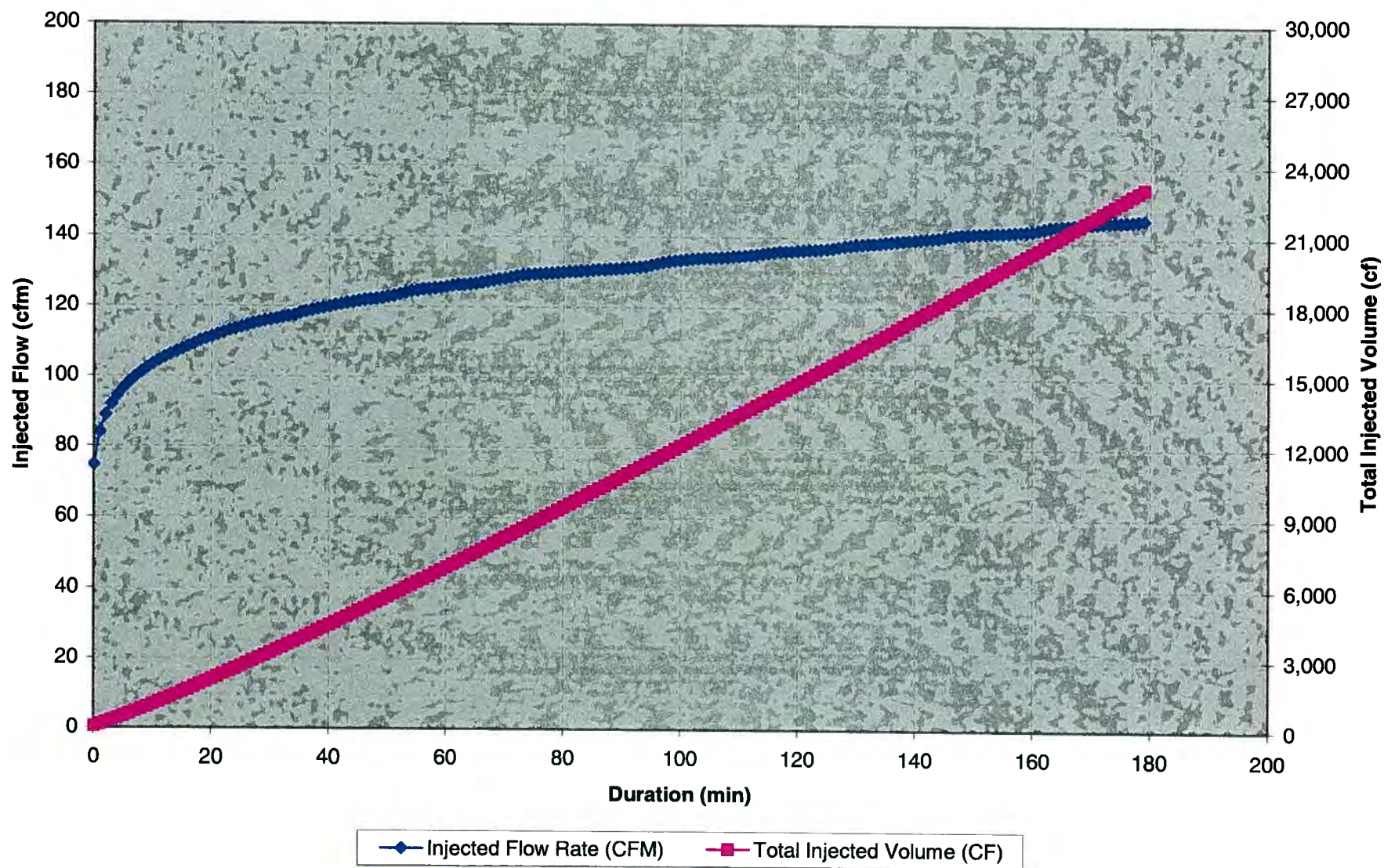
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-1
3/10/2008**



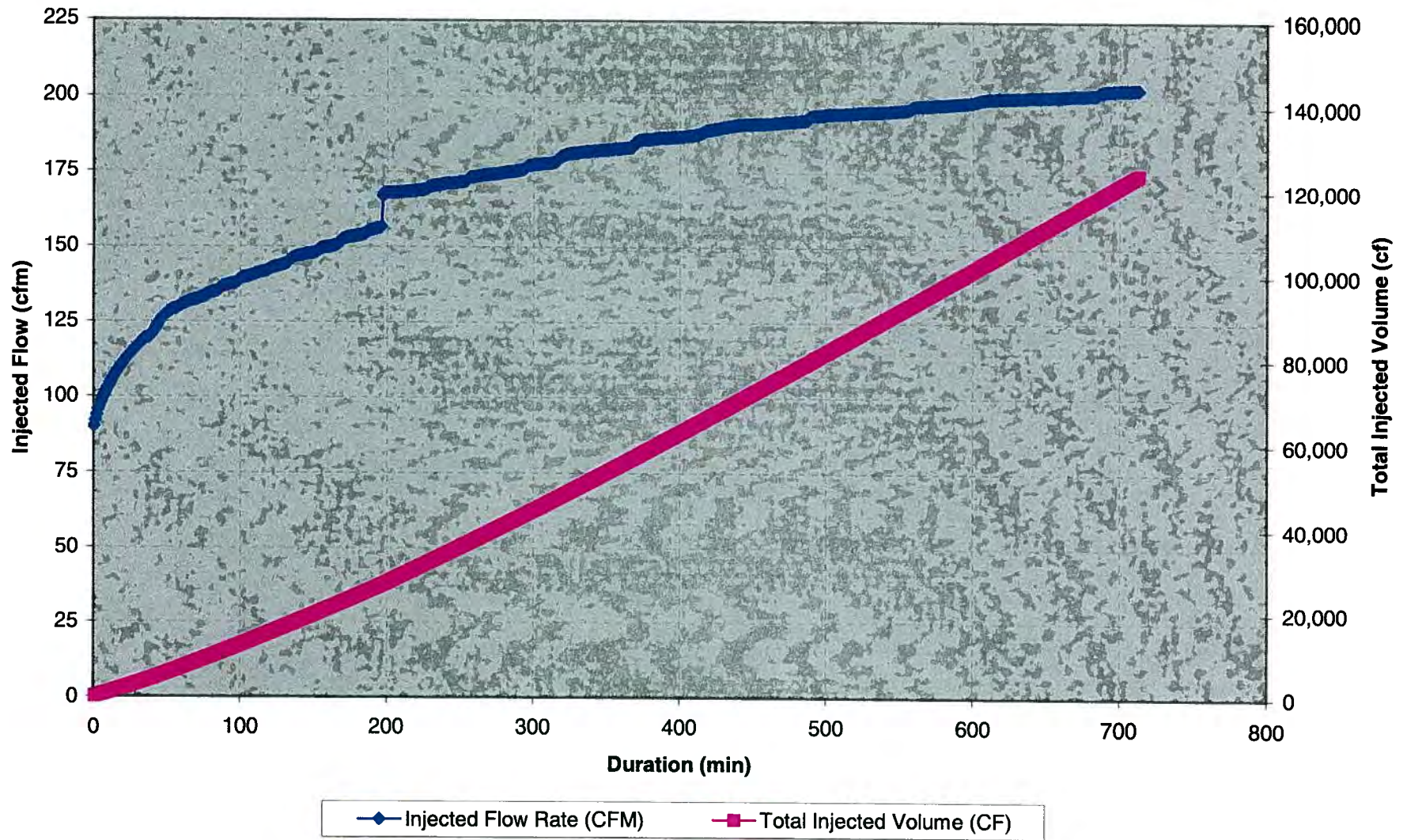
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-2
3/25/2008**



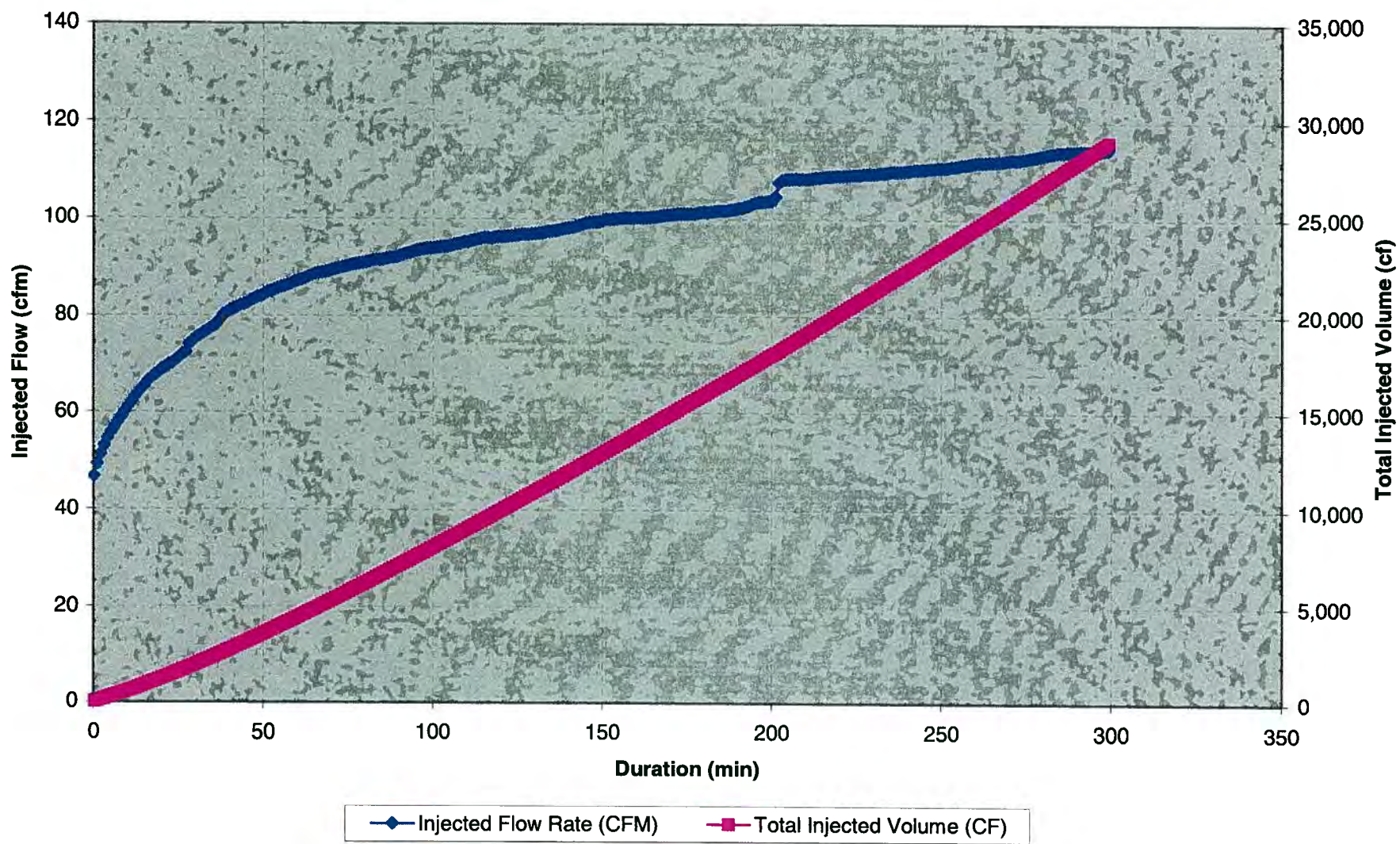
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-3
4/12/2008**



