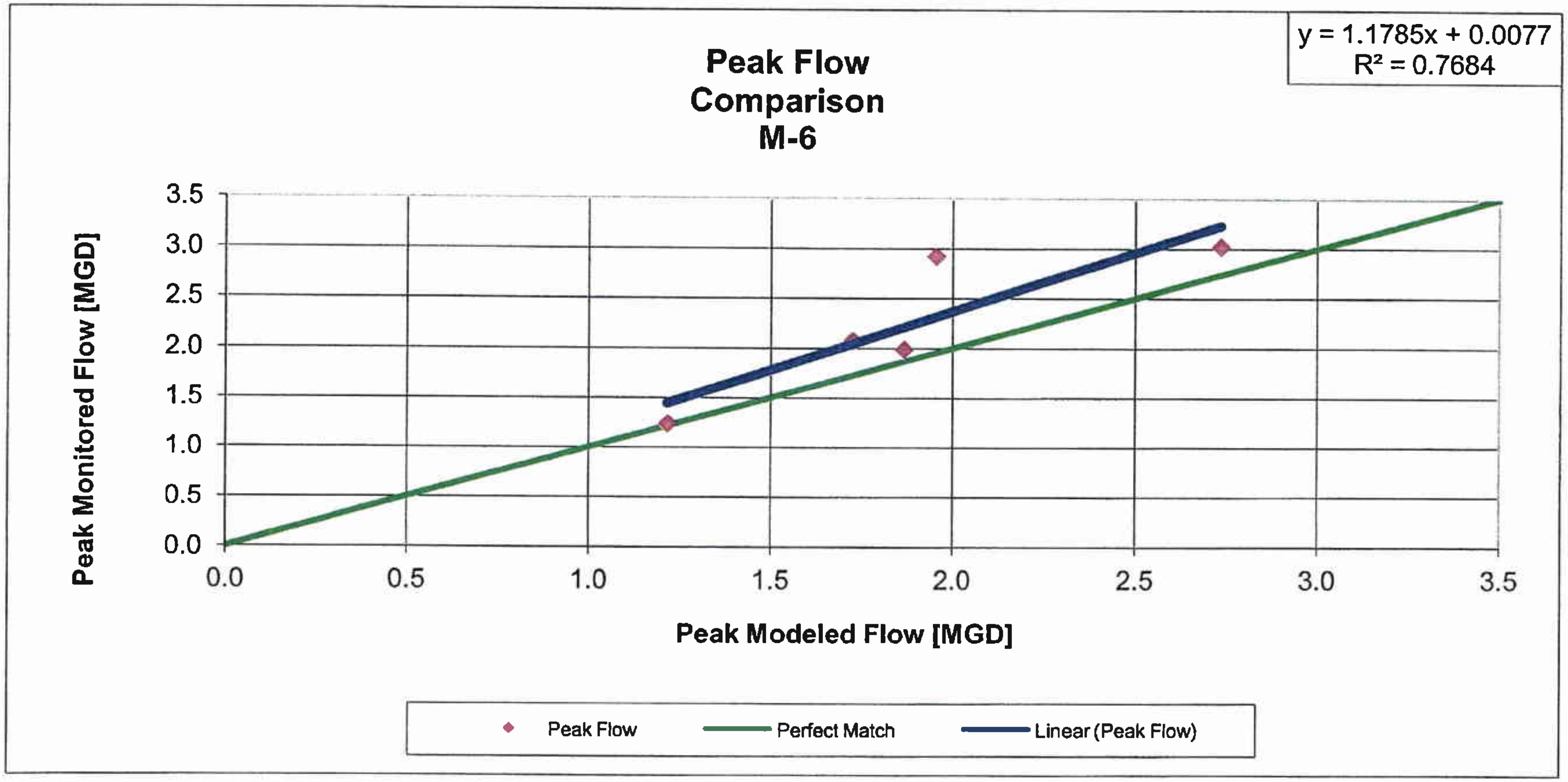
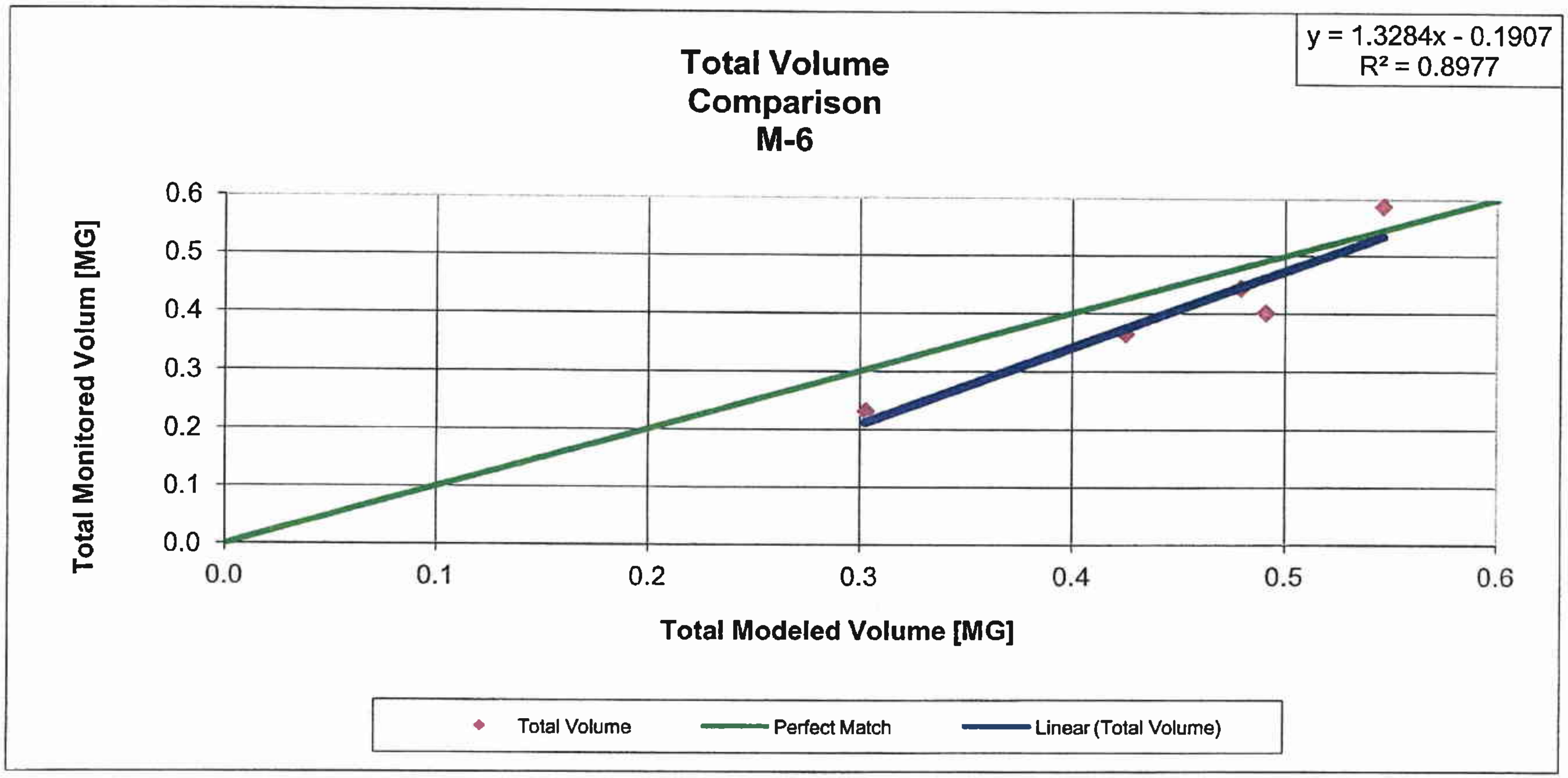
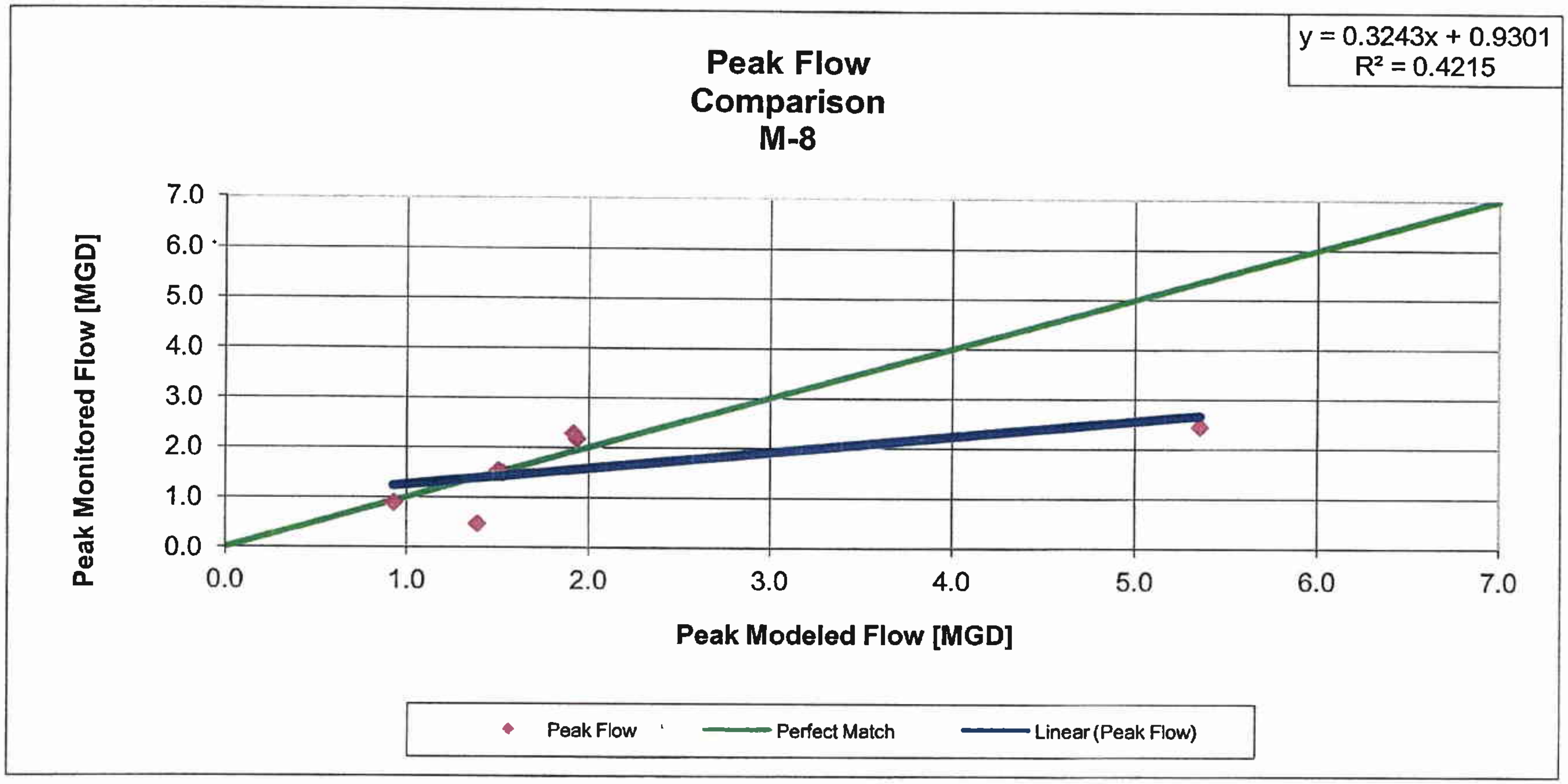


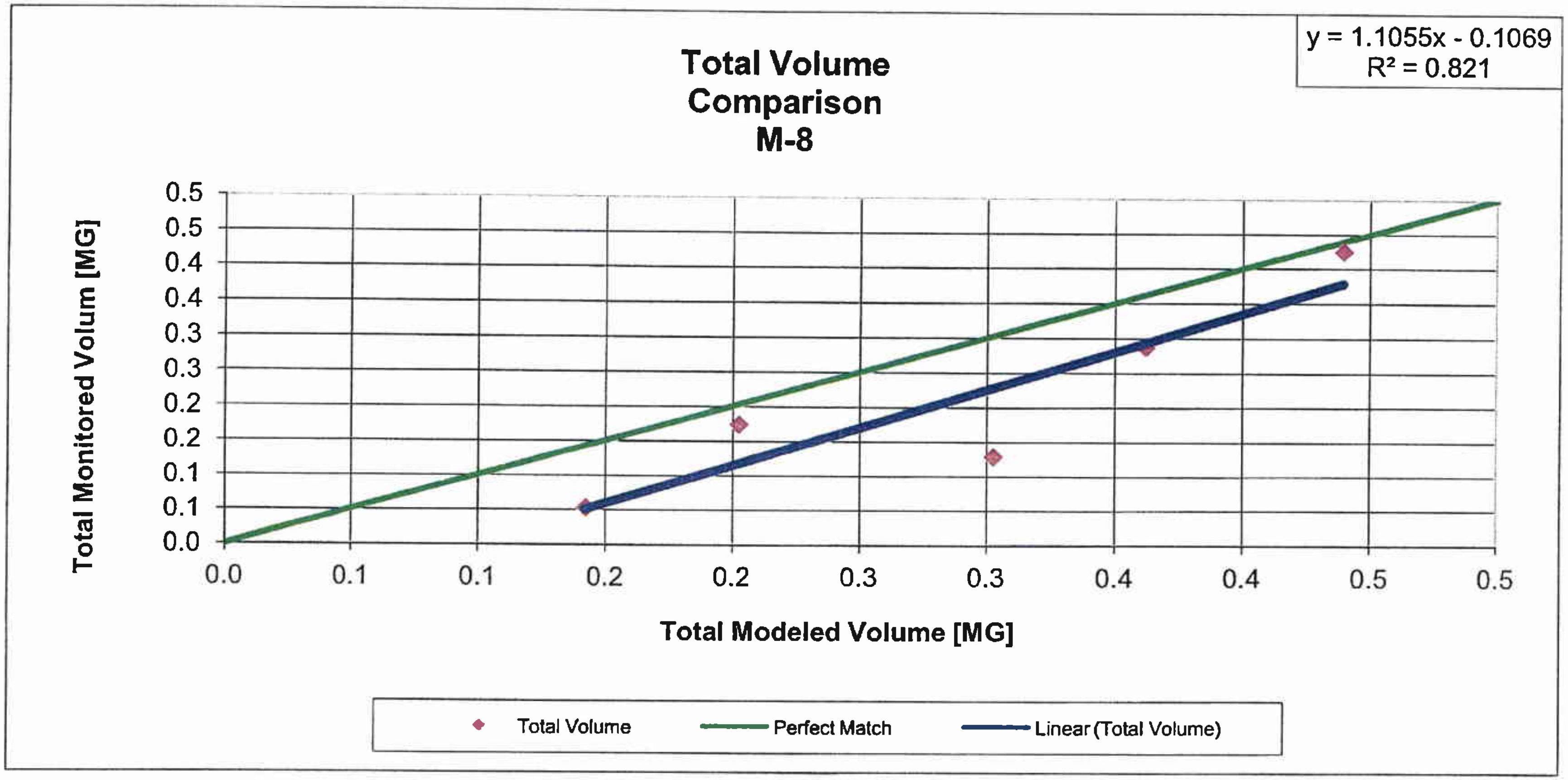
y = 1.1785x + 0.0077
R² = 0.7684
Peak Flow
Comparison
M-6
Peak Monitored Flow [MGD]
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Peak Modeled Flow [MGD]
Peak Flow
Perfect Match
Linear (Peak Flow)