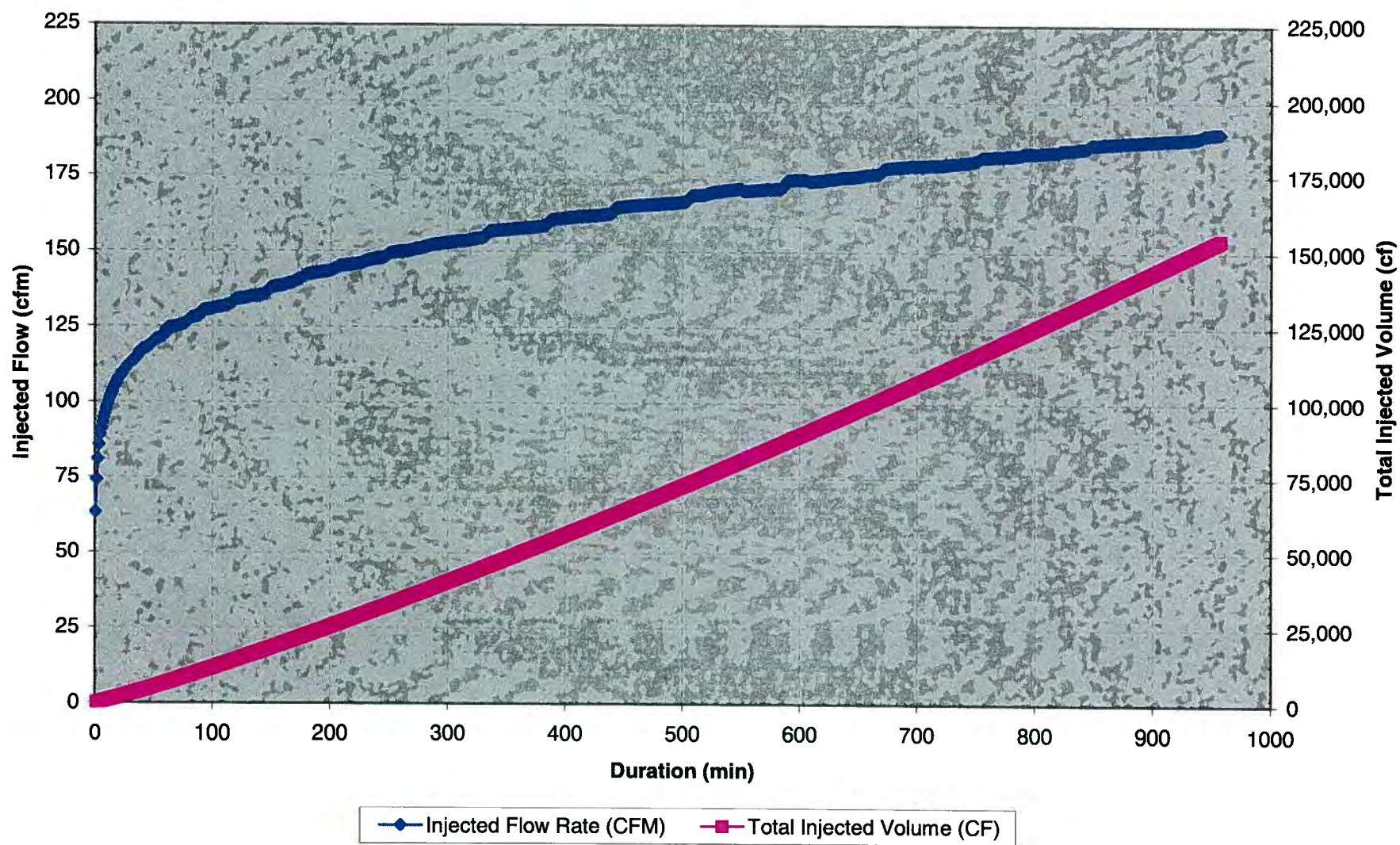
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-4
3/18/2008**



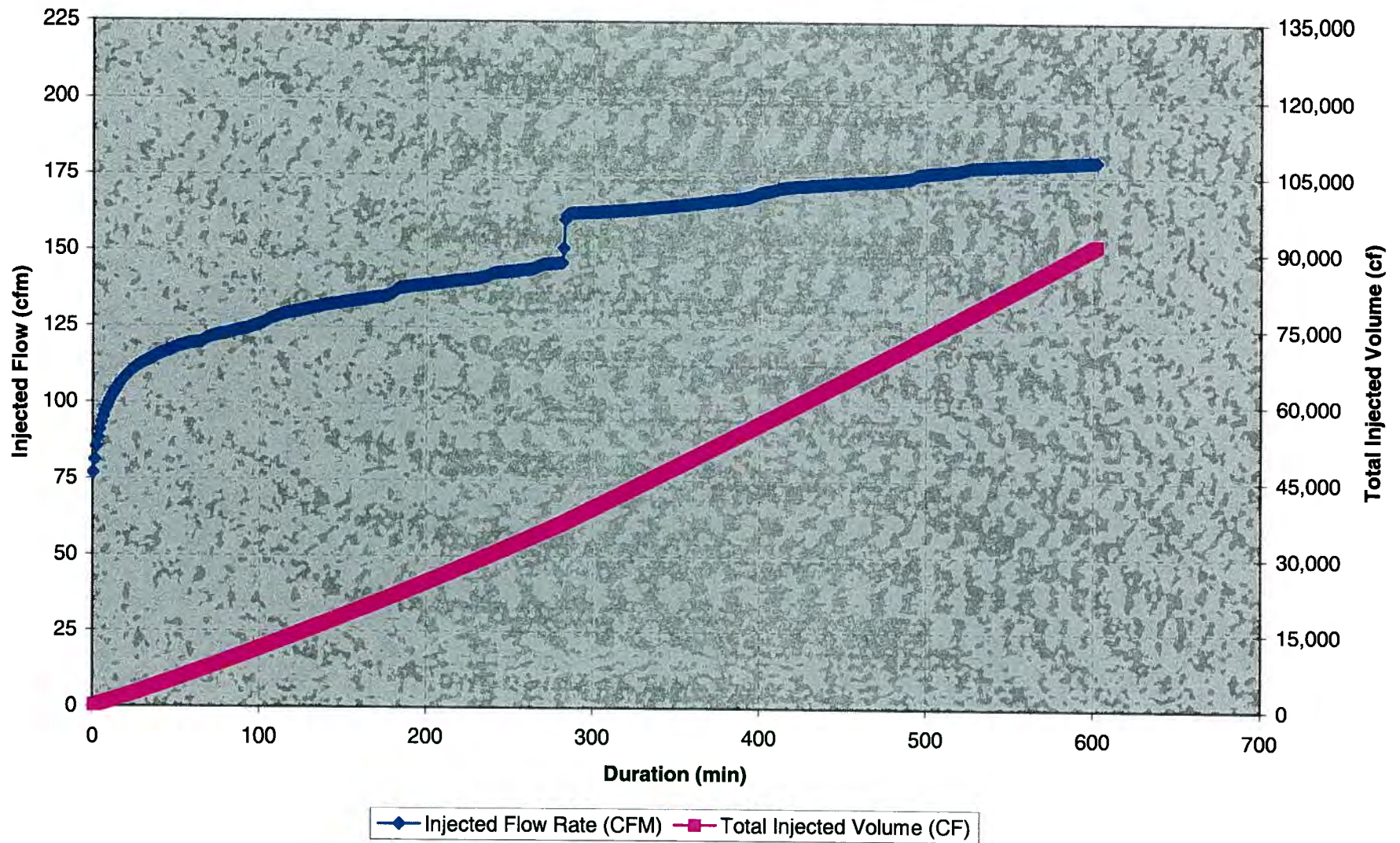
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-5
4/7/2008**



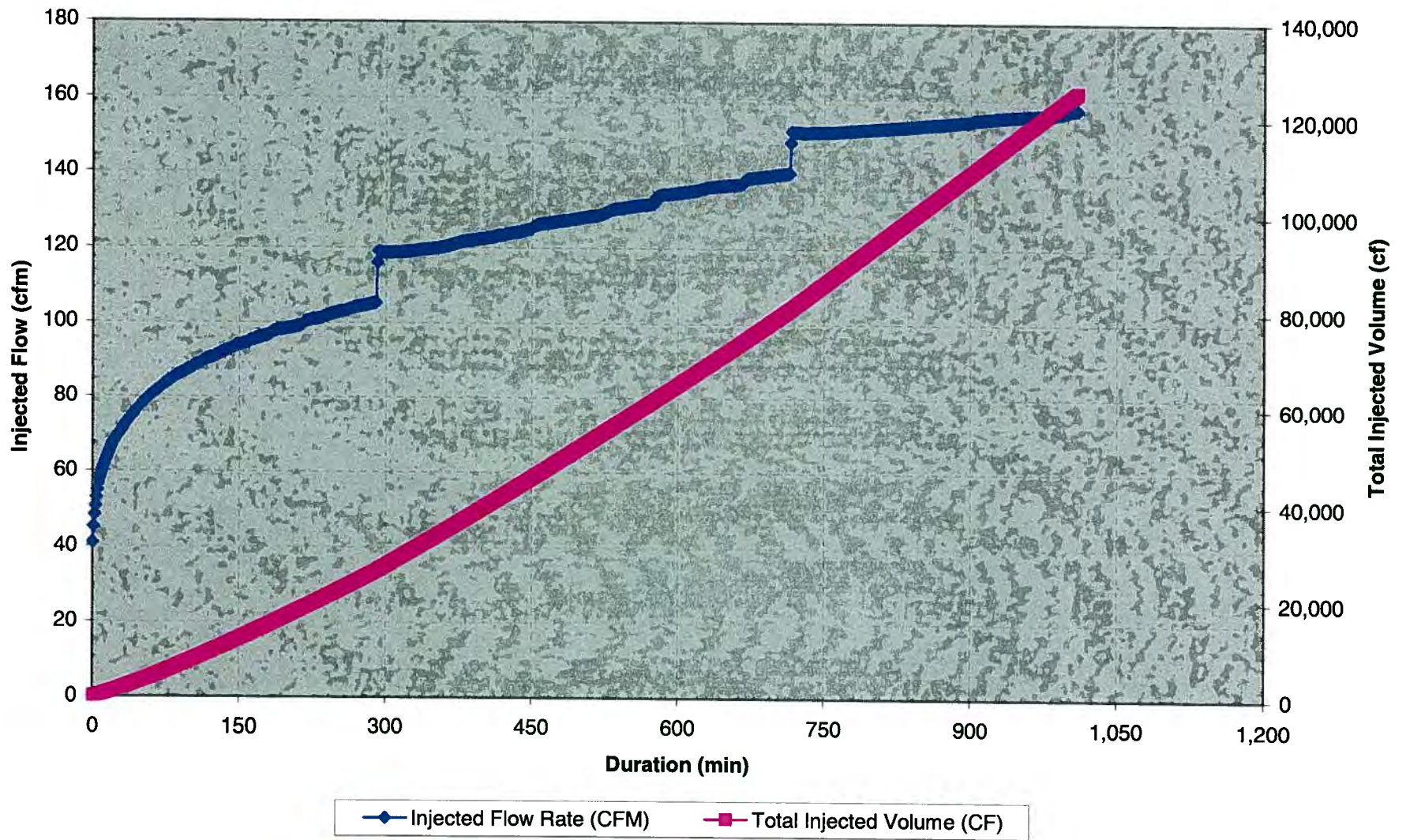
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-7
3/13/2008**



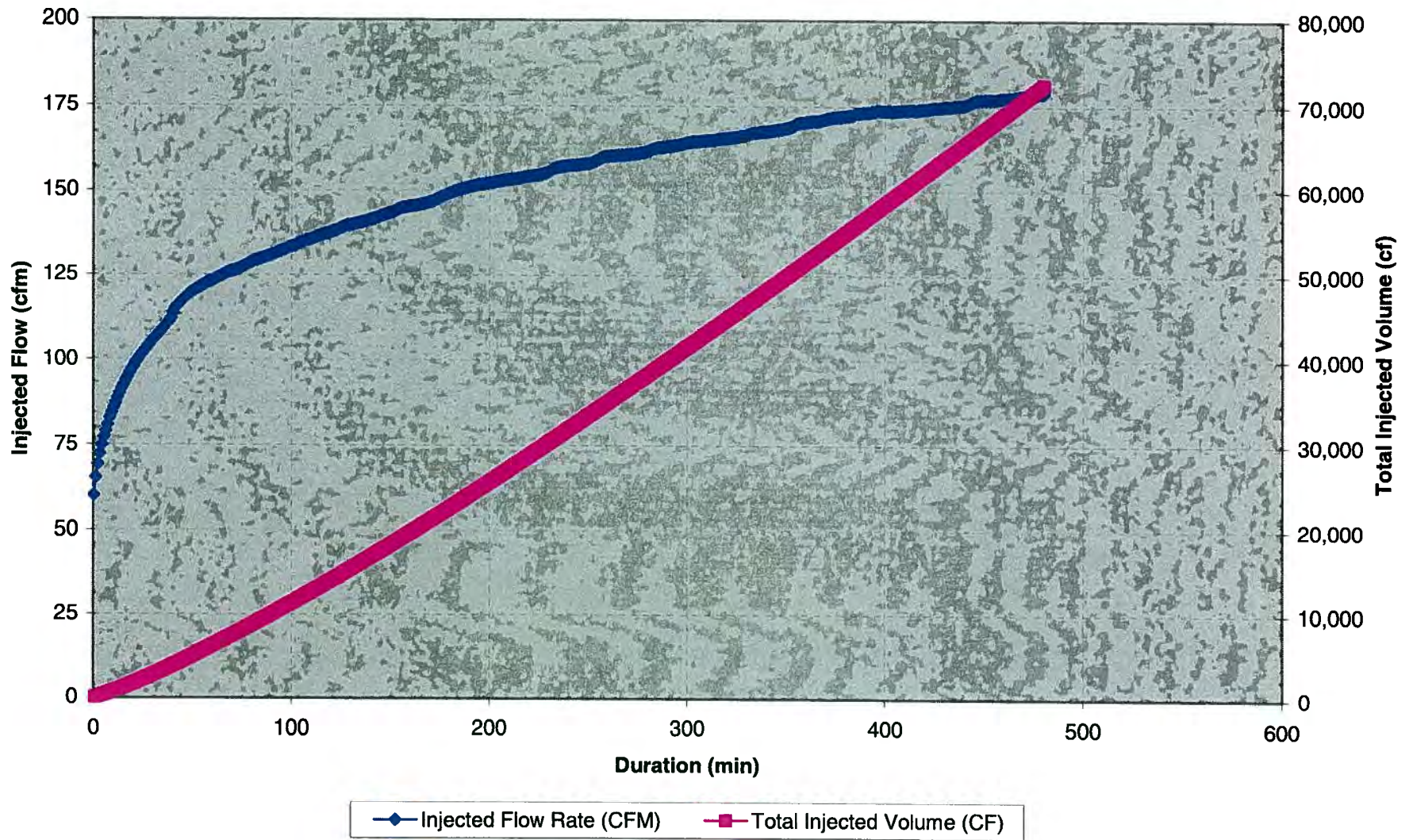
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-8
4/15/2008**



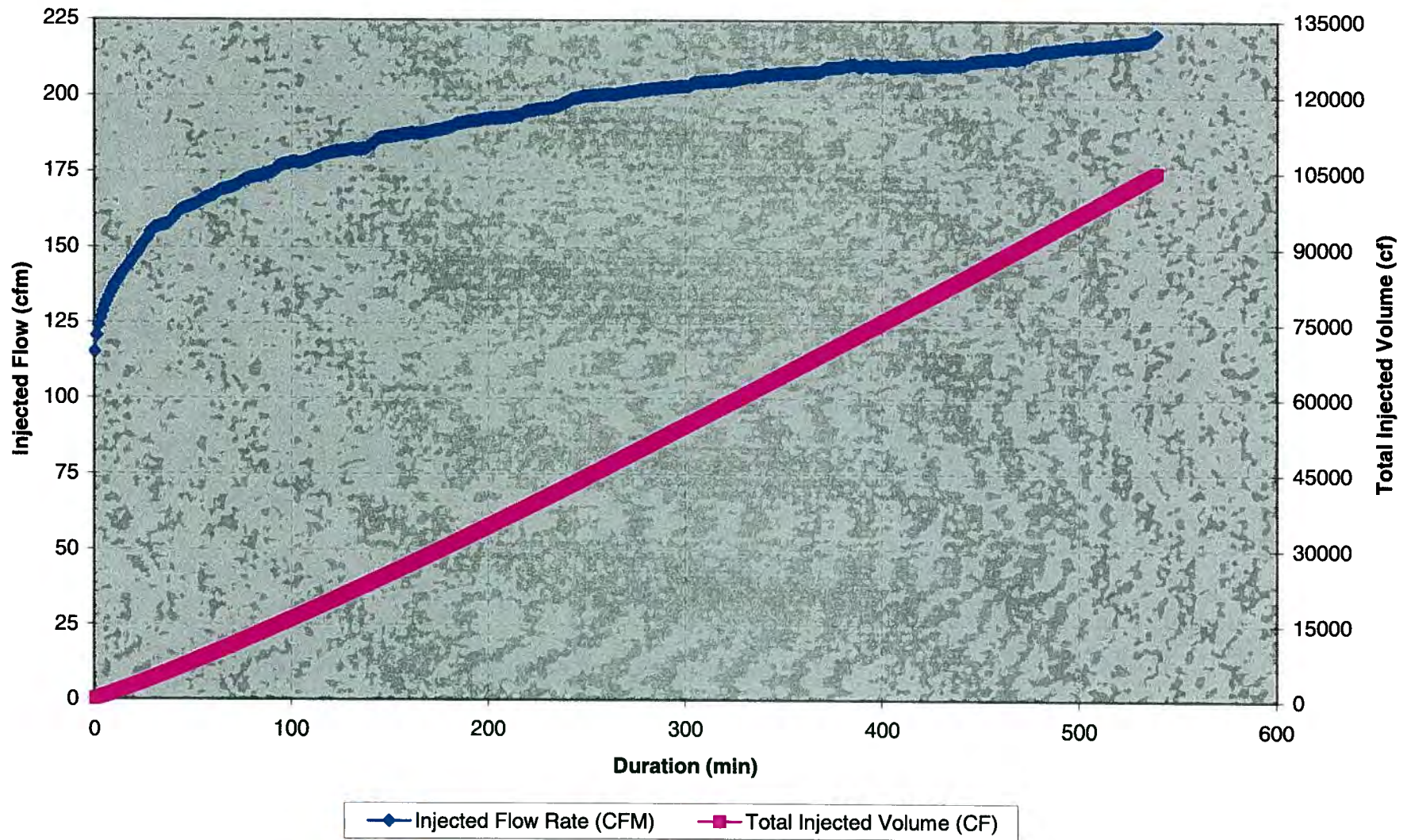
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-9
4/3/2008**