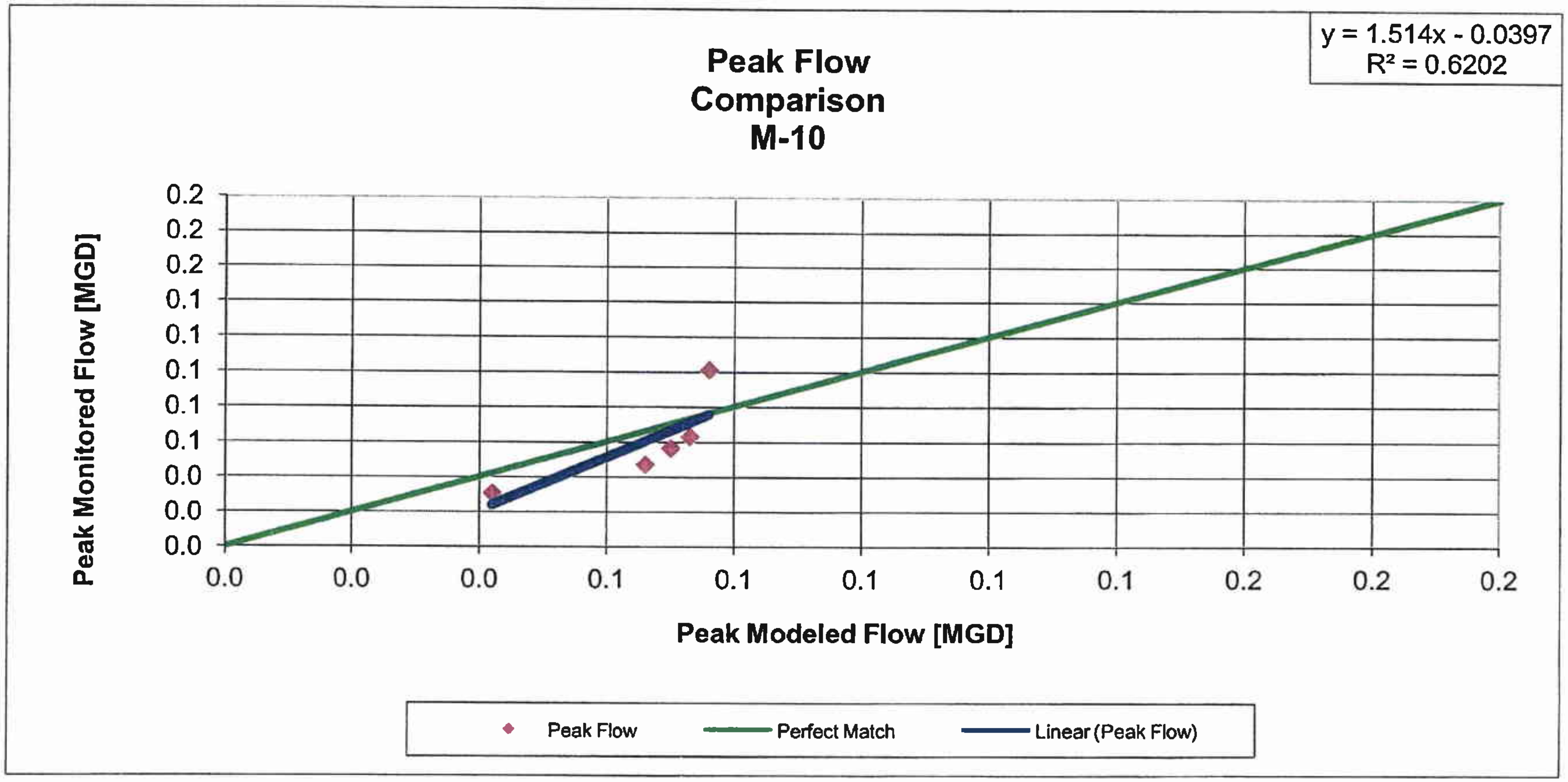
y = 1.3284x - 0.1907
R² = 0.8977
Total Volume
Comparison
M-6
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Total Monitored Volum [MG]
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Total Modeled Volume [MG]
Total Volume
Perfect Match
Linear (Total Volume)



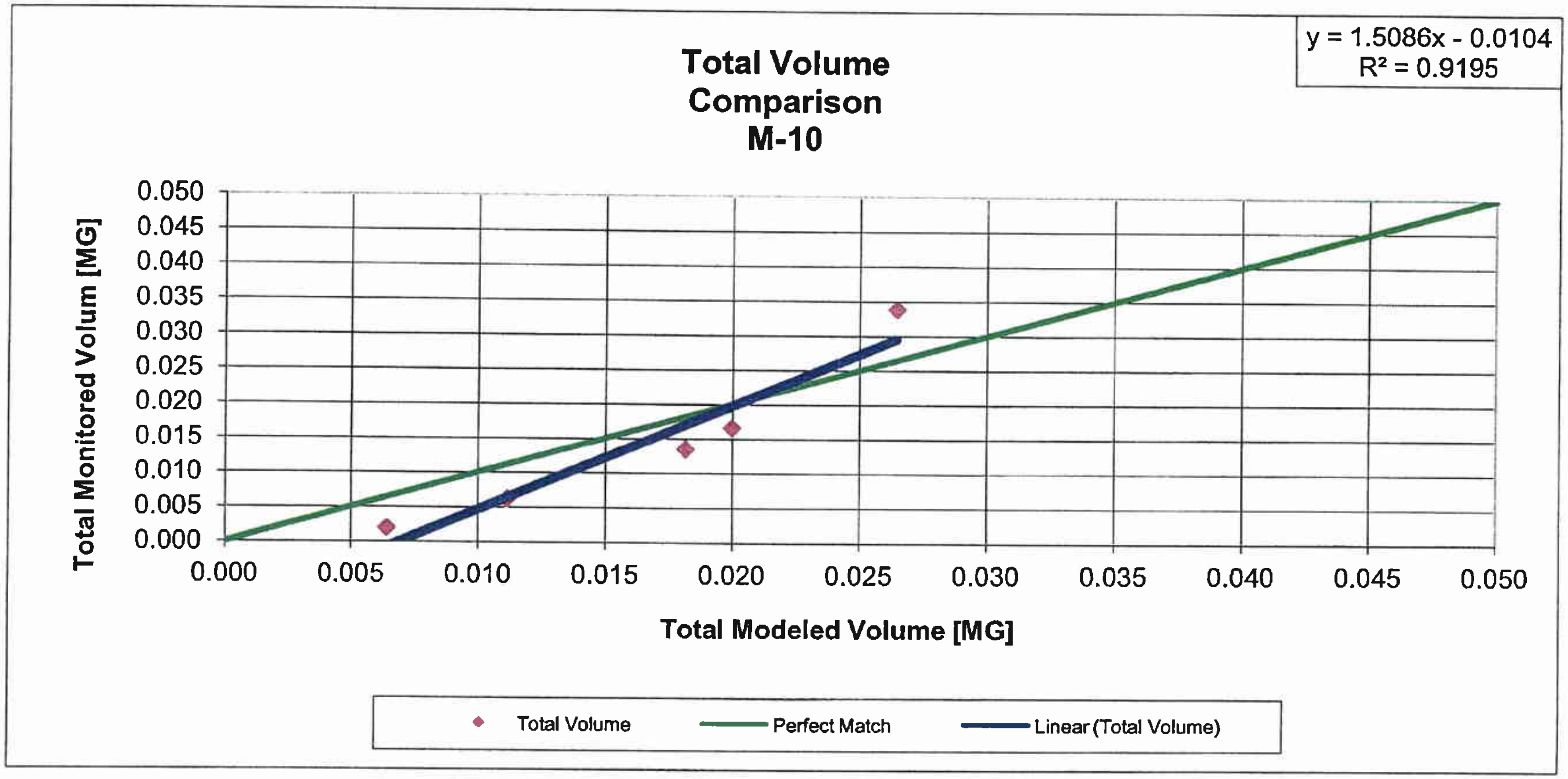
y = 0.3243x + 0.9301
R² = 0.4215
Peak Flow
Comparison
M-8
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Peak Monitored Flow [MGD]
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
Peak Modeled Flow [MGD]
Peak Flow
Perfect Match
Linear (Peak Flow)

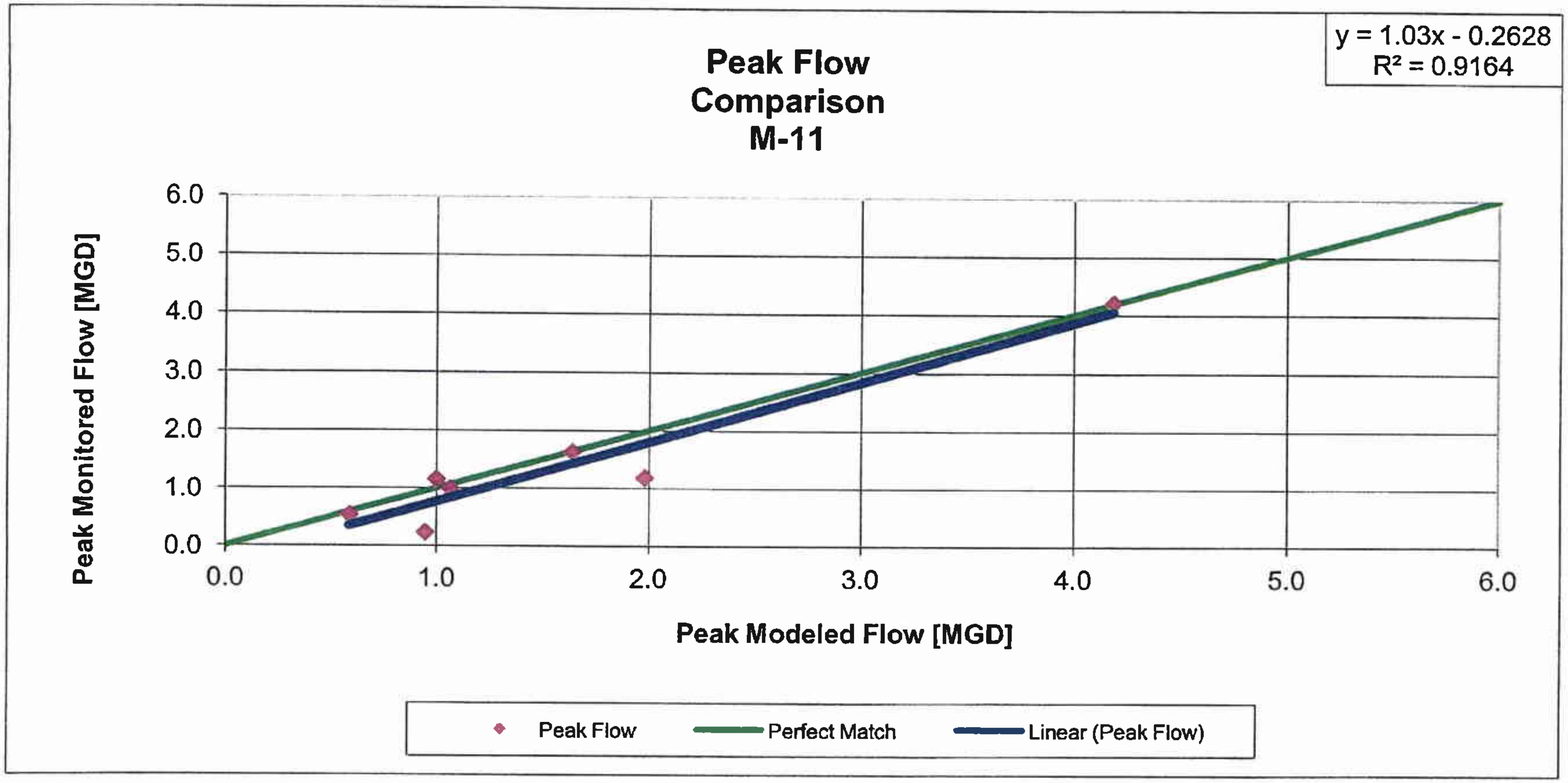


Total Volume
Comparison
M-8
y = 1.1055x - 0.1069
R² = 0.821
Total Monitored Volum [MG]
0.5
0.5
0.4
0.4
0.3
0.3
0.2
0.2
0.1
0.1
0.0
0.0
0.1
0.1
0.2
0.2
0.3
0.3
0.4
0.4
0.5
0.5
Total Modeled Volume [MG]
Total Volume
Perfect Match
Linear (Total Volume)