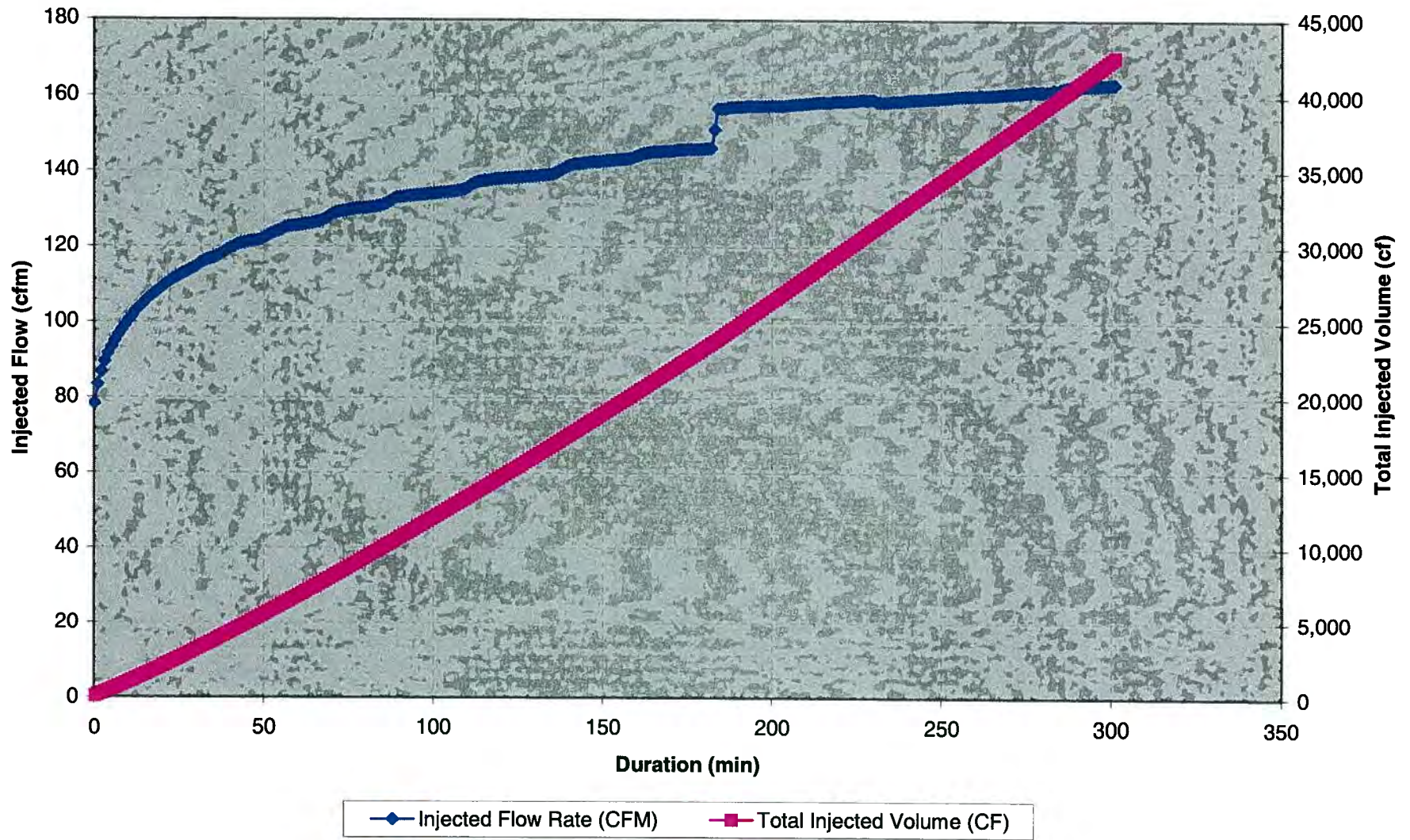
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-10
4/1/2008**



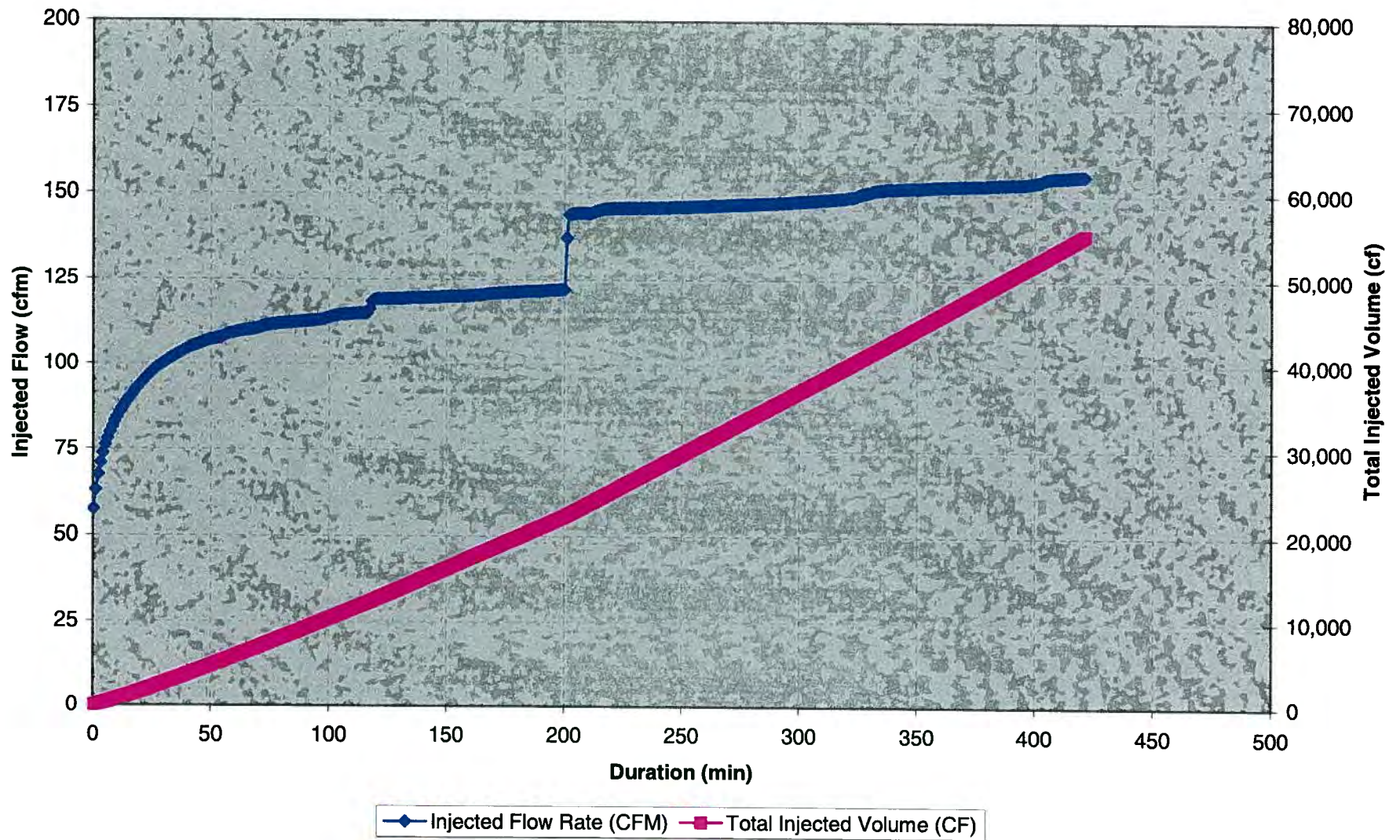
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-11
4/4/2008**



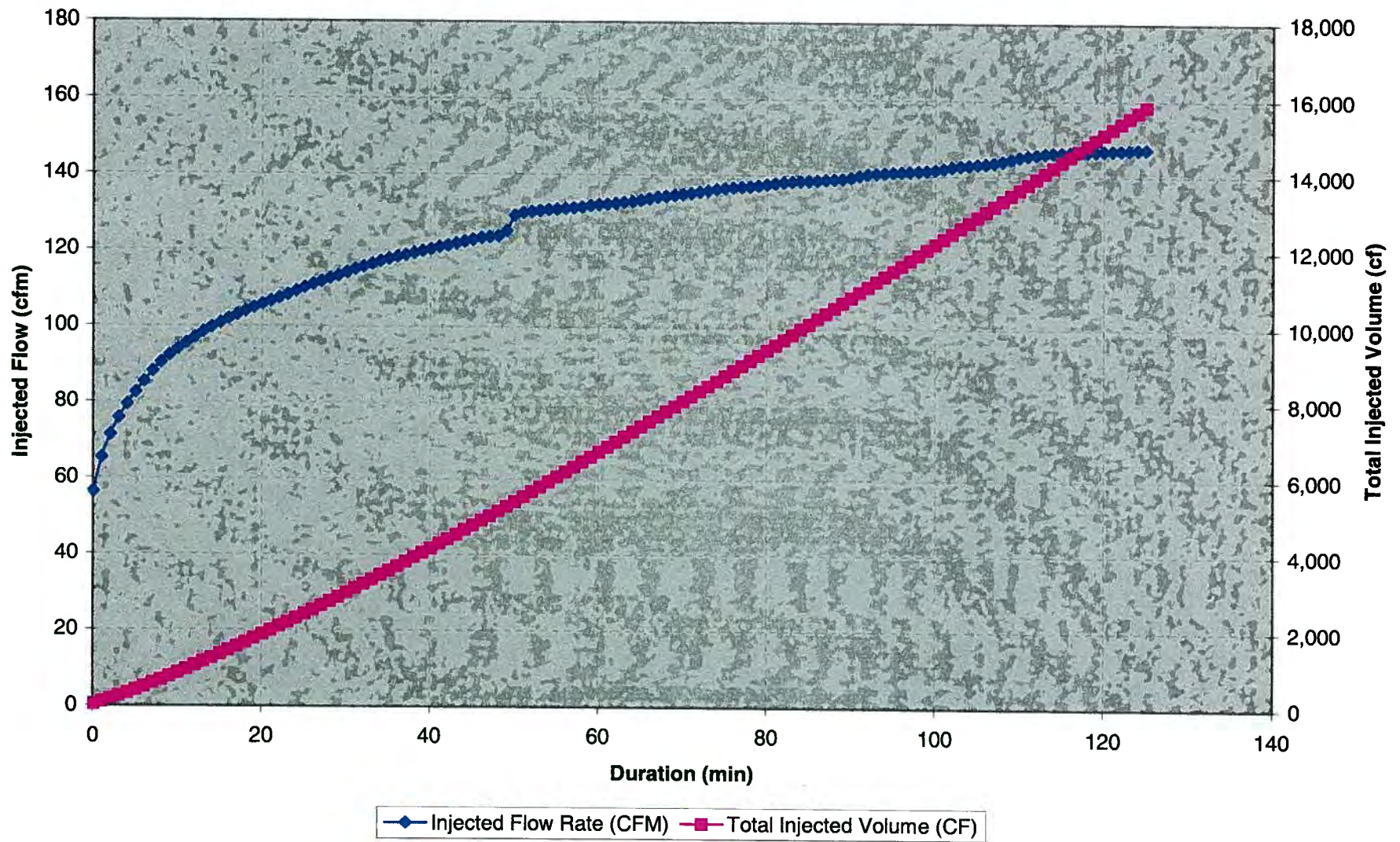
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-12
3/12/2008**



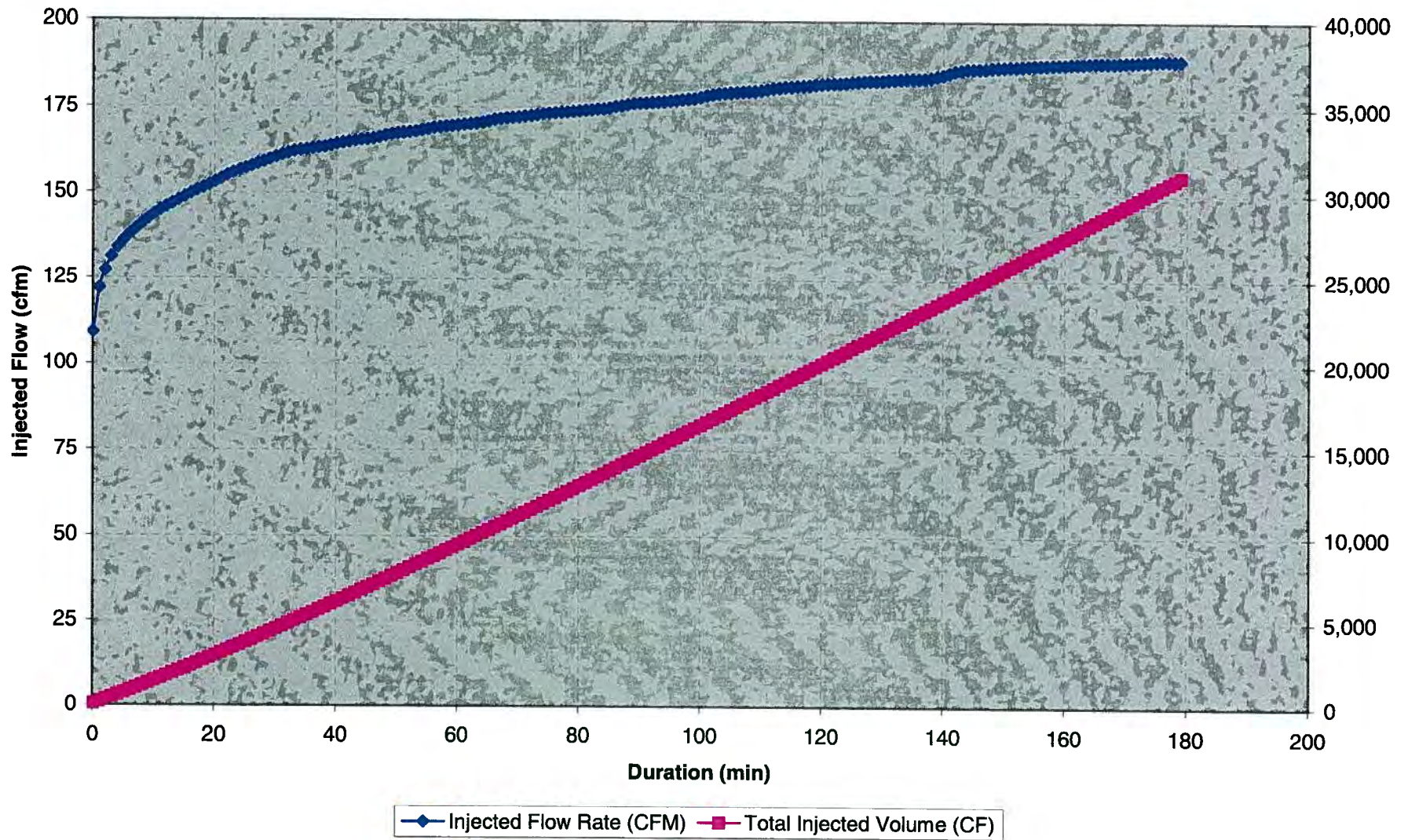
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-13
4/16/2008**



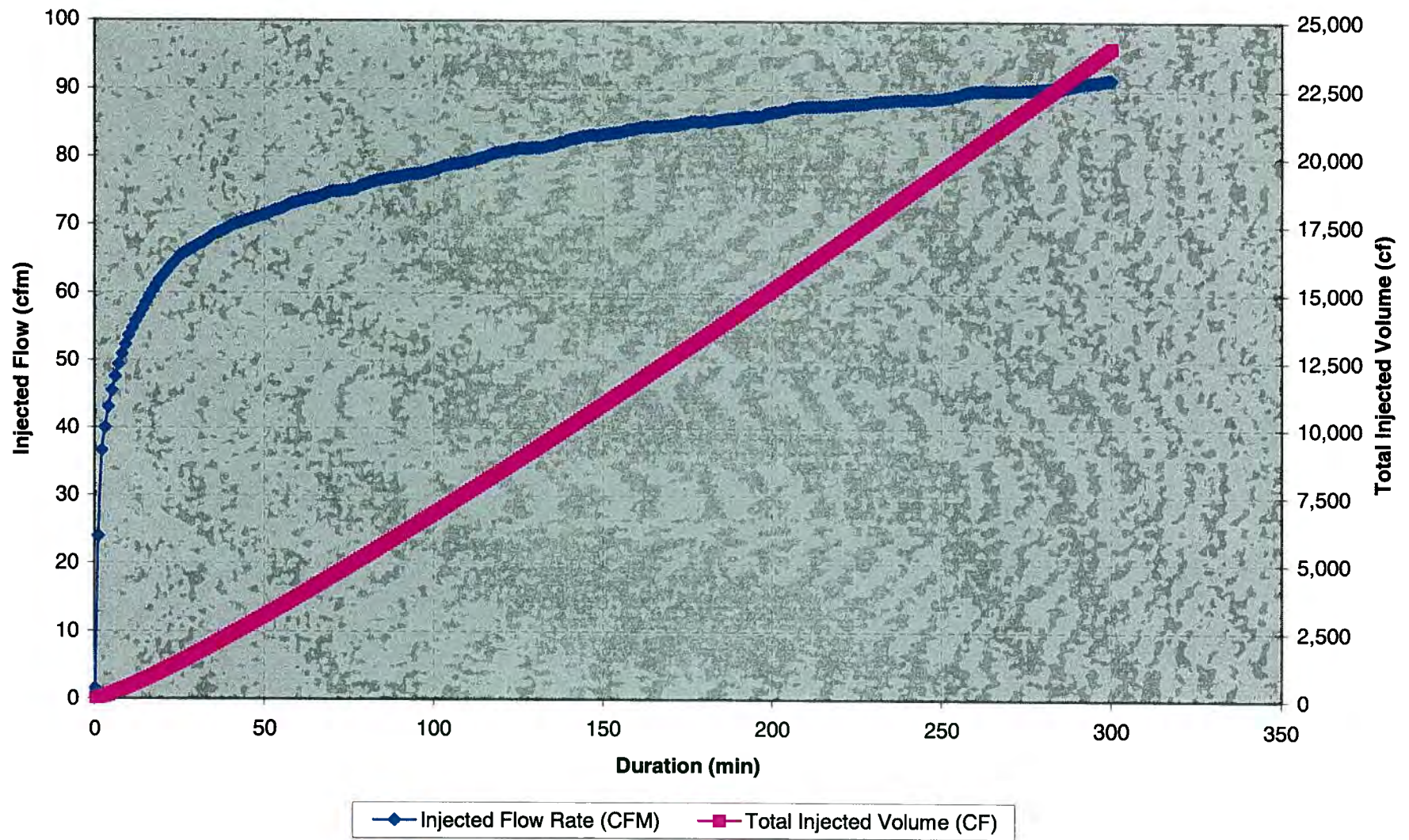
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-14
3/26/2008**



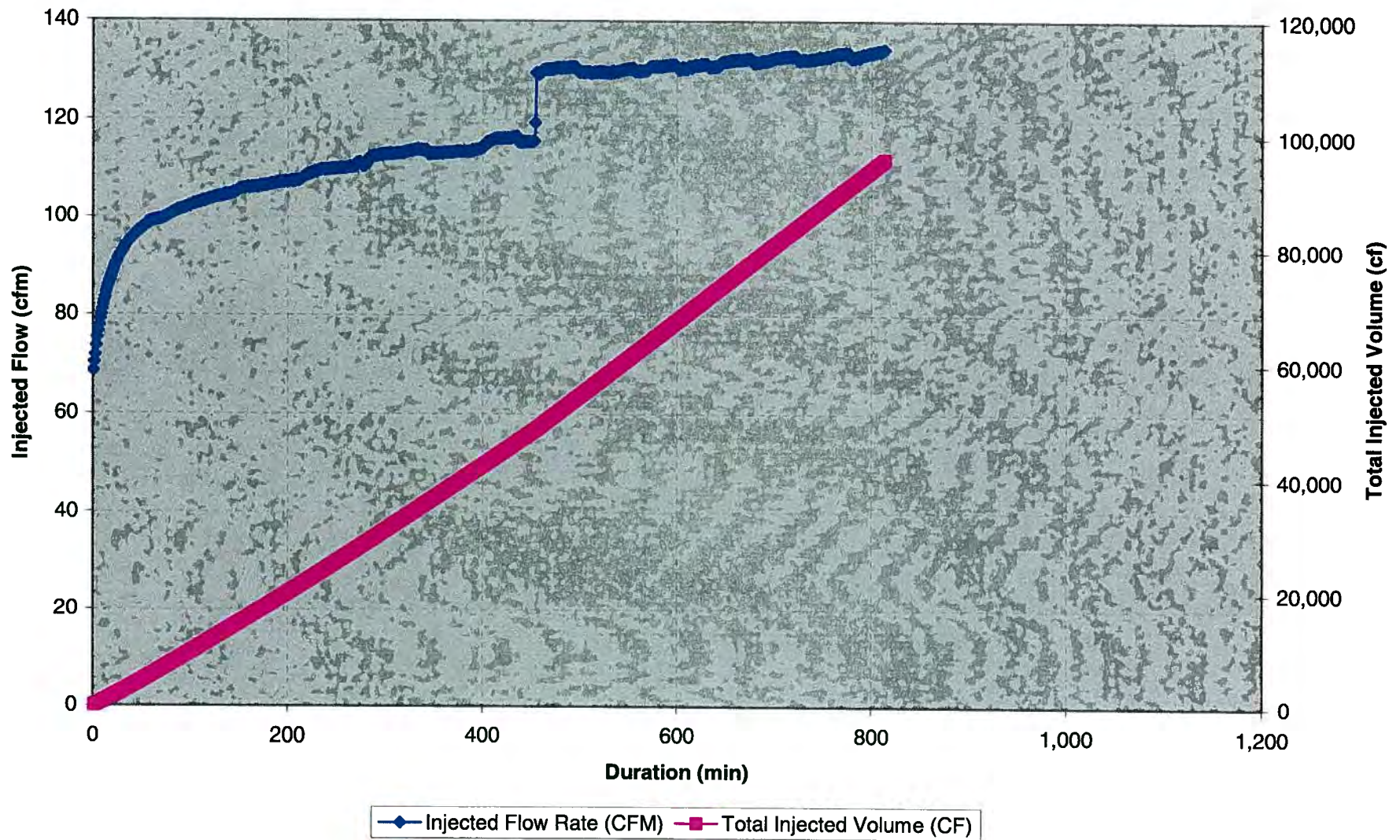
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-15
3/20/2008**