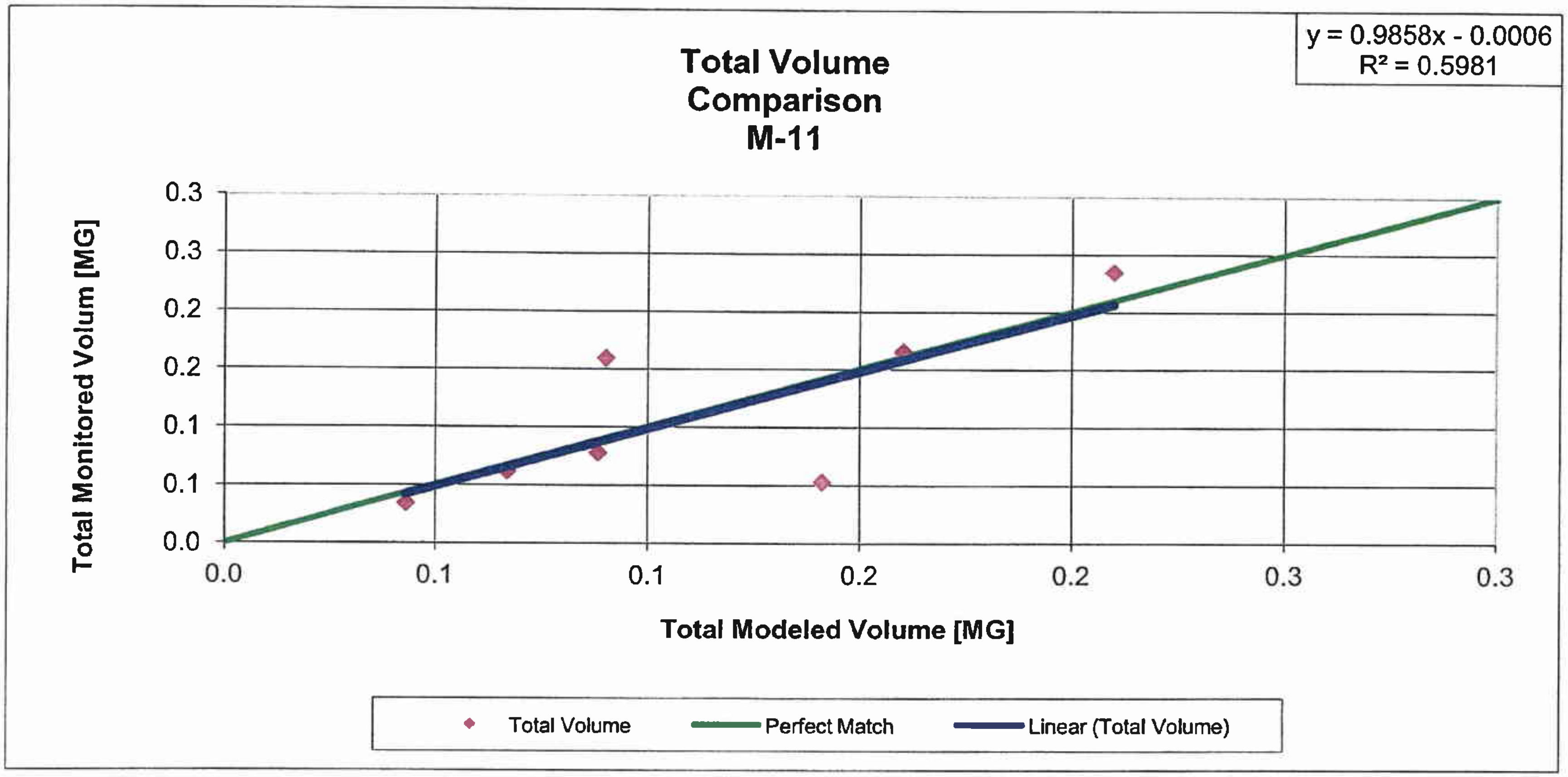


y = 1.514x - 0.0397
R² = 0.6202
Peak Flow
Comparison
M-10
Peak Monitored Flow [MGD]
0.2
0.2
0.2
0.1
0.1
0.1
0.1
0.1
0.0
0.0
0.0
0.0
0.0
0.0
0.1
0.1
0.1
0.1
0.1
0.2
0.2
0.2
Peak Modeled Flow [MGD]
Peak Flow
Perfect Match
Linear (Peak Flow)


y = 1.5086x - 0.0104
R² = 0.9195
Total Volume
Comparison
M-10
Total Monitored Volum [MG]
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0.000
0.005
0.010
0.015
0.020
0.025
0.030
0.035
0.040
0.045
0.050
Total Modeled Volume [MG]
Total Volume
Perfect Match
Linear (Total Volume)



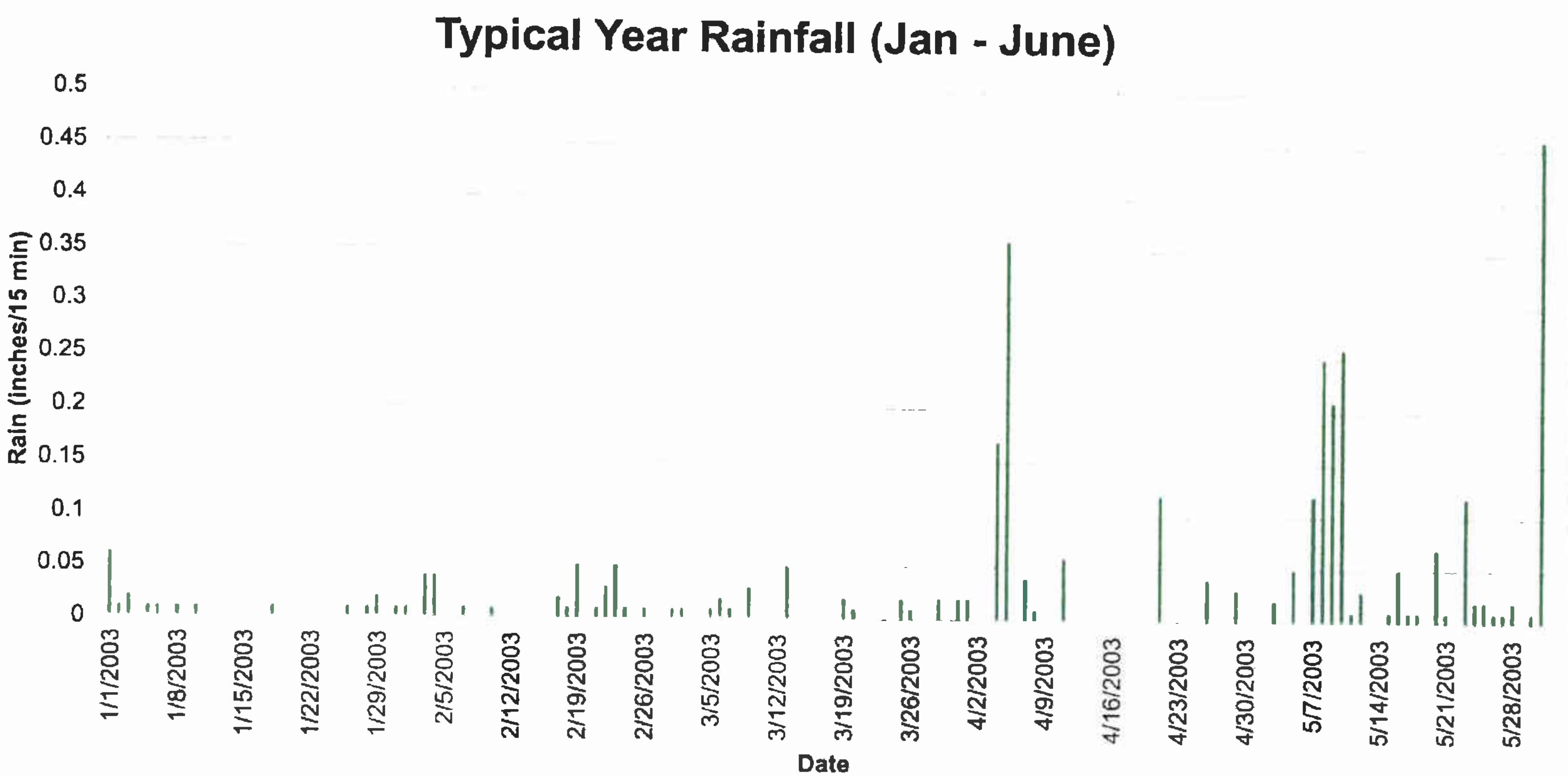
y = 1.03x - 0.2628
R² = 0.9164
Peak Flow
Comparison
M-11
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Peak Monitored Flow [MGD]
0.0
1.0
2.0
3.0
4.0
5.0
6.0
Peak Modeled Flow [MGD]
Peak Flow
Perfect Match
Linear (Peak Flow)



y = 0.9858x - 0.0006
R² = 0.5981
Total Volume
Comparison
M-11
0.3
0.3
0.2
0.2
0.1
0.1
0.0
Total Monitored Volum [MG]
0.0
0.1
0.1
0.2
0.2
0.3
0.3
Total Modeled Volume [MG]
Total Volume
Perfect Match
Linear (Total Volume)

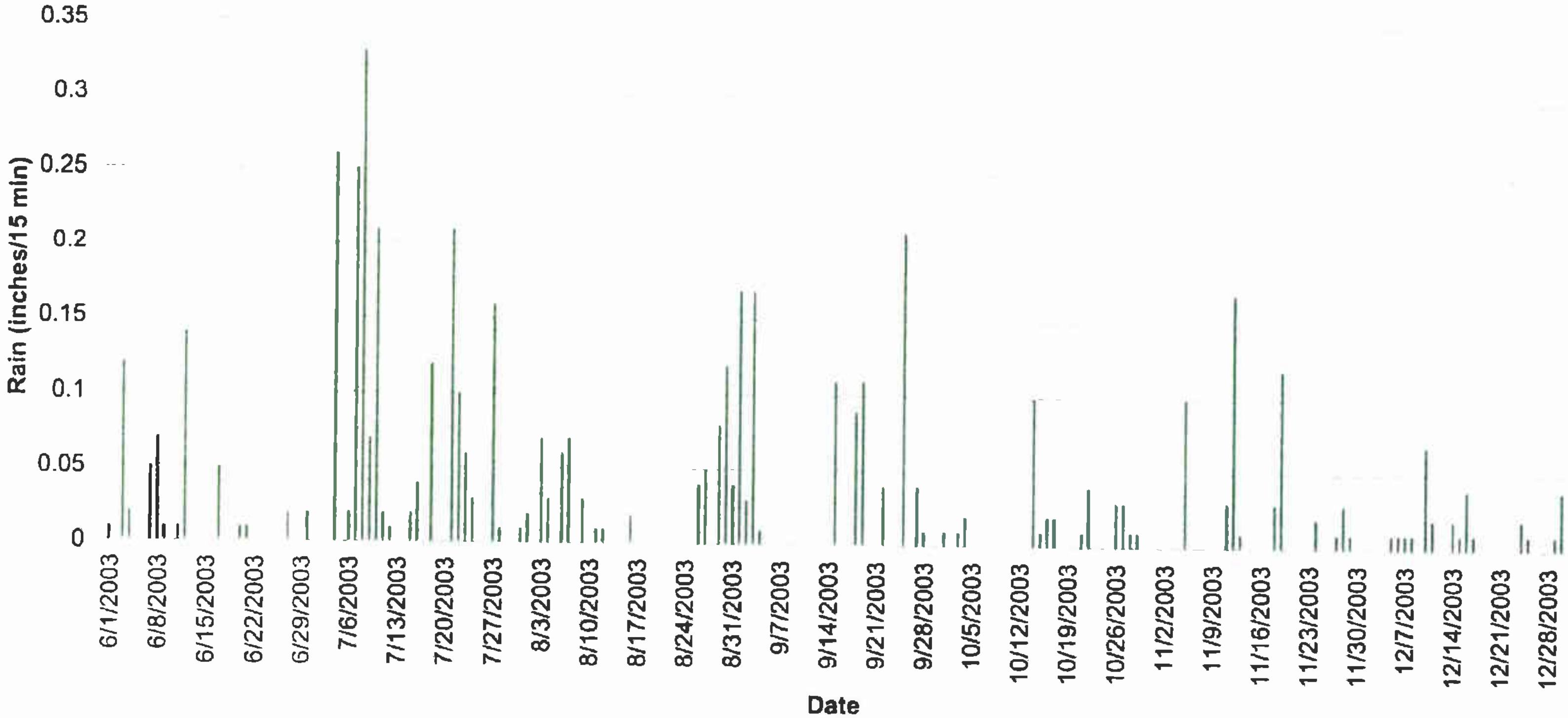
APPENDIX I

TYPICAL YEAR RAIN HYETOGRAPH



Typical Year Rainfall (Jan - June)
Rain (inches/15 min)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1/1/2003
1/8/2003
1/15/2003
1/22/2003
1/29/2003
2/5/2003
2/12/2003
2/19/2003
2/26/2003
3/5/2003
3/12/2003
3/19/2003
3/26/2003
4/2/2003
4/9/2003
4/16/2003
4/23/2003
4/30/2003
5/7/2003
5/14/2003
5/21/2003
5/28/2003
Date

Typical Year Rainfall (June - Dec)