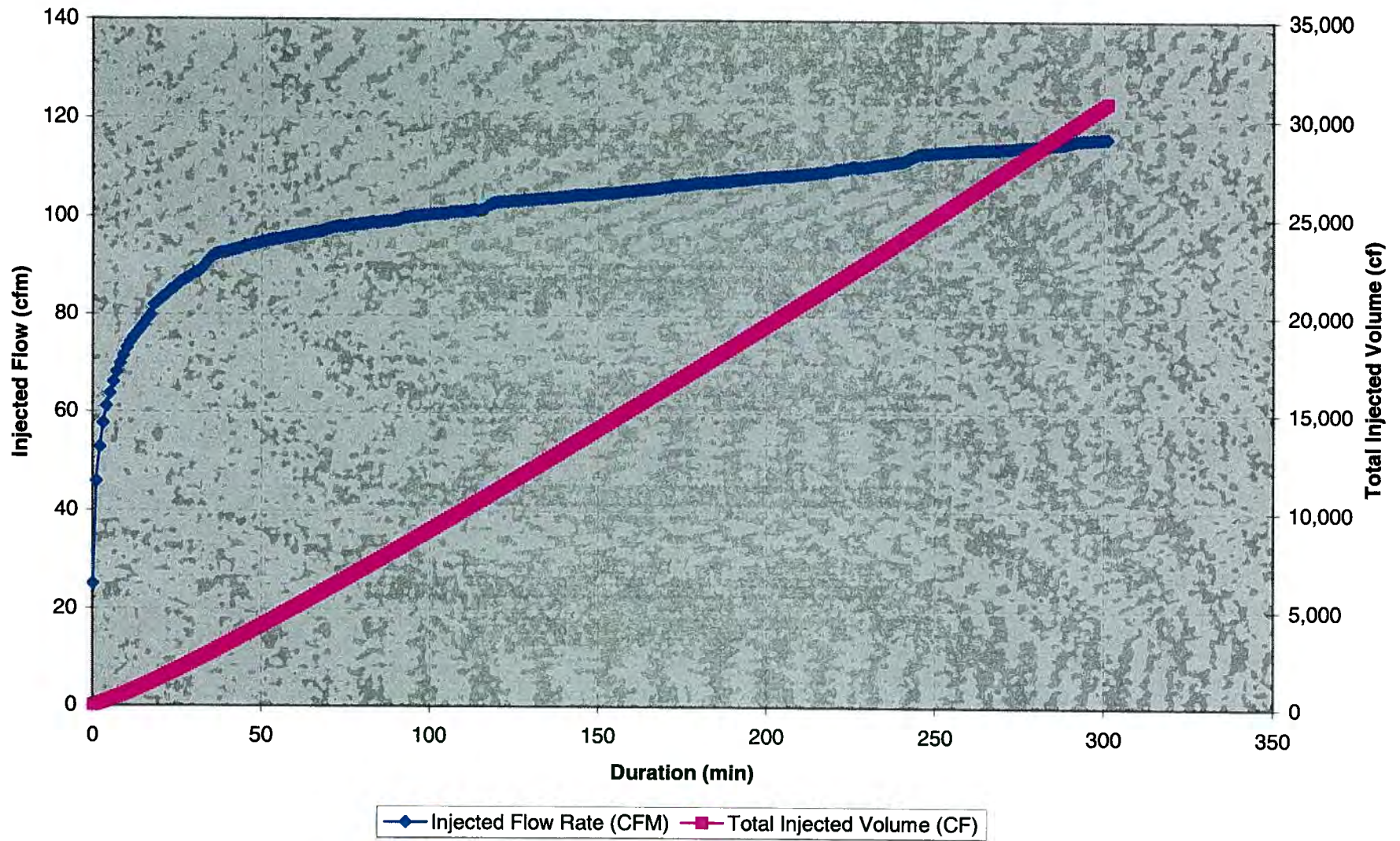
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-16
4/10/2008**



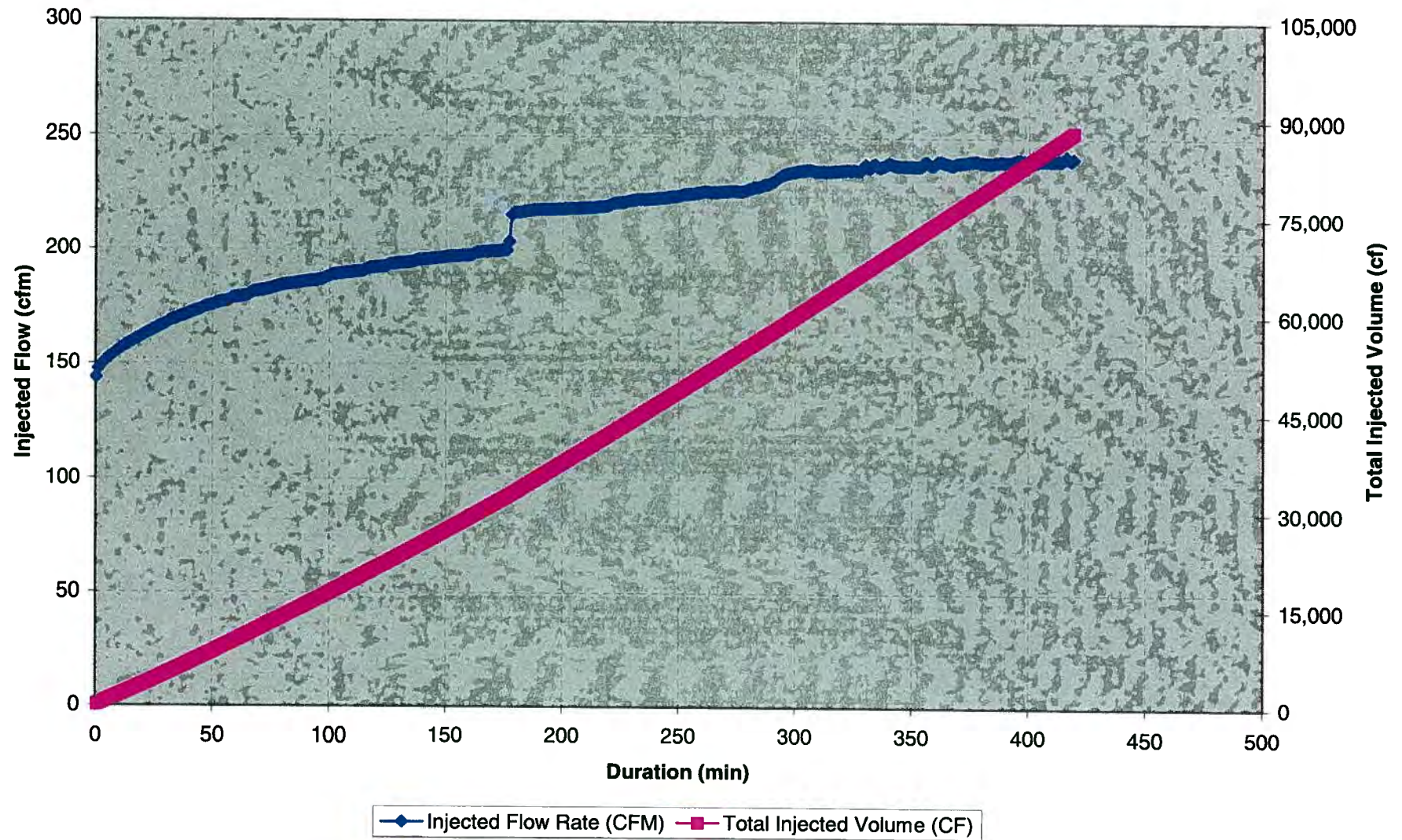
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-17
4/14/2008**



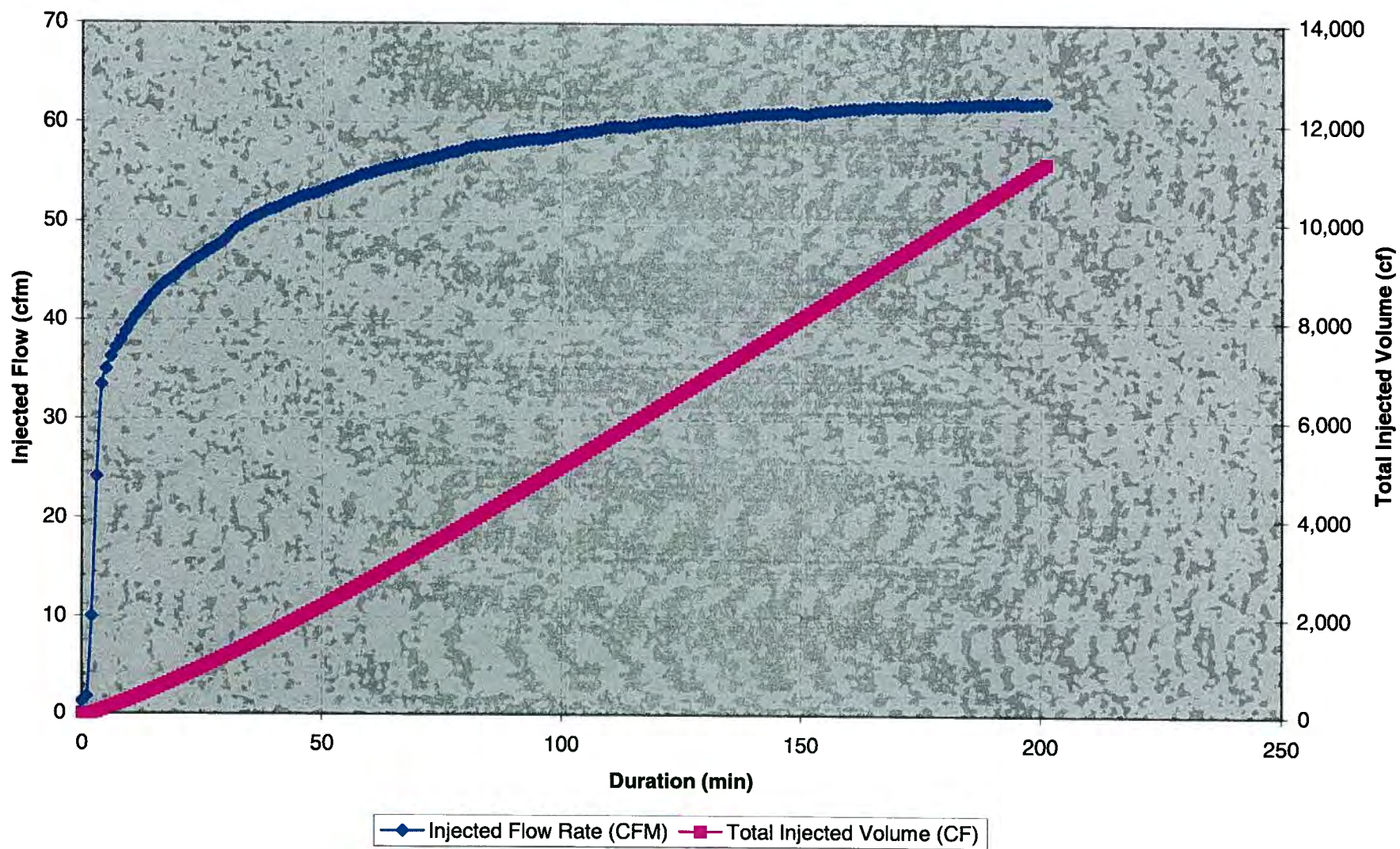
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-18
4/17/2008**