APPENDIX J

INFOSWMM TYPICAL YEAR MODEL REPORT

```
  --------------------------------------------------------------------------
    Comprehensive Storm Water Management Model: based on EPA-SWMM 5.0.022
  --------------------------------------------------------------------------

Warning 08: elevation drop 17.616 exceeds length 16.068 for Conduit CSO_OVERFLOW
 Needed length: 17.616000 ft

  *************************
    Rainfall File Summary
  *************************
  Station    First         Last          Recording  Periods    Periods    Periods
  ID         Date          Date          Frequency  w/Precip   Missing    Malfunc.
  -------------------------------------------------------------------------------
  RG-324381S012 DEC-21-2002  DEC-30-2003    15 min     1479          0          0


  **********************         Volume         Volume
  Rainfall Dependent I/I       acre-feet       10^6 gal
  **********************       ---------      ---------
  Sewershed Rainfall ......     1940.983        632.498
  RDII Produced ...........      504.005        164.238
  RDII Ratio ..............        0.260


  *************************************************************
    NOTE: The summary statistics displayed in this report are
    based on results found at every computational time step,
    not just on results from each reporting time step.
  *************************************************************

  ********************
    Analysis Options
  ********************
  Flow Units ............... MGD
  Process Models:
    Rainfall/Runoff ........ YES
    Snowmelt ............... NO
    Groundwater ............ NO
    Flow Routing ........... YES
    Ponding Allowed ........ YES
    Water Quality .......... NO
  Flow Routing Method ...... DYNWAVE
  Starting Date ............ DEC-28-2002 00:00:00
  Ending Date .............. JAN-01-2004 00:00:00
  Antecedent Dry Days ...... 5.0
  Report Time Step ......... 00:15:00
  Routing Time Step ........ 1.00 sec


  **************************        Volume         Volume
  Flow Routing Continuity        acre-feet       10^6 gal
  **************************     ---------      ---------
  Dry Weather Inflow .......      1136.535        370.357
  Wet Weather Inflow .......         0.000          0.000
  Groundwater Inflow .......         0.000          0.000
  RDII Inflow ..............       504.006        164.238
  External Inflow ..........         0.000          0.000
  External Outflow .........      1633.636        532.345
  Internal Outflow .........         0.000          0.000
  Storage Losses ...........         0.000          0.000
  Initial Stored Volume ....         0.000          0.000
  Final Stored Volume ......         0.075          0.024
```

```
Continuity Error (%) .....          0.416


*****************************
  Highest Continuity Errors
*****************************
Node DU2003.1M                           -3.13%   -11.7581
Node DU2001M                              2.75%    10.6164
Node DU2003M                              1.89%     6.3484
Node DU2002M                             -1.80%    -5.9279
Node DU2005M                              1.14%     2.9112
Node JCT-38                              -0.22%    -0.0834
Node DU6177S                              0.05%     0.0071
Node DU2631M                              0.04%     0.0146
Node DU4004M                              0.02%     0.0121
Node DU2632M                             -0.02%    -0.0069
Node DU1004M                              0.01%     0.0435
Node DU4003M                             -0.01%    -0.0051
Node DU1010M                              0.01%     0.0313
Node DU3097M                              0.01%     0.0032
Node DU2834M                              0.00%     0.0118
Node CSO-4                               -0.00%    -0.0025
Node CSO-3                                0.00%     0.0045
Node DU3107M                             -0.00%    -0.0014
Node DU1016M                              0.00%     0.0071
Node DU3168M                              0.00%     0.0042
                                                    2.2300 Mgal


*******************************
  Time-Step Critical Elements
*******************************
Link DU2001M-DU2003.1M (64.62%)
Link DU2003M-DU2002M (4.96%)
Link CDT-67 (2.70%)
Link DU3158M-CSO3 (0.44%)
Link CSO_OVERFLOW (0.39%)
Link DU1003M-DU1002M (0.09%)
Link DU2633M-DU2634M (0.05%)
Link CSO3-DU3155M (0.02%)
Link DU3155M-DU3156M (0.00%)
Link DU3157M-DU3158M (0.00%)
Link DU1013M-DU1010M (0.00%)
Link DU3156M-DU1016M (0.00%)
Link DU6028M-DU3156M (0.00%)
Node JCT-38 (0.00%)
Link DU7001.1M-DU7001M (0.00%)
Link DU6177S-CSO3OUTFALL (0.00%)
Node DU2632.1M (0.00%)
Node DU7002M (0.00%)
Link DU7001.2M-DU7001.1M (0.00%)
Link DU6177S-DU3157M (0.00%)


*************************************
  Highest Flow Instability Indexes
*************************************
Link DU2003.1M-DU2003M (38)
Link DU2001M-DU2003.1M (23)
Link DU2003M-DU2002M (23)
Link DU2002M-DU2834M (21)
Link DU2005M-DU2001M (21)
Link DU2631M-DU2632M (0)
```

Link TO_WWTP (0)
Link DU4001M-CSO4 (0)
Link BYPASS2 (0)
Link DU7001.1M-DU7001M (0)
Link DU2597M-DU7004M (0)
Link CDT-67 (0)
Link DU2632M-DU2633M (0)
Link DU2633M-DU2634M (0)
Link DU2005M-CSO2 (0)
Link DU2006M-DU2005M (0)
Link DU4003M-DU4002.1 (0)
Link DU4299M-DU4298M (0)
Link DU2630.1M-DU2631M (0)
Link DU5001M-DU2632.1M (0)

****
Routing Time Step Summary
****

Minimum Time Step	:	0.10 sec
Average Time Step	:	0.81 sec
Maximum Time Step	:	1.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	3.43
Total Steps	:	39030066
Total Iterations	:	133694420
Minimum Possible Steps	:	31881600

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum Run HGL Feet	Time of Max Occurrence days hr:min	Maximum Output HGL Feet	Time of Max Occurrence days hr:min
CSO-3	JUNCTION	0.55	5.90	746.95	219 12:43	746.28	219 12:45
CSO-4	JUNCTION	0.12	0.31	752.01	219 13:01	752.01	219 13:00
DU1001M	JUNCTION	0.52	1.74	739.51	219 13:01	739.50	219 13:00
DU1002M	JUNCTION	0.65	2.24	740.10	219 13:01	740.08	219 13:00
DU1003M	JUNCTION	0.50	2.21	740.22	219 13:01	740.20	219 13:00
DU1004M	JUNCTION	0.64	2.46	740.67	219 12:43	740.62	219 13:00
DU1010M	JUNCTION	0.61	18.08	757.08	219 12:42	742.51	219 13:00
DU1013M	JUNCTION	0.56	21.20	760.65	219 13:27	743.62	219 13:00
DU1016M	JUNCTION	0.65	60.55	800.35	219 13:25	745.68	174 18:15
DU2001M	JUNCTION	0.65	4.31	752.23	247 13:51	751.77	

326 12:15

DU2002M	JUNCTION	1.42	2.26	749.43	290	20:47	749.42	326	11:00
DU2003.1M	JUNCTION	1.37	4.68	752.01	326	14:03	751.84	290	21:15
DU2003M	JUNCTION	1.43	2.95	750.07	326	09:44	750.04	326	09:45
DU2006M	JUNCTION	0.20	0.73	753.02	219	12:55	752.99	219	13:15
DU2597M	JUNCTION	0.08	16.59	917.46	219	12:53	901.84	219	13:00
DU2630.1M	JUNCTION	0.10	0.67	903.71	219	12:59	903.71	219	13:00
DU2631M	JUNCTION	0.13	1.17	900.18	219	12:59	900.18	219	13:00
DU2632.1M	JUNCTION	0.34	0.98	899.22	219	12:59	899.22	219	13:00
DU2633M	JUNCTION	0.32	1.13	899.44	219	12:59	899.44	219	13:00
DU2634M	JUNCTION	0.33	1.12	899.41	219	12:59	899.41	219	13:00
DU2815M	JUNCTION	0.44	1.17	748.26	290	20:54	748.26	326	11:15
DU2818M	JUNCTION	0.58	1.38	747.98	290	20:55	747.97	174	22:30
DU2821M	JUNCTION	0.44	1.14	747.59	290	20:56	747.59	290	21:00
DU2826M	JUNCTION	0.53	1.30	748.69	290	20:53	748.68	326	11:15
DU2834M	JUNCTION	0.51	1.34	749.03	290	20:52	749.01	290	21:30
DU3097M	JUNCTION	0.19	1.30	816.20	219	12:57	816.15	219	13:00
DU3098M	JUNCTION	0.13	0.64	814.26	219	12:57	814.26	219	13:00
DU3107.1M	JUNCTION	0.22	21.41	839.38	219	12:42	820.12	219	12:45
DU3107.2M	JUNCTION	0.09	0.43	845.41	219	12:51	845.38	219	13:00
DU3107M	JUNCTION	0.16	0.91	817.46	219	12:53	817.41	219	13:00
DU3155M	JUNCTION	0.43	10.28	751.38	219	13:25	746.16	219	13:00
DU3156M	JUNCTION	0.41	18.07	759.16	219	12:41	746.06	219	13:00
DU3158M	JUNCTION	0.55	4.77	746.79	219	12:43	746.37	219	12:45
DU3168M	JUNCTION	0.35	1.56	746.31	219	13:02	746.08	219	13:00
DU3177M	JUNCTION	0.71	1.66	746.47	219	13:03	746.28	290	21:00
DU3184M	JUNCTION	0.49	1.46	746.65	219	13:04	746.54	290	21:00
DU3191M	JUNCTION	0.76	1.44	746.96	290	20:58	746.96	290	21:00
DU3206M	JUNCTION	0.55	1.34	747.25	290	20:58	747.25	290	21:00
DU4002.1M	JUNCTION	0.07	0.55	802.45	219	13:01	802.45	219	13:00
DU4003M	JUNCTION	0.14	1.30	807.90	219	13:01	807.88	219	13:00
DU4004M	JUNCTION	0.13	0.77	836.34	219	13:01	836.33	219	13:00

DU4006.1M	JUNCTION	0.00	0.00	859.09	0	00:00	859.09	0	00:00
DU4006M	JUNCTION	0.00	0.00	840.08	0	00:00	840.08	0	00:00
DU4033M	JUNCTION	0.00	0.00	838.45	0	00:00	838.45	0	00:00
DU4037M	JUNCTION	0.00	0.00	846.40	0	00:00	846.40	0	00:00
DU4298M	JUNCTION	0.03	14.69	769.26	219	12:35	758.76	174	17:45
DU4299M	JUNCTION	0.14	1.03	759.15	219	13:01	759.13	219	13:00
DU5001M	JUNCTION	0.04	0.19	904.38	326	13:29	904.38	326	13:30
DU5013M	JUNCTION	0.10	0.50	888.30	219	12:51	888.27	219	13:00
DU6025M	JUNCTION	0.06	49.46	792.02	219	12:41	746.06	219	13:00
DU6028M	JUNCTION	0.06	17.39	759.16	219	12:41	746.04	219	13:00
DU6029M	JUNCTION	0.11	10.49	754.61	219	12:43	746.05	219	13:00
DU6177S	JUNCTION	0.02	21.32	759.58	219	12:39	746.60	219	12:45
DU7001.1M	JUNCTION	0.11	0.52	747.52	219	12:59	747.52	219	13:00
DU7001.2M	JUNCTION	0.16	0.89	749.89	219	12:59	749.89	219	13:00
DU7001M	JUNCTION	0.20	0.82	738.25	219	13:01	738.24	219	13:00
DU7002M	JUNCTION	0.07	0.33	791.33	219	12:59	791.33	219	13:00
DU7003M	JUNCTION	0.16	0.94	794.94	219	12:58	794.94	219	13:00
DU7004.1M	JUNCTION	0.11	0.55	805.55	219	12:58	805.55	219	13:00
DU7004M	JUNCTION	0.13	0.82	896.90	219	12:51	896.82	219	13:00
DU7006M	JUNCTION	0.16	0.53	898.65	219	13:05	898.65	219	13:00
JCT-38	JUNCTION	0.28	1.10	899.45	219	12:59	899.45	219	13:00
CSO2	OUTFALL	0.00	0.00	723.91	0	00:00	723.91	0	00:00
CSO3-OUTFALL	OUTFALL	0.02	1.83	728.99	219	12:46	728.98	219	12:45
DU2635M	OUTFALL	0.00	0.00	889.61	0	00:00	889.61	0	00:00
JCT-20	OUTFALL	0.00	0.41	735.41	219	13:00	735.40	219	13:00
WWTP	OUTFALL	0.19	0.62	730.62	219	13:01	730.62	219	13:00
DU2005M	STORAGE	0.22	0.92	751.23	219	13:19	751.19	219	13:15
DU2632M	STORAGE	0.21	1.43	900.23	219	13:00	900.23	219	13:00
DU3157M	STORAGE	0.32	4.40	746.70	219	12:46	746.59	219	12:45
DU4001M	STORAGE	0.28	1.60	753.32	219	13:00	753.28	219	13:00

****

Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow MGD	Maximum Total Inflow MGD	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal
CSO-3	JUNCTION	0.000	15.222	219	12:41	0.000	137.932
CSO-4	JUNCTION	0.000	1.087	219	13:00	0.000	54.149
DU1001M	JUNCTION	0.000	11.307	219	13:01	0.000	445.540
DU1002M	JUNCTION	0.000	11.313	219	13:01	0.000	445.544
DU1003M	JUNCTION	0.000	3.081	219	12:42	0.000	202.866
DU1004M	JUNCTION	0.000	10.231	219	13:01	0.000	391.438
DU1010M	JUNCTION	0.000	10.231	219	13:01	0.000	391.469
DU1013M	JUNCTION	0.000	10.230	219	13:01	0.000	391.472
DU1016M	JUNCTION	0.000	10.231	219	13:01	0.000	391.479
DU2001M	JUNCTION	0.000	4.482	290	20:49	0.000	385.944
DU2002M	JUNCTION	0.000	12.159	290	19:31	0.000	328.718
DU2003.1M	JUNCTION	0.000	4.800	192	20:41	0.000	375.328
DU2003M	JUNCTION	0.000	7.297	4	11:38	0.000	335.066
DU2006M	JUNCTION	8.357	8.357	219	13:20	253.005	255.601
DU2597M	JUNCTION	2.684	2.684	219	12:49	17.716	17.879
DU2630.1M	JUNCTION	5.296	5.296	219	12:59	39.478	39.860
DU2631M	JUNCTION	0.000	5.296	219	12:59	0.000	40.121
DU2632.1M	JUNCTION	0.000	0.967	219	12:58	0.000	40.283
DU2633M	JUNCTION	0.000	0.842	174	16:58	0.000	37.695
DU2634M	JUNCTION	0.000	0.851	174	16:57	0.000	37.695
DU2815M	JUNCTION	0.000	3.831	290	20:54	0.000	249.920
DU2818M	JUNCTION	0.000	3.827	290	20:54	0.000	249.919
DU2821M	JUNCTION	0.000	3.824	290	20:55	0.000	249.918

DU2826M	JUNCTION	0.000	3.841	290	20:53	0.000	249.923
DU2834M	JUNCTION	0.000	4.114	290	20:47	0.000	249.935
DU3097M	JUNCTION	0.000	3.567	219	12:53	0.000	58.163
DU3098M	JUNCTION	0.000	3.427	219	12:57	0.000	58.160
DU3107.1M	JUNCTION	0.000	3.619	219	12:51	0.000	58.161
DU3107.2M	JUNCTION	0.000	3.620	219	12:51	0.000	58.161
DU3107M	JUNCTION	0.000	3.619	219	12:51	0.000	58.162
DU3155M	JUNCTION	0.000	14.179	219	12:41	0.000	137.928
DU3156M	JUNCTION	0.000	14.767	219	12:41	0.000	391.525
DU3158M	JUNCTION	0.000	14.950	219	12:41	0.000	137.931
DU3168M	JUNCTION	0.000	4.067	219	13:05	0.000	249.916
DU3177M	JUNCTION	0.000	3.861	219	13:05	0.000	249.912
DU3184M	JUNCTION	0.000	3.817	290	20:58	0.000	249.914
DU3191M	JUNCTION	0.000	3.819	290	20:57	0.000	249.915
DU3206M	JUNCTION	0.000	3.822	290	20:56	0.000	249.917
DU4002.1M	JUNCTION	0.000	11.062	219	13:01	0.000	62.318
DU4003M	JUNCTION	0.000	11.147	219	13:01	0.000	62.313
DU4004M	JUNCTION	11.147	11.147	219	13:00	61.707	62.325
DU4006.1M	JUNCTION	0.000	0.000	0	00:00	0.000	0.000
DU4006M	JUNCTION	0.000	0.000	0	00:00	0.000	0.000
DU4033M	JUNCTION	0.000	0.000	0	00:00	0.000	0.000
DU4037M	JUNCTION	0.000	0.000	0	00:00	0.000	0.000
DU4298M	JUNCTION	0.000	5.580	219	12:53	0.000	7.694
DU4299M	JUNCTION	0.000	11.061	219	13:01	0.000	62.318
DU5001M	JUNCTION	0.137	0.137	326	13:28	2.564	2.588
DU5013M	JUNCTION	0.000	3.621	219	12:51	0.000	58.161
DU6025M	JUNCTION	0.040	0.559	219	12:41	2.149	2.173
DU6028M	JUNCTION	0.000	5.864	219	12:41	0.000	3.687
DU6029M	JUNCTION	0.031	3.431	219	12:41	1.461	1.478
DU6177S	JUNCTION	0.000	23.332	219	12:40	0.000	14.729
DU7001.1M	JUNCTION	0.000	3.414	219	12:59	0.000	58.159
DU7001.2M	JUNCTION	0.000	3.415	219	12:59	0.000	

							58.159
DU7001M	JUNCTION	0.000	14.684	219	13:01	0.000	503.699
DU7002M	JUNCTION	0.000	3.416	219	12:58	0.000	58.160
DU7003M	JUNCTION	0.000	3.422	219	12:58	0.000	58.160
DU7004.1M	JUNCTION	0.000	3.426	219	12:58	0.000	58.160
DU7004M	JUNCTION	0.000	3.626	219	12:50	0.000	58.161
DU7006M	JUNCTION	0.000	0.967	219	12:59	0.000	40.283
JCT-38	JUNCTION	0.000	0.839	219	13:00	0.000	37.612
CSO2	OUTFALL	0.000	4.736	219	13:19	0.000	3.476
CSO3-OUTFALL	OUTFALL	0.000	18.073	219	12:46	0.000	14.722
DU2635M	OUTFALL	0.000	4.457	219	13:00	0.000	2.241
JCT-20	OUTFALL	0.000	10.112	219	13:00	0.000	8.168
WWTP	OUTFALL	0.000	14.683	219	13:01	0.000	503.699
DU2005M	STORAGE	0.000	8.357	219	13:20	0.000	255.601
DU2632M	STORAGE	0.000	5.296	219	13:00	0.000	40.106
DU3157M	STORAGE	30.944	30.944	219	12:45	151.184	152.653
DU4001M	STORAGE	0.000	11.331	219	13:00	0.000	62.318

****
Node Surcharge Summary
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Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Feet	Min. Depth Below Rim Feet
CSO-3	JUNCTION	0.47	2.645	24.005
DU1003M	JUNCTION	56.28	0.704	15.547
DU1004M	JUNCTION	0.43	0.301	17.566
DU1010M	JUNCTION	19.52	16.081	9.199
DU1013M	JUNCTION	23.97	19.197	23.903
DU1016M	JUNCTION	38.27	58.553	0.000
DU2001M	JUNCTION	96.20	2.504	12.226
DU2003.1M	JUNCTION	1645.02	3.178	12.562
DU2597M	JUNCTION	0.29	15.754	0.893
DU2633M	JUNCTION	36.36	0.133	12.367
DU2634M	JUNCTION	28.17	0.117	14.092
DU3097M	JUNCTION	0.06	0.051	6.789
DU3107.1M	JUNCTION	0.65	20.155	0.000
DU3155M	JUNCTION	15.19	8.067	19.673
DU3156M	JUNCTION	17.36	16.067	11.838
DU3158M	JUNCTION	0.50	2.563	24.099
DU4298M	JUNCTION	2.14	13.043	0.000
DU6025M	JUNCTION	17.91	48.964	0.000

DU6028M	JUNCTION	0.65	15.390	0.000
DU6029M	JUNCTION	0.16	8.898	6.862
DU6177S	JUNCTION	0.53	15.737	0.000
JCT-38	JUNCTION	10.44	0.101	12.349

****
Node Flooding Summary
****

Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate MGD	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 gal	Maximum Ponded Depth Feet
DU6028M	0.01	4.314	219 12:41	0.000	17.39
DU6177S	0.01	4.919	219 12:40	0.000	21.32

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Storage Volume Summary
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Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	E&I Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow MGD
DU2005M	0.011	2.54	0.00	0.046	11	219 13:19	8.848
DU2632M	0.001	0.78	0.00	0.036	20	219 13:00	5.296
DU3157M	0.013	2.48	0.00	0.176	34	219 12:46	33.452
DU4001M	0.000	0.00	0.00	0.000	0	0 00:00	11.197

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Outfall Loading Summary
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Outfall Node	Flow Freq. Pcnt.	Avg. Flow MGD	Max. Flow MGD	Total Volume 10^6 gal
CSO2	5.95	0.338	4.736	3.476
CSO3-OUTFALL	5.35	1.665	18.073	14.722
DU2635M	2.71	0.557	4.457	2.241
JCT-20	3.89	1.216	10.112	8.168
WWTP	98.94	1.522	14.683	503.699
System	23.37	5.298	49.598	532.305

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Link Flow Summary
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Link	Type	Maximum |Run Flow| MGD	Time of Max Occurrence days	hr:min	Maximum |Output Flow| MGD	Time of Max Occurrence days	hr:min	Max/ Full Flow	Maximum |Veloc| ft/sec	Time of Max Occurrence days	hr:min	Max/ Full Depth	Time of Max Occurrence days	hr:min	Maximum Top Width ft
BYPASS1	CONDUIT	1.760	219	12:53	1.637	219	13:00	0.88	2.64	219	12:47	0.86	219	12:56	1.25
BYPASS2	CONDUIT	6.013	219	13:00	5.380	219	13:00	1.10	8.17	219	13:00	0.88	219	13:00	1.25
CDT-67	CONDUIT	0.842	174	16:58	0.839	219	13:00	0.45	1.95	271	08:42	1.00	97	20:32	1.00
CSO3-DU3155M	CONDUIT	14.179	219	12:41	12.293	219	12:45	0.83	6.98	219	12:41	1.00	4	10:22	2.00
CSO4-DU1003M	CONDUIT	1.080	219	13:01	1.071	219	13:00	0.14	3.51	271	08:34	0.63	219	13:01	1.25
CSO_OVERFLOW	CONDUIT	10.112	219	13:00	9.626	219	13:00	0.23	32.56	247	12:20	0.44	219	13:00	1.25
DU-3107.2M-DU3107.1M	CONDUIT	3.619	219	12:51	3.230	219	13:00	0.26	6.38	219	12:51	0.67	219	12:51	1.25
DU1001M-DU7001M	CONDUIT	11.302	219	13:01	11.162	219	13:00	1.08	5.78	219	13:01	0.71	219	13:01	2.25
DU1002M-DU1001M	CONDUIT	11.307	219	13:01	11.180	219	13:00	2.45	5.73	219	13:01	0.94	219	13:01	2.00
DU1003M-DU1002M	CONDUIT	3.080	219	12:42	3.011	219	13:00	0.90	3.88	219	12:42	1.00	4	06:13	1.25
DU1004M-DU1002M	CONDUIT	8.273	219	13:01	8.189	219	13:00	5.48	4.12	219	13:01	0.97	219	13:01	2.00
DU1004M-DU1003M	CONDUIT	2.025	219	12:42	1.940	219	13:00	2.72	2.55	219	12:42	1.00	4	08:09	1.25
DU1010M-DU1004M	CONDUIT	10.231	219	13:01	10.131	219	13:00	1.73	5.04	219	13:01	1.00	174	17:43	2.00
DU1013M-DU1010M	CONDUIT	10.231	219	13:01	10.131	219	13:00	1.59	5.04	219	13:01	1.00	4	10:18	2.00
DU1016M-DU1013M	CONDUIT	10.230	219	13:01	10.131	219	13:00	2.03	5.04	219	13:01	1.00	4	10:09	2.00
DU2001M-DU2003.1M	CONDUIT	4.800	192	20:41	4.326	33	22:30	0.26	5.85	132	08:34	1.00	4	06:26	1.49
DU2002M-DU2834M	CONDUIT	4.114	290	20:47	4.025	326	11:00	0.70	3.33	219	12:54	0.61	290	20:49	2.00
DU2003M-DU2002M	CONDUIT	12.159	290	19:31	11.046	247	15:00	0.25	8.43	290	19:31	0.99	174	22:22	1.92
DU2005M-DU2001M	CONDUIT	4.482	290	20:49	4.345	326	14:30	0.26	8.08	194	18:10	0.81	219	13:19	1.50
DU2006M-DU2005M	CONDUIT	8.357	219	13:20	8.190	219	13:15	0.46	13.57	219	12:58	0.54	219	13:19	1.50
DU2597M-DU7004M	CONDUIT	2.684	219	12:49	2.250	219	13:00	1.25	7.62	219	12:49	1.00	219	12:45	0.83
DU2630.1M-DU2631M	CONDUIT	5.296	219	12:59	5.296	219	13:00	0.24	8.99	219	12:59	0.33	219	12:59	1.99
DU2631M-DU2632M	CONDUIT	5.296	219	13:00	5.296	219									

13:00	0.30	3.89	219	12:59	0.64	219	12:59	2.00		
DU2632.1M-DU7006M	CONDUIT				0.967	219	12:59		0.967	219
13:00	2.56	2.36	219	12:59	0.75	219	12:59	1.00		
DU2632M-DU2635M	CONDUIT				4.457	219	13:00		4.457	219
13:00	0.10	14.21	219	13:00	0.21	219	13:00	1.92		
DU2633M-DU2634M	CONDUIT				0.851	174	16:57		0.839	219
13:00	1.37	1.87	271	08:42	1.00	4	09:46	1.00		
DU2634M-DU2632.1M	CONDUIT				0.839	219	13:00		0.839	219
13:00	1.90	1.69	174	16:56	0.99	219	12:59	1.00		
DU2815M-DU2818M	CONDUIT				3.827	290	20:54		3.793	326
11:15	0.60	2.83	219	12:57	0.64	290	20:55	2.00		
DU2818M-DU2821M	CONDUIT				3.824	290	20:55		3.793	174
22:30	1.06	2.86	219	12:58	0.63	290	20:56	2.00		
DU2821M-DU3206M	CONDUIT				3.822	290	20:56		3.797	290
21:00	0.60	2.94	219	12:59	0.62	290	20:57	2.00		
DU2826M-DU2815M	CONDUIT				3.831	290	20:54		3.792	326
11:15	0.80	2.96	219	12:56	0.62	290	20:54	2.00		
DU2834M-DU2826M	CONDUIT				3.841	290	20:53		3.798	290
20:45	0.80	2.74	219	12:55	0.66	290	20:53	2.00		
DU3097M-DU3098M	CONDUIT				3.427	219	12:57		3.365	219
13:00	1.11	4.67	219	12:52	0.87	219	12:57	1.25		
DU3098M-DU7004.1M	CONDUIT				3.426	219	12:58		3.372	219
13:00	0.49	9.17	219	12:57	0.48	219	12:58	1.25		
DU3107.1M-DU3107M	CONDUIT				3.619	219	12:51		3.230	219
13:00	1.46	5.00	219	12:50	0.86	219	12:53	1.25		
DU3107M-DU3097M	CONDUIT				1.808	219	12:53		1.682	219
13:00	0.88	2.71	219	12:47	0.86	219	12:56	1.25		
DU3155M-DU3156M	CONDUIT				14.143	219	12:41		12.303	219
12:45	9.57	6.97	219	12:41	1.00	4	10:21	2.00		
DU3156M-DU1016M	CONDUIT				10.231	219	13:01		10.130	219
13:00	0.87	5.04	219	13:01	1.00	4	10:21	2.00		
DU3157M-DU3158M	CONDUIT				14.950	219	12:41		12.273	219
12:45	2.10	7.37	219	12:41	1.00	174	17:42	2.00		
DU3158M-CSO3	CONDUIT				15.222	219	12:41		12.281	219
12:45	0.56	7.72	219	12:41	1.00	174	17:42	2.00		
DU3168M-DU3156M	CONDUIT				7.045	219	13:03		3.807	290
21:00	0.63	4.36	175	00:29	0.89	219	13:02	2.00		
DU3177M-DU3168M	CONDUIT				4.067	219	13:05		3.811	290
21:00	1.23	3.31	290	21:00	0.77	219	13:02	2.00		
DU3184M-DU3177M	CONDUIT				3.861	219	13:05		3.814	290
21:00	0.72	2.50	174	17:46	0.77	219	13:03	2.00		
DU3191M-DU3184M	CONDUIT				3.817	290	20:58		3.815	290
21:00	0.62	3.05	174	17:30	0.62	219	13:04	2.00		
DU3206M-DU3191M	CONDUIT				3.819	290	20:57		3.810	290
21:00	0.64	2.64	290	20:57	0.67	290	20:58	2.00		
DU4002.1M-DU4299M	CONDUIT				11.061	219	13:01		10.861	219
13:00	0.40	23.02	219	12:53	0.63	219	13:01	1.25		
DU4003M-DU4002.1	CONDUIT				11.062	219	13:01		10.864	219
13:00	0.75	7.92	219	13:01	0.65	219	13:01	1.99		
DU4004M-DU4003M	CONDUIT				11.147	219	13:01		10.952	219
13:00	0.46	16.59	219	12:32	0.65	219	13:01	1.50		
DU4006.1M-DU4006M	CONDUIT				0.000	0	00:00		0.000	0
00:00	0.00	0.00	0	00:00	0.00	4	00:00			
DU4006M-DU4033M	CONDUIT				0.000	0	00:00		0.000	0
00:00	0.00	0.00	0	00:00	0.00	4	00:00			
DU4033M-DU4004M	CONDUIT				0.000	0	00:00		0.000	0
00:00	0.00	0.00	0	00:00	0.26	219	13:01	1.30		
DU4037MDU4033M	CONDUIT				0.000	0	00:00		0.000	0
00:00	0.00	0.00	0	00:00	0.00	4	00:00			
DU4298M-DU4001M	CONDUIT				5.580	219	12:53		5.336	174
17:45	1.75	7.15	219	12:53	0.96	219	12:53	1.25		
DU4299M-DU4298M	CONDUIT				5.580	219	12:53		5.336	174
17:45	0.52	12.71	219	12:33	0.85	219	13:01	1.25		