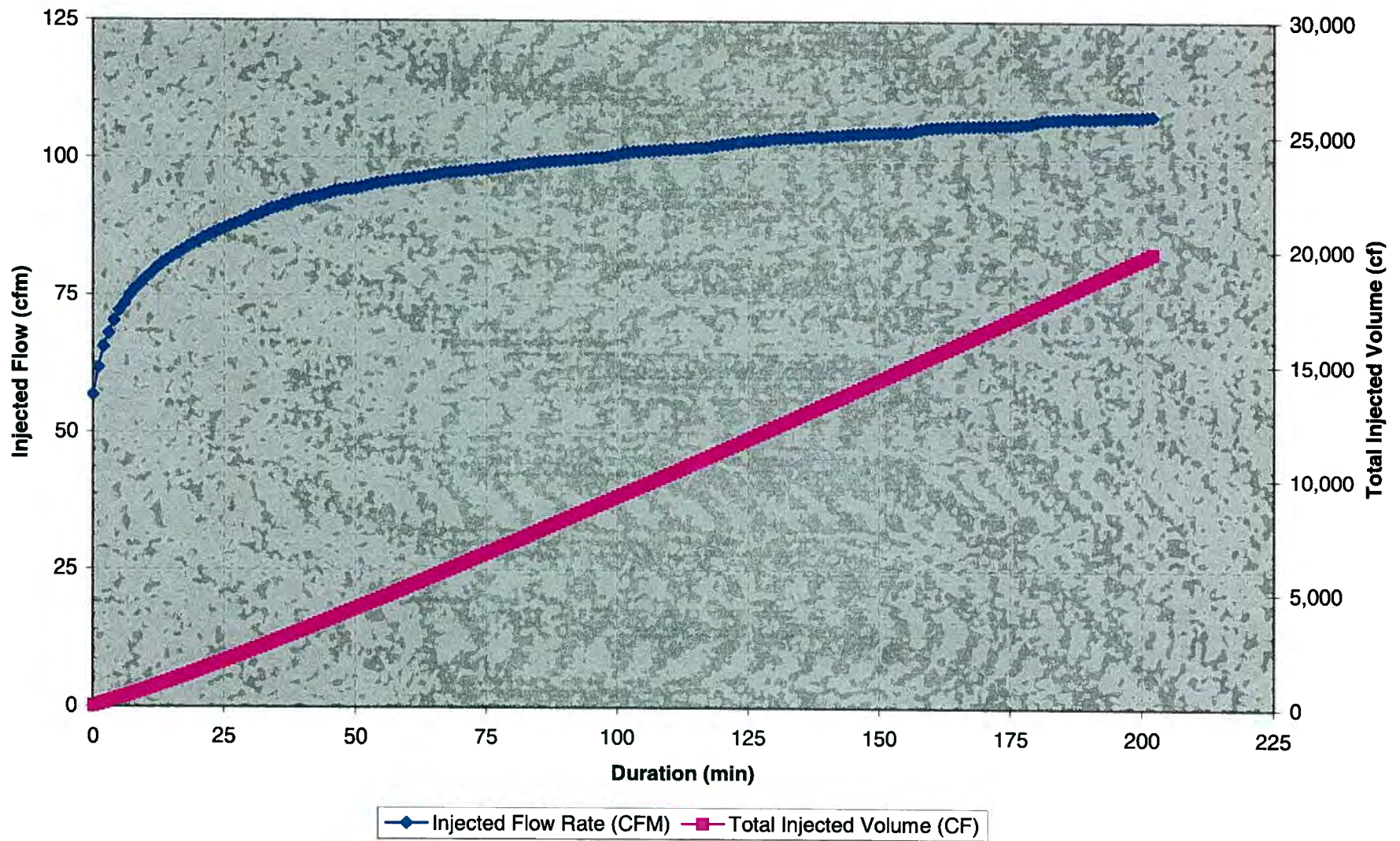
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-19
3/27/2008**



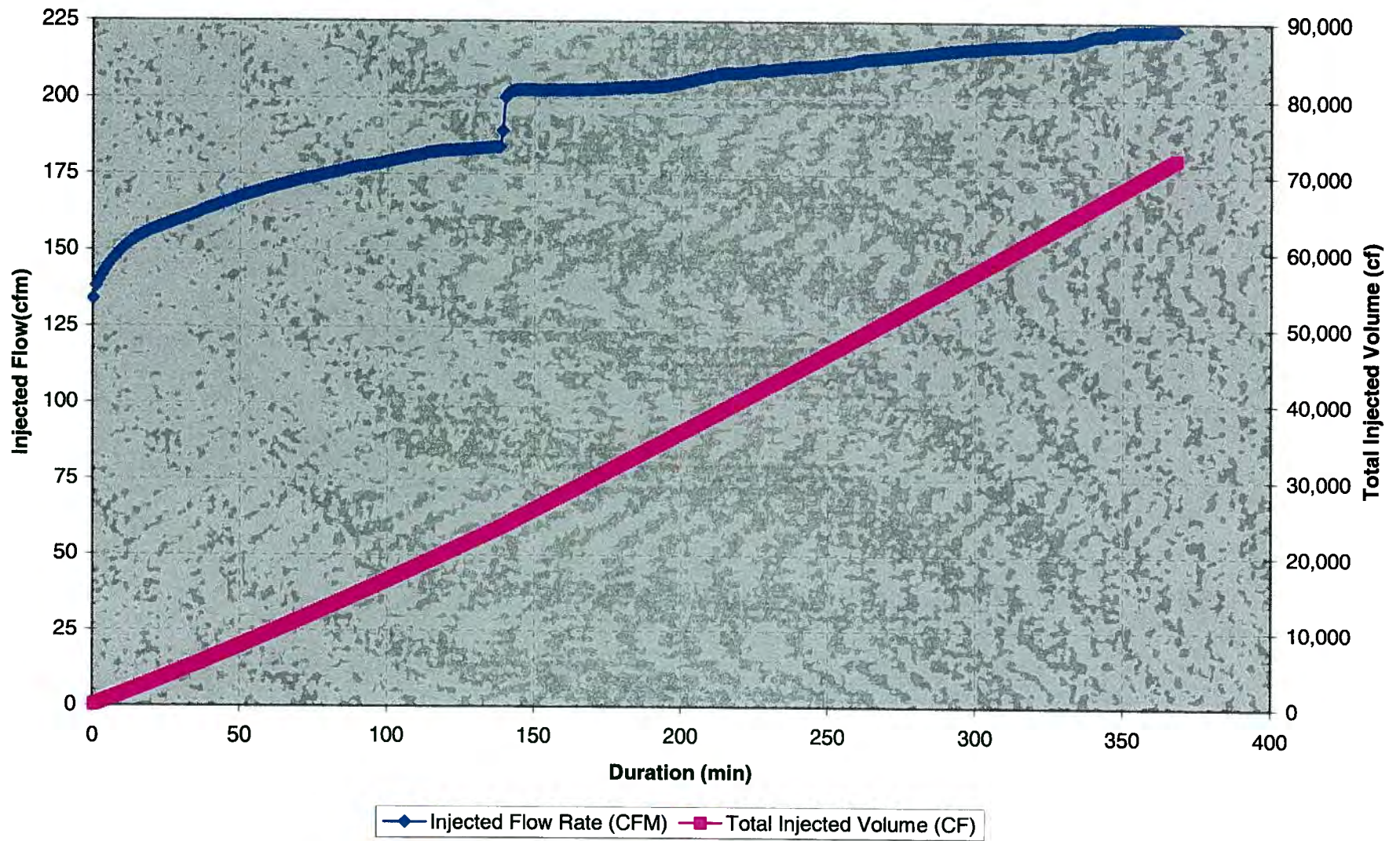
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-20
4/12/2008**