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  DU5001M-DU2632.1M     CONDUIT           0.137   326  13:29          0.137   326
13:30    0.17      2.65   326  13:29      0.28   326  13:29        0.67
  DU5013M-DU3107.2M     CONDUIT           3.620   219  12:51          3.219   219
13:00    0.47     15.65   219  12:51      0.47   219  12:51        0.99
  DU6025M-DU6028M       CONDUIT           0.541   219  12:41          0.039   174
17:45    2.23      4.46   219  12:41      1.00     4  10:20        0.50
  DU6028M-DU3156M       CONDUIT           5.845   219  12:41          0.472   245
06:30    0.56      2.93   219  12:41      1.00   174  17:31        2.00
  DU6029M-DU6028M       CONDUIT           3.411   219  12:41          0.078   219
12:45    0.26      4.18   219  12:41      1.00   174  17:44        1.50
  DU6177S-CSO3OUTFALL   CONDUIT          18.073   219  12:46         18.015   219
12:45    1.28      9.04   219  12:46      0.96   219  12:46        2.00
  DU6177S-DU3157M       CONDUIT          23.332   219  12:40         18.016   219
12:45    0.06     11.04   174  16:48      0.82   219  12:46        5.51
  DU7001.1M-DU7001M     CONDUIT           3.413   219  12:59          3.411   219
13:00    0.36     10.91   219  12:59      0.42   219  12:59        1.25
  DU7001.2M-DU7001.1M   CONDUIT           3.414   219  12:59          3.409   219
13:00    0.66      7.37   219  12:59      0.57   219  12:59        1.25
  DU7002M-DU7001.2M     CONDUIT           3.415   219  12:59          3.402   219
13:00    0.15      8.86   219  12:58      0.49   219  12:59        1.25
  DU7003M-DU7002M       CONDUIT           3.416   219  12:58          3.399   219
13:00    0.59      8.41   219  12:58      0.51   219  12:58        1.25
  DU7004.1M-DU7003M     CONDUIT           3.422   219  12:58          3.384   219
13:00    0.40      6.94   219  12:58      0.60   219  12:58        1.25
  DU7004M-DU5013M       CONDUIT           3.621   219  12:51          3.212   219
13:00    0.83     10.22   219  12:48      0.66   219  12:51        1.00
  DU7006M-DU7004M       CONDUIT           0.967   219  13:00          0.967   219
13:00    0.55      3.58   219  13:05      0.57   219  12:51        1.00
  TO_WWTP               CONDUIT          14.683   219  13:01         14.571   219
13:00    0.17     21.23   219  12:43      0.32   219  13:01        2.10
  DU2003.1M-DU2003M     ORIFICE           4.291   326  14:10          4.170   174
21:45                                     1.00     4  00:00
  DU2632M-DU2633M       ORIFICE           0.839   219  13:00          0.839   219
13:00                                     1.00     4  05:48
  DU4001M-CSO4          ORIFICE           1.087   219  13:00          1.073   219
13:00                                     1.00     4  05:34
  DU2005M-CSO2          WEIR              4.736   219  13:19          4.285   219
13:15                                     0.10   219  13:19


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   Flow Classification Summary
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                          Adjusted    --- Fraction of Time in Flow Class ----    Avg.
Avg.
                          /Actual          Up    Down    Sub    Sup     Up    Down    Froude
Flow
  Conduit                   Length    Dry   Dry    Dry    Crit   Crit   Crit   Crit    Number
Change
---------------------------------------------------------------------------------
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  BYPASS1                   1.00   0.00  0.00  0.00  0.99  0.00  0.00  0.00    0.53
0.0000
  BYPASS2                   1.00   0.00  0.00  0.00  0.00  0.00  0.00  0.99    1.63
0.0000
  CDT-67                    1.00   0.00  0.00  0.00  0.99  0.00  0.00  0.00    0.28
0.0001
  CSO3-DU3155M              1.00   0.00  0.00  0.00  0.54  0.00  0.45  0.00    0.41
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0.0000

CSO4-DU1003M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.37	0.0000
CSO_OVERFLOW	1.00	0.95	0.00	0.00	0.00	0.04	0.00	0.00	0.49	0.0000
DU-3107.2M-DU3107.1M	1.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00	1.37	0.0000
DU1001M-DU7001M	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.99	0.86	0.0000
DU1002M-DU1001M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.64	0.0000
DU1003M-DU1002M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.40	0.0000
DU1004M-DU1002M	1.00	0.00	0.00	0.00	0.12	0.00	0.87	0.00	0.48	0.0000
DU1004M-DU1003M	1.00	0.00	0.00	0.00	0.12	0.00	0.87	0.00	0.42	0.0000
DU1010M-DU1004M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.66	0.0000
DU1013M-DU1010M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.57	0.0000
DU1016M-DU1013M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.55	0.0000
DU2001M-DU2003.1M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.38	0.0371
DU2002M-DU2834M	1.00	0.00	0.00	0.00	0.08	0.00	0.00	0.91	0.71	0.0018
DU2003M-DU2002M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.27	0.0110
DU2005M-DU2001M	1.00	0.00	0.00	0.00	0.06	0.61	0.00	0.32	1.90	0.0034
DU2006M-DU2005M	1.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00	3.25	0.0000
DU2597M-DU7004M	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.99	1.75	0.0000
DU2630.1M-DU2631M	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.99	1.87	0.0000
DU2631M-DU2632M	1.00	0.00	0.00	0.00	0.17	0.74	0.00	0.08	1.16	0.0001
DU2632.1M-DU7006M	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.99	0.41	0.0000
DU2632M-DU2635M	1.00	0.96	0.00	0.00	0.00	0.00	0.00	0.03	0.11	0.0000
DU2633M-DU2634M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.23	0.0002
DU2634M-DU2632.1M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.22	0.0000
DU2815M-DU2818M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.48	0.0000
DU2818M-DU2821M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.48	0.0000
DU2821M-DU3206M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.51	0.0000
DU2826M-DU2815M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.53	0.0000
DU2834M-DU2826M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.46	0.0001
DU3097M-DU3098M	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.99	0.97	0.0000
DU3098M-DU7004.1M	1.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00	2.25	0.0000
DU3107.1M-DU3107M	1.00	0.00	0.00	0.00	0.98	0.01	0.00	0.00	0.91	0.0000

DU3107M-DU3097M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.55	0.0000
DU3155M-DU3156M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.34	0.0001
DU3156M-DU1016M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.70	0.0000
DU3157M-DU3158M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.57	0.0000
DU3158M-CSO3	1.00	0.00	0.00	0.00	0.01	0.00	0.98	0.00	0.46	0.0000
DU3168M-DU3156M	1.00	0.00	0.00	0.00	0.95	0.04	0.00	0.00	0.92	0.0000
DU3177M-DU3168M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.52	0.0000
DU3184M-DU3177M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.35	0.0000
DU3191M-DU3184M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.69	0.0000
DU3206M-DU3191M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.33	0.0000
DU4002.1M-DU4299M	1.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00	3.17	0.0000
DU4003M-DU4002.1	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.99	1.29	0.0000
DU4004M-DU4003M	1.00	0.00	0.00	0.00	0.00	0.08	0.00	0.91	4.13	0.0000
DU4006.1M-DU4006M	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
DU4006M-DU4033M	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
DU4033M-DU4004M	1.00	0.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
DU4037MDU4033M	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
DU4298M-DU4001M	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.99	0.14	0.0000
DU4299M-DU4298M	1.00	0.87	0.00	0.00	0.00	0.00	0.00	0.12	0.35	0.0000
DU5001M-DU2632.1M	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.99	1.09	0.0000
DU5013M-DU3107.2M	1.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00	4.20	0.0000
DU6025M-DU6028M	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.98	0.79	0.0000
DU6028M-DU3156M	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.04	0.0000
DU6029M-DU6028M	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.96	2.00	0.0000
DU6177S-CSO3OUTFALL	1.00	0.00	0.00	0.00	0.93	0.05	0.00	0.00	0.08	0.0000
DU6177S-DU3157M	1.00	0.00	0.95	0.00	0.01	0.04	0.00	0.00	0.05	0.0000
DU7001.1M-DU7001M	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.99	2.76	0.0000
DU7001.2M-DU7001.1M	1.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00	1.90	0.0000
DU7002M-DU7001.2M	1.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00	2.55	0.0000
DU7003M-DU7002M	1.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00	2.50	0.0000
DU7004.1M-DU7003M	1.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00	1.80	0.0000
DU7004M-DU5013M	1.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00	2.79	

0.0000									
DU7006M-DU7004M	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.99	0.99
0.0000									
TO_WWTP	1.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00	5.88
0.0000									

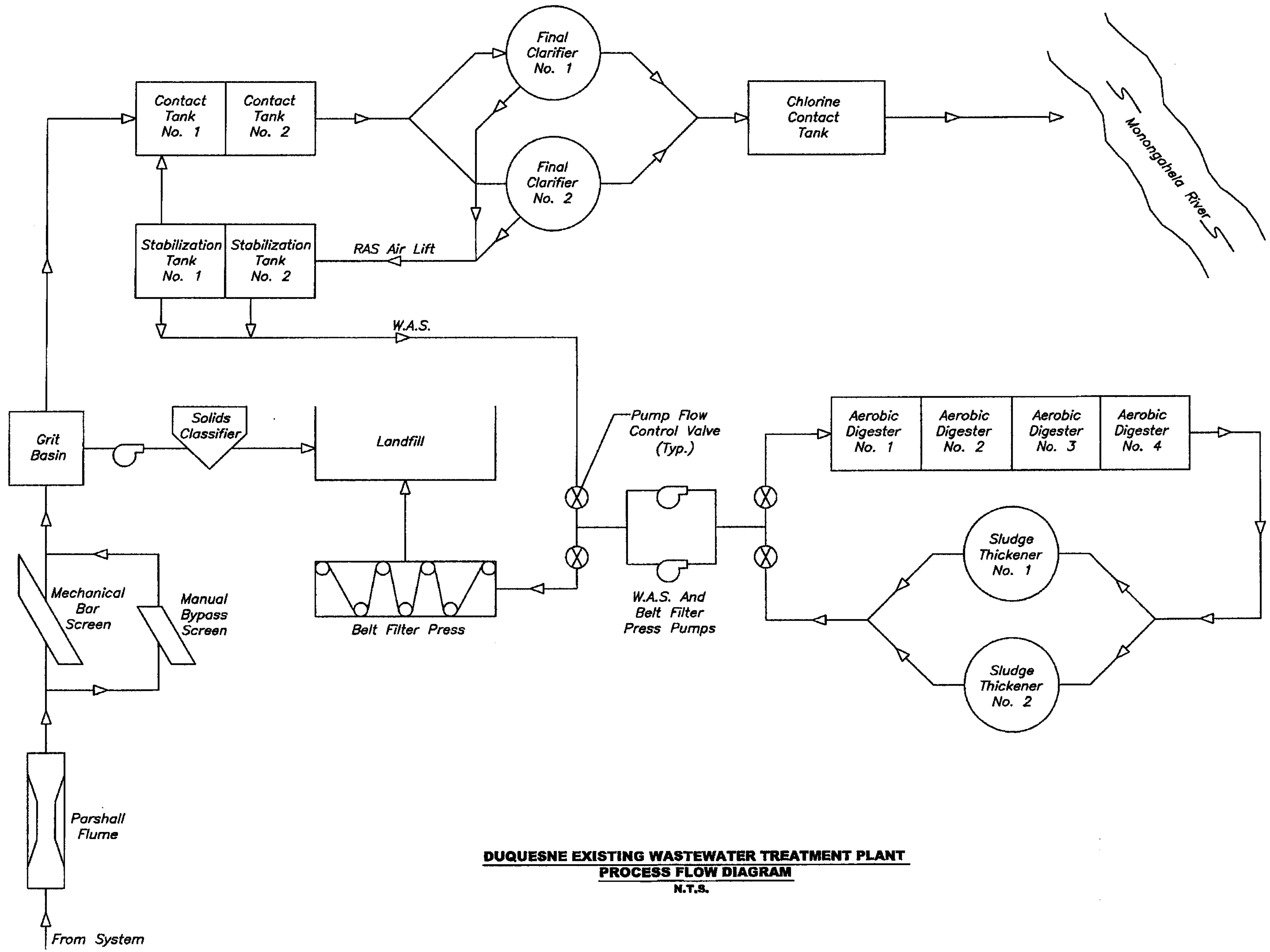
****
Conduit Surcharge Summary
****

Conduit	--------- Hours Full -------- Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
BYPASS2	0.01	0.01	0.01	0.03	0.01
CDT-67	10.41	10.41	10.41	0.01	0.01
CSO3-DU3155M	15.18	15.18	15.18	0.01	0.03
DU1001M-DU7001M	0.01	0.01	0.01	0.40	0.01
DU1002M-DU1001M	0.01	0.01	0.01	188.39	0.01
DU1003M-DU1002M	153.90	153.90	153.92	0.01	0.01
DU1004M-DU1002M	0.01	0.01	0.01	453.43	0.01
DU1004M-DU1003M	56.23	56.23	56.24	645.59	0.01
DU1010M-DU1004M	0.43	0.43	0.43	61.47	0.43
DU1013M-DU1010M	19.51	19.51	19.51	46.23	19.46
DU1016M-DU1013M	23.96	23.96	23.97	111.77	23.90
DU2001M-DU2003.1M	177.05	177.05	179.59	0.01	0.01
DU2597M-DU7004M	0.12	0.12	0.13	0.35	0.12
DU2632.1M-DU7006M	0.01	0.01	0.01	350.05	0.01
DU2633M-DU2634M	28.08	28.08	28.08	144.70	28.08
DU2634M-DU2632.1M	0.01	0.01	0.01	262.79	0.01
DU2818M-DU2821M	0.01	0.01	0.01	23.45	0.01
DU3097M-DU3098M	0.01	0.01	0.01	0.32	0.01
DU3107.1M-DU3107M	0.01	0.01	0.01	1.12	0.01
DU3155M-DU3156M	17.36	17.36	17.36	348.77	17.18
DU3156M-DU1016M	17.35	17.35	17.36	0.01	0.17
DU3157M-DU3158M	0.49	0.49	0.49	0.46	0.36
DU3158M-CSO3	0.47	0.47	0.47	0.01	0.01
DU3177M-DU3168M	0.01	0.01	0.01	38.47	0.01
DU4298M-DU4001M	0.01	0.01	0.01	4.29	0.01
DU6025M-DU6028M	17.90	17.90	17.91	0.01	0.01
DU6028M-DU3156M	0.65	0.65	0.65	0.01	0.01
DU6029M-DU6028M	0.16	0.16	0.17	0.01	0.01
DU6177S-CSO3OUTFALL	0.01	0.01	0.01	1.48	0.01

Analysis begun on: Thu Jun 19 08:45:42 2014
Analysis ended on: Thu Jun 19 10:16:26 2014
Total elapsed time: 01:30:44

APPENDIX K

EXISTING PROCESS FLOW DIAGRAM



DUQUESNE EXISTING WASTEWATER TREATMENT PLANT
PROCESS FLOW DIAGRAM
N.T.S.