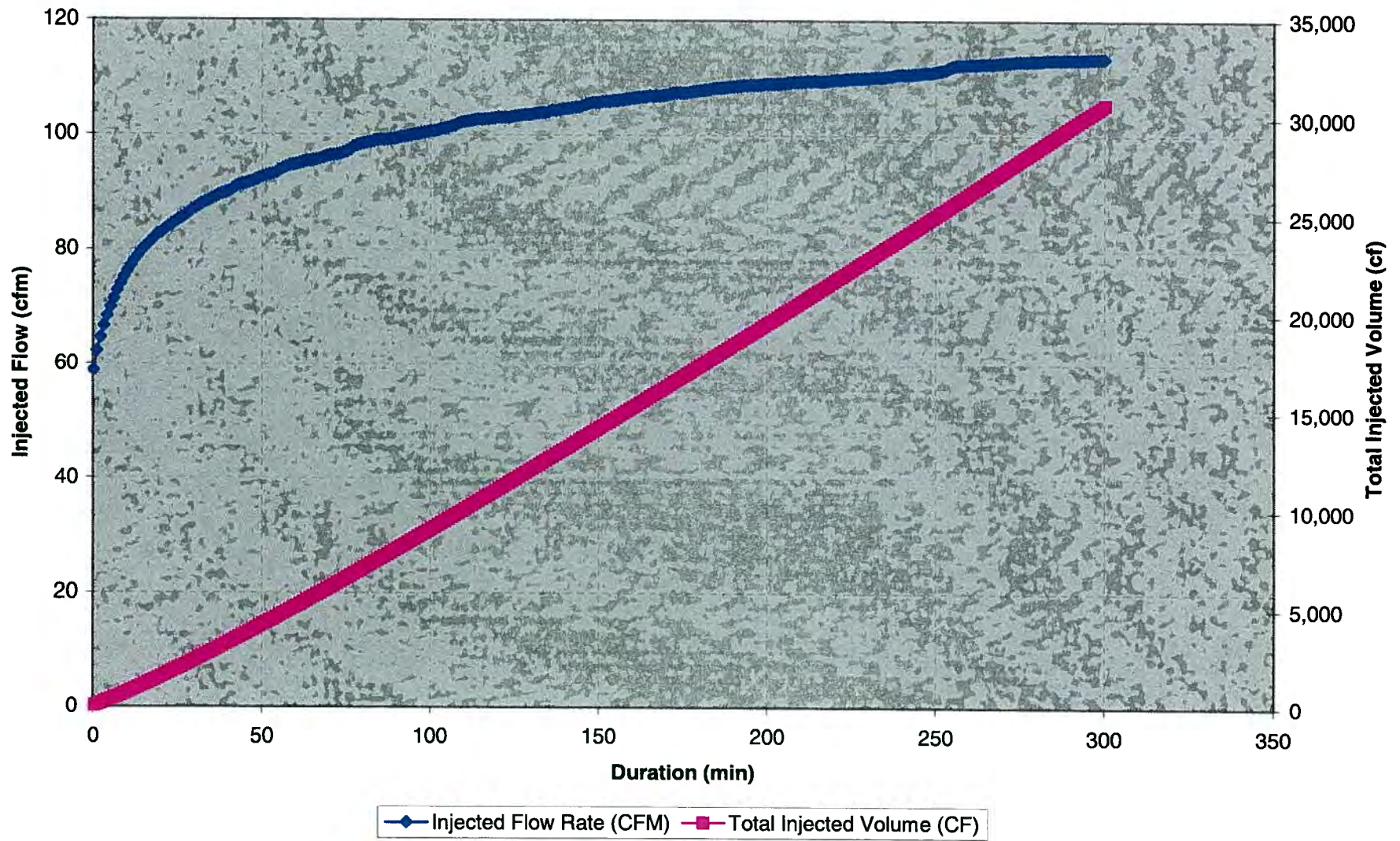
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-21
3/11/2008**



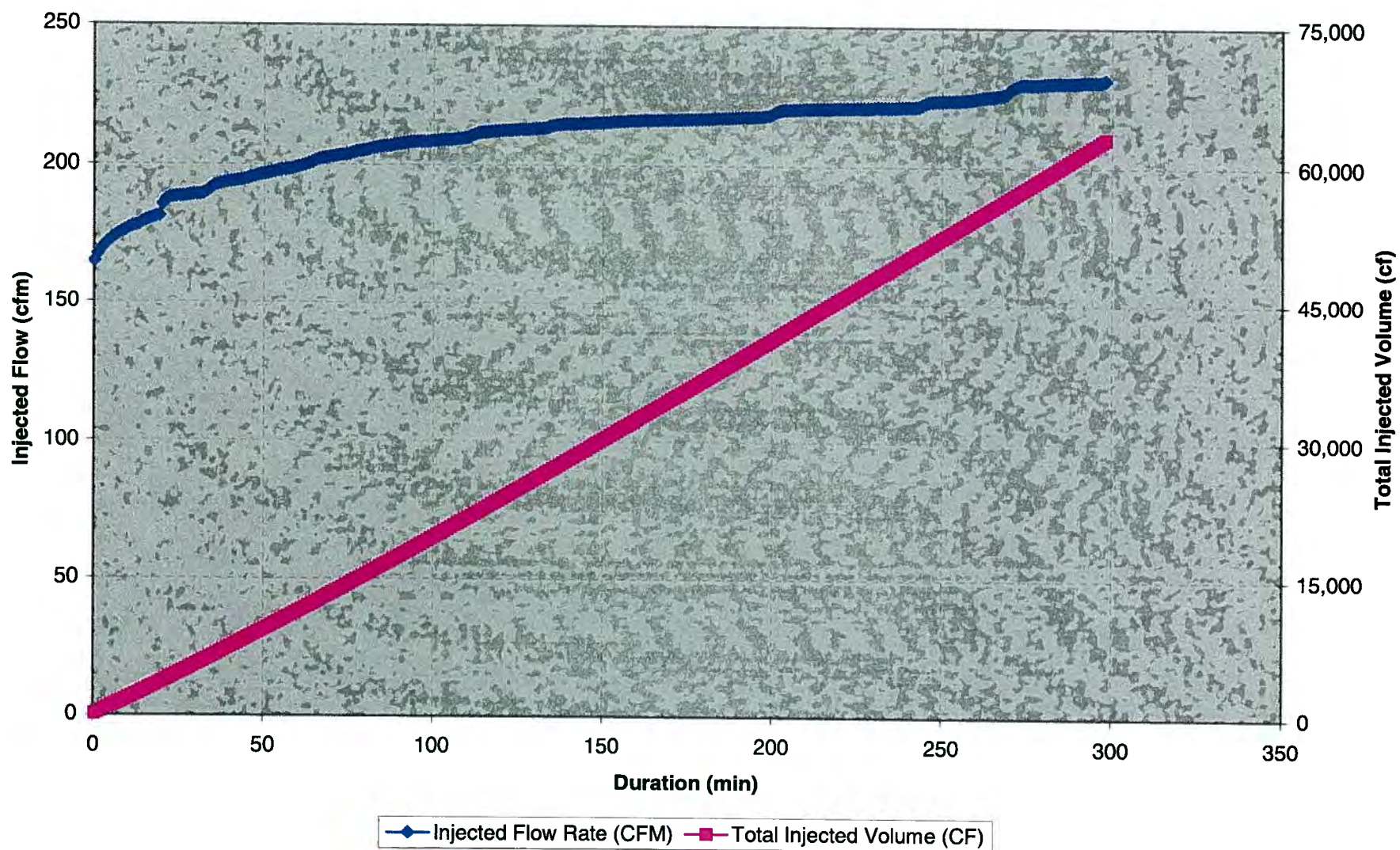
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-22
3/24/2008**



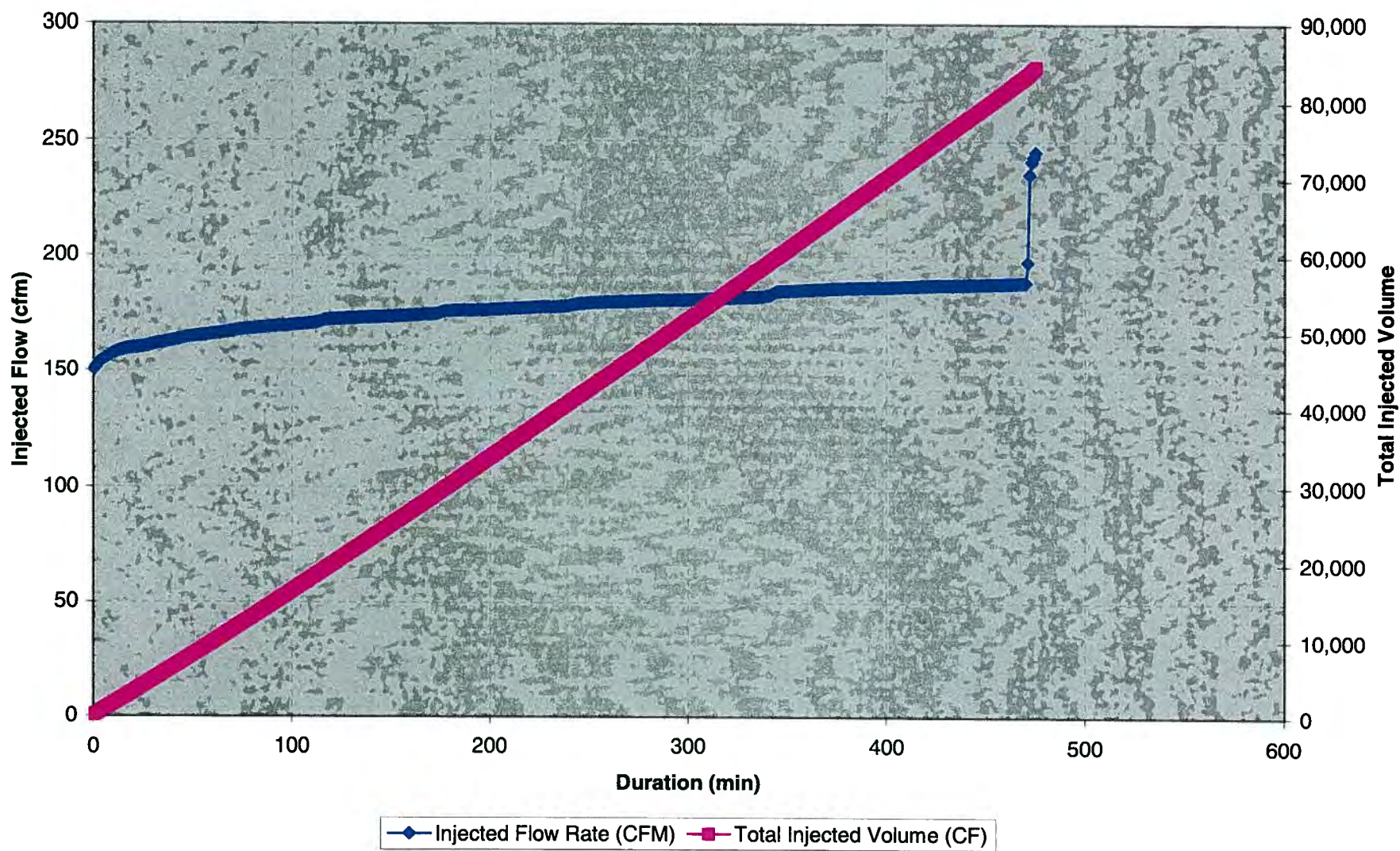
**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-23
4/2/2008**



**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**BP-24
3/14/2008**



**AIR FLOW -vs- TIME GRAPH
SIXTH ROUND OF BIO-PULSE SPARGING**

**SP-100
4/8/2008**