Date	Revisions	Date	Revisions

KLH ENGINEERS, INC
5173 Campbells Run Road
Pittsburgh, PA 15205
Phone: 412.494.0510
Fax: 412.494.0426
info@klhengineers.com

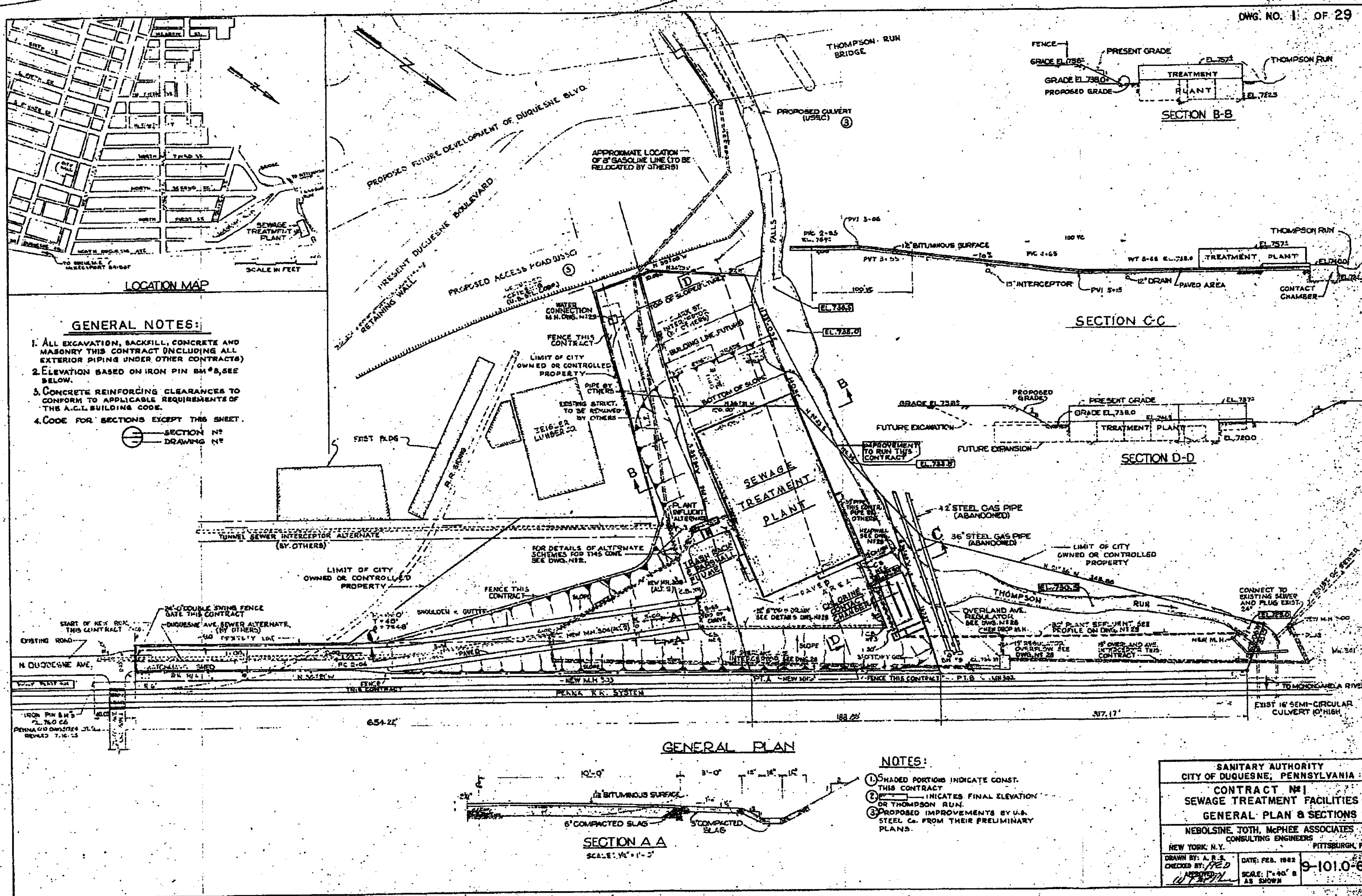
BOROUGH OF DUQUESNE
ALLEGHENY COUNTY, PENNSYLVANIA
EXISTING WASTEWATER TREATMENT PLANT
PROCESS FLOW DIAGRAM

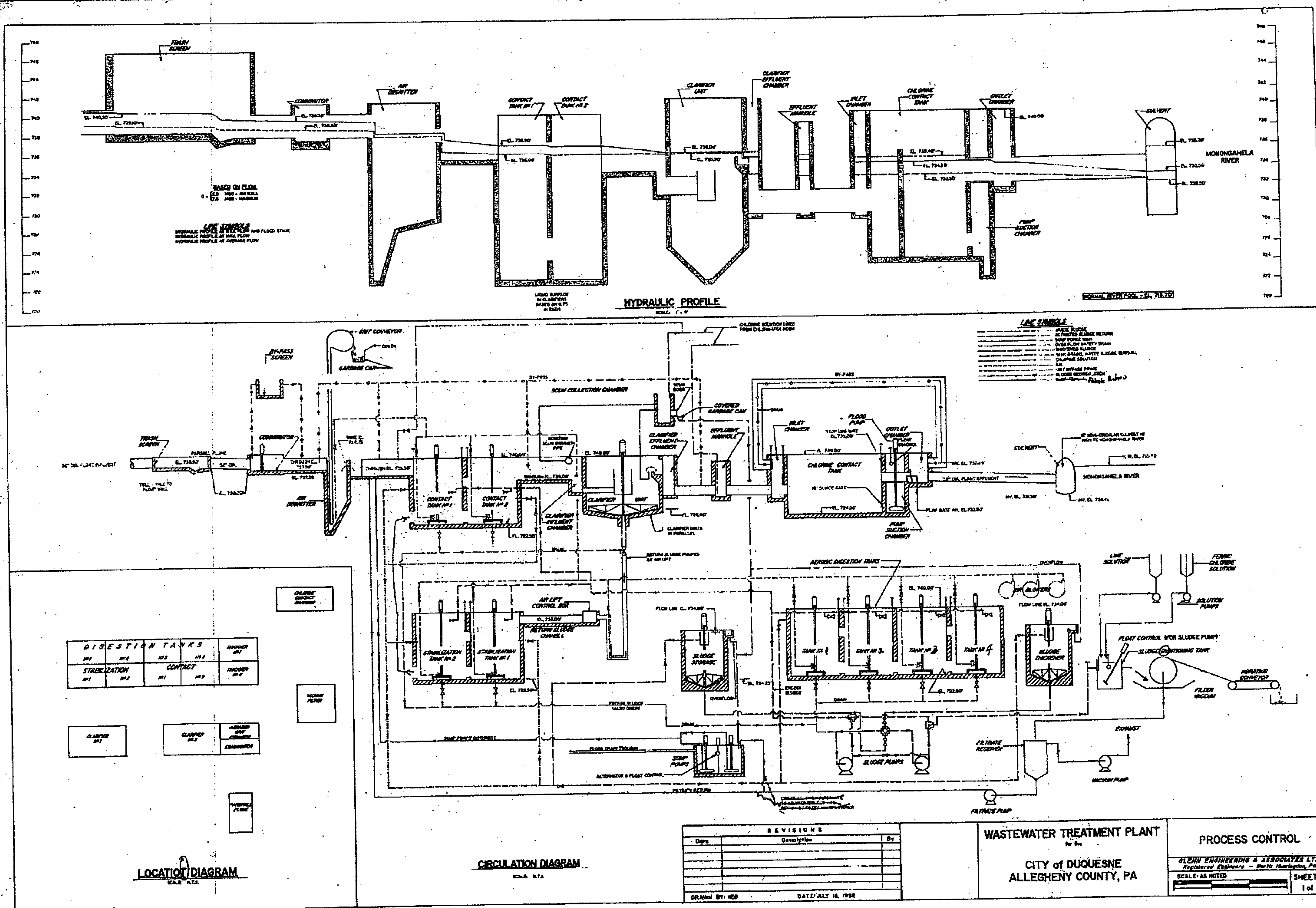
Scale: As Shown
Date: August 2014
Drawn By: BHD
Checked By: BMC
Approved By: SHG

Order No. 220-53
Drawing No. EX4
Sheet No. 1 of 1

Appendix L

Existing WWTP Plans


DWG. NO. 1 OF 29
LOCATION MAP
SEWAGE TREATMENT PLANT
SCALE IN FEET
GENERAL NOTES:
1. ALL EXCAVATION, BACKFILL, CONCRETE AND MASONRY THIS CONTRACT (INCLUDING ALL EXTERIOR PIPING UNDER OTHER CONTRACTS)
2. ELEVATION BASED ON IRON PIN BM #8, SEE BELOW.
3. CONCRETE REINFORCING CLEARANCES TO CONFORM TO APPLICABLE REQUIREMENTS OF THE A.C.I. BUILDING CODE.
4. CODE FOR SECTIONS EXCEPT THIS SHEET.
SECTION Nº
DRAWING Nº
THOMPSON RUN BRIDGE
PROPOSED CULVERT (USSC) 3
PROPOSED FUTURE DEVELOPMENT OF DUQUESNE BLVD.
PRESENT DUQUESNE BOULEVARD
RETAINING WALL
PROPOSED ACCESS ROAD (USSC) 5
APPROXIMATE LOCATION OF 8" GASOLINE LINE (TO BE RELOCATED BY OTHERS)
FALLS
ZEIGLER LUMBER CO.
EXIST. BLDG.
R.R. SIDING
SEWAGE TREATMENT PLANT
TUNNEL SEWER INTERCEPTOR ALTERNATE (BY OTHERS)
LIMIT OF CITY OWNED OR CONTROLLED PROPERTY
FENCE THIS CONTRACT
42" STEEL GAS PIPE (ABANDONED)
36" STEEL GAS PIPE (ABANDONED)
THOMPSON RUN
N. DUQUESNE AVE.
PENNA. R.R. SYSTEM
TO MONONGAHELA RIVER
EXIST 16' SEMI-CIRCULAR CULVERT (0' HIGH)
654.22'
317.17'
GENERAL PLAN
SECTION B-B
SECTION C-C
SECTION D-D
SECTION A A
SCALE: 1/2" = 1'-0"
6" COMPACTED SLAG
1/2" BITUMINOUS SURFACE
NOTES:
1. SHADED PORTIONS INDICATE CONST. THIS CONTRACT
2. INICATES FINAL ELEVATION OF THOMPSON RUN.
3. PROPOSED IMPROVEMENTS BY U.S. STEEL Co. FROM THEIR PRELIMINARY PLANS.
SANITARY AUTHORITY
CITY OF DUQUESNE, PENNSYLVANIA
CONTRACT Nº 1
SEWAGE TREATMENT FACILITIES
GENERAL PLAN & SECTIONS
NEBOLSINE, TOTH, McPHEE ASSOCIATES
CONSULTING ENGINEERS
NEW YORK, N.Y.
PITTSBURGH, PA.
DRAWN BY: A. R. S.
DATE: FEB. 1962
SCALE: 1" = 40' & AS SHOWN
9-101.0-62



REVISIONS		
Date	Description	By

DRAWN BY: NEB DATE: JULY 16, 1992

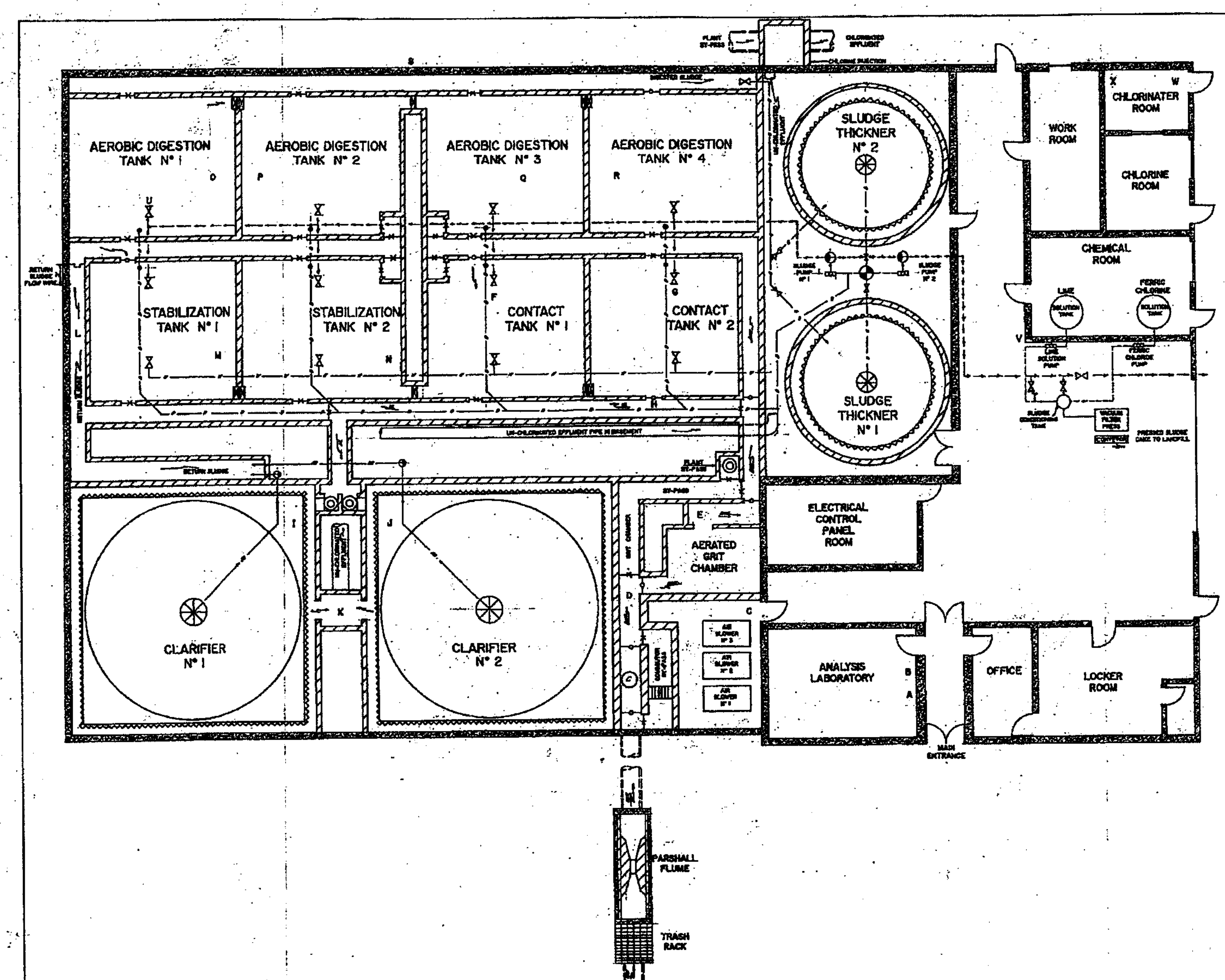
WASTEWATER TREATMENT PLANT
for the
CITY of DUQUESNE
ALLEGHENY COUNTY, PA

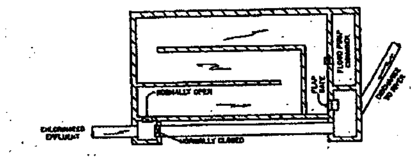
PROCESS CONTROL

GLENN ENGINEERING & ASSOCIATES LTD.
Registered Engineers — North Huntingdon, Pa.

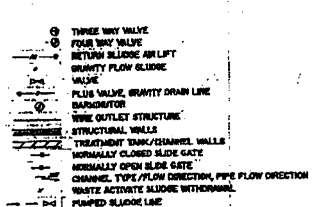
SCALE: AS NOTED

SHEET No 1 of 1





CHLORINE CONTACT TANK



SAMPLE POINTS LOCATION & DESIGNATION

POINT/TYPE		LOCATION	WORKSHEET
A	METER	In Laboratory	Plant Influent (Raw) Total Daily Flow, GPD
B	METER	In Laboratory	Air Usage – Total Daily Air Supplied, Cu. Ft.
C	GAUGE	By Blowers	Air Pressure being Supplied to Plant, P.S.I.
D	CHANNEL	By Grit Tank	Plant Influent (Raw) Sample Point
E	TANK	In Grit Tank	Plant Influent (Raw) Sample Point (Alternate)
F	TANK	In Tank C – 1	Contact Tank No. 2 Sample Point
G	TANK	In Tank C – 2	Contact Tank No. 2 Sample Point
H	CHANNEL	By Tank C – 2	Mixed Liquor Sample Point
I	TANK	In Tank CL – 1	Clarifier Tank No. 1 Sample Point
J	TANK	In Tank CL – 2	Clarifier Tank No. 2 Sample Point
K	CHANNEL	By Tank CL – 2	Plant Un-chlorinated Effluent (Final) Sample
L	WEIR	By Tank S– 1	Return Sludge Flow Measurement
M	TANK	In Tank S– 1	Stabilization Tank No. 1 Sample Point
N	TANK	In Tank S– 2	Stabilization Tank No. 2 Sample Point
O	TANK	In Tank D– 1	Digestor Tank No. 1 Sample Point
P	TANK	In Tank D– 2	Digestor Tank No. 2 Sample Point
Q	TANK	In Tank D– 3	Digestor Tank No. 3 Sample Point
R	TANK	In Tank D– 4	Digestor Tank No. 4 Sample Point
S	METER	Between D–2, D–3	Air Flow Volume to each tank, CFM
T	GRAB	At Vacuum Filter	Sludge Return Pipe Outlet
U	GRAB	In Tank D – 1	Sludge Return Pipe Outlet
V	METER	In Hallway	Chlorine Gas Leak Detector
W	GAUGE	In Chlorine Room	Scale Weight of Chlorine Gas Cylinder
X	METER	In Chlorine Room	Feed Rate of Chlorine Gas Injector
Y			
Z	TANK	In Tank CC – 1	Chlorine Contact Tank Sample Point

REVISIONS		
Date	Description	By

DRAWN BY: H.E.S. DATE: MARCH 23, 1983

SEWAGE TREATMENT PLANT

SITUATE IN

CITY OF DUQUESNE
ALLEGHENY COUNTY, PA

SAMPLE TEST LOCATIONS

GLENN ENGINEERING & ASSOCIATES LTD.
Registered Engineers - North Huntingdon, Pa.

SCALE: N.T.S.

SHEET Nº 1 of 1

APPENDIX M

EXISTING PROCESS CALCULATIONS

Duquesne WWTP Capacity Analysis

Tank Description	Surface Area	Depth @T/Wall	Depth @ Q_{av}	Depth @ Q_{max}	Vol Wall		Vol Avg		Vol Max	
	[FT^2]	[FT]	[FT]	[FT]	[FT^3]	[kGAL]	[FT^3]	[kGAL]	[FT^3]	[kGAL]
Stabilization No. 1	495.67	16.70	13.50	14.40	8,277.69	61.92	6,691.55	50.05	7,137.65	53.39
Stabilization No. 2	512.95	16.60	13.50	14.40	8,514.97	63.69	6,924.83	51.80	7,386.48	55.25
Contact No. 1	515.57	17.55	13.50	14.40	9,048.25	67.68	6,960.20	52.06	7,424.21	55.53
Contact No. 2	489.44	16.50	13.50	14.40	8,075.76	60.41	6,607.44	49.42	7,047.94	52.72
Aerobic Digester No. 1	570.15	17.60	---	---	10,034.64	75.06	---	---	---	---
Aerobic Digester No. 2	512.95	17.35	---	---	8,899.68	66.57	---	---	---	---
Aerobic Digester No. 3	517.84	17.50	---	---	9,062.20	67.79	---	---	---	---
Aerobic Digester No. 4	554.57	17.60	---	---	9,760.43	73.01	---	---	---	---
Final Clarifier No. 1	1,156.00	---	9.90	10.00	---	---	9,215.39	68.93	9,306.18	69.61
Final Clarifier No. 2	1,156.00	---	9.90	10.00	---	---	9,215.39	68.93	9,306.18	69.61
Chlorine Contact Tank	1,277.80	17.50	9.00	10.30	---	---	8,398.26	62.82	9,578.56	71.65
Grit Chamber	130.00	---	13.50	---	---	---	1,527.50	11.43	---	---

Final Clarifier Capacity

Design Criteria

Surface Overflow Rate =	800.00	gpd/ft²	[MMAF]
Surface Overflow Rate =	1,200.00	gpd/ft²	[PHF]
Weir Loading =	10,000.00	gpd/ft	[MMAF]

Method

Q = (SOR) x (A)

Q = (WL) x (L)

Analysis

A =	2,312.00	ft²
Q_{av} =	1,849,600.00	gpd
	1.85	mgd
Q_{max} =	2,774,400.00	gpm
	2.77	mgd
Total Weir Length =	272.00	ft
Q_{av} =	2,720,000.00	gpd
	2.72	mgd

Aeration Capacity

Design Criteria

$T_D \geq$ 5.00 hr [MMAF]

Method

Q = V / T_D

Analysis

V_{Qav} =	203,336.36	gallons
Q_{av} =	40,667.27	gph
	0.98	mgd

Chlorine Contact Tank Capacity

Design Criteria

$T_D \geq$	30.00	min	[MMAF]
$T_D \geq$	15.00	min	[PHF]

Method

Q = V / T_D

Analysis

V_{Qav} =	62,819.00	gallons
Q_{av} =	2,093.97	gpm
	3.02	mgd
V_{max} =	71,647.62	gallons
Q_{max} =	4,776.51	gpm
	6.88	mgd

Grit Chamber Capacity

Design Criteria

$T_D \geq$ 3.00 min [MMAF]

Method

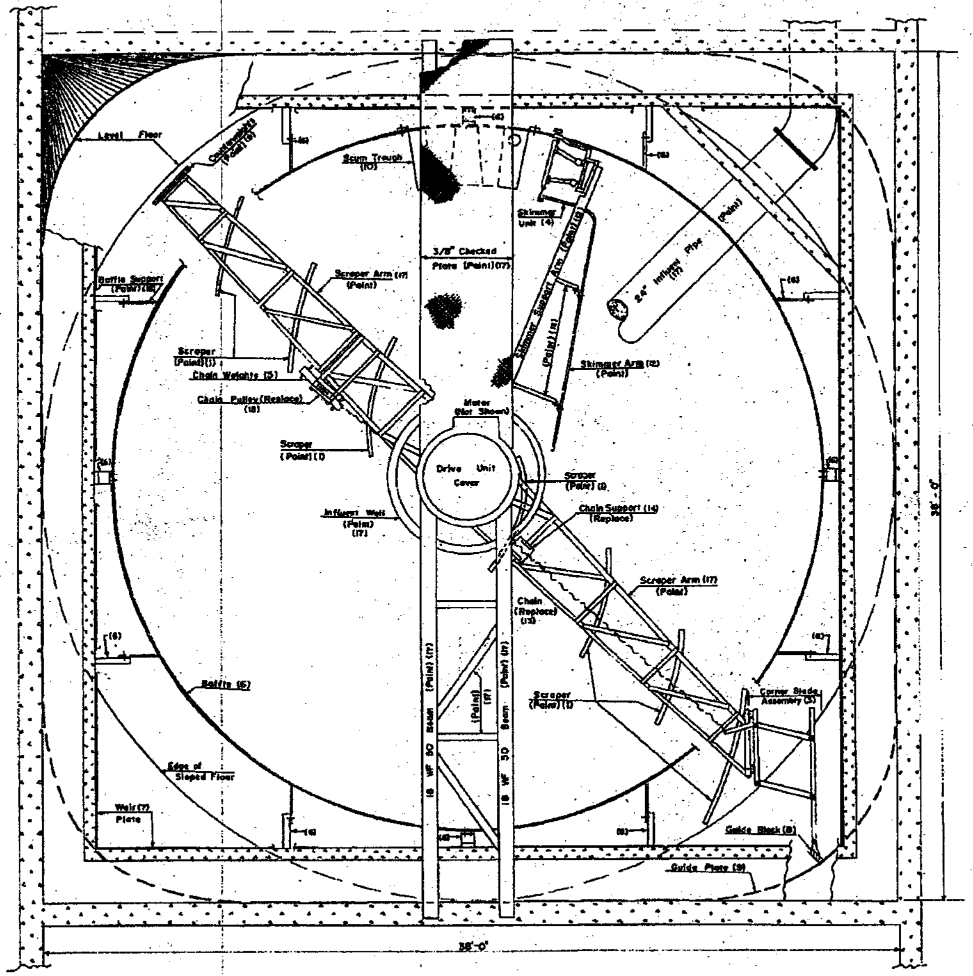
Q = V / T_D

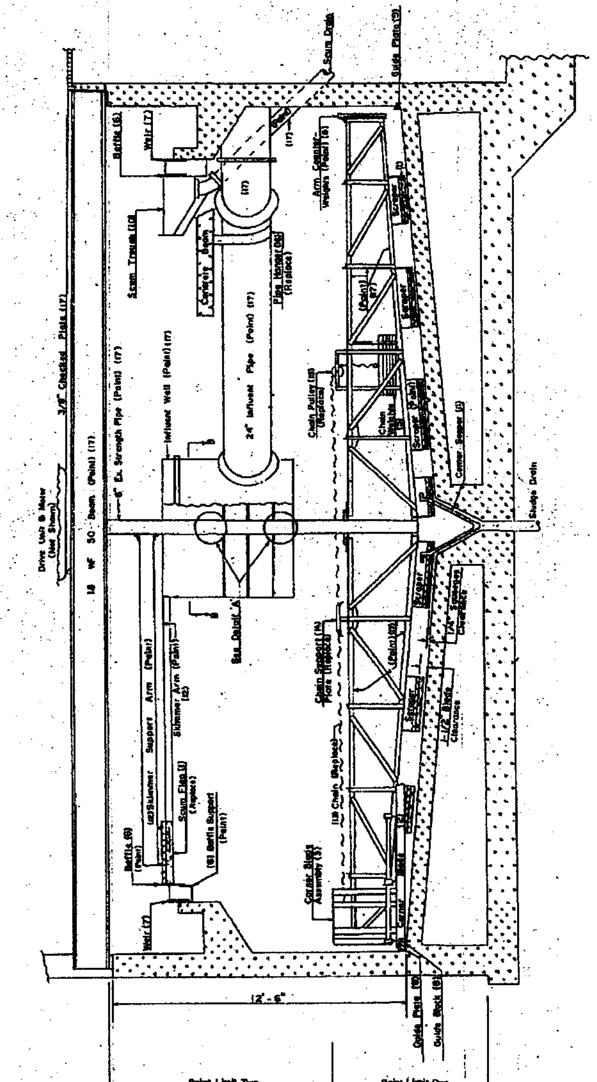
Analysis

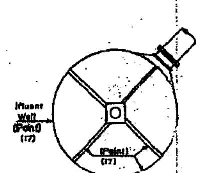
V_{Qav} =	11,425.70	gallons
Q_{av} =	3,808.57	gpm
	5.48	mgd

APPENDIX N

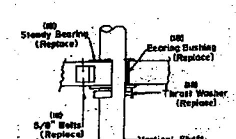
EXISTING FINAL CLARIFIER PLAN AND PROPOSED UPGRADE EQUIPMENT







SECTION 'B'



DETAIL 'A'

NOTES

REPLACE PAINT	(1)	FLAPS SCUM & SCRAPER SQUEEZES
REPLACE	(2)	FLAPS CORNER BLADE
REPLACE PAINT	(3)	CORNER ASSEMBLY UNIT
PAINT	(4)	SCUM UNIT
PAINT	(5)	CHAIN, WEIGHTS & COUNTERWEIGHTS
PAINT	(6)	BAFFLE PLATE & SUPPORTS
CLEAN	(7)	WEIR PLATE
REPLACE	(8)	GUIDE BLOCK
CLEAN	(9)	GUIDE PLATE
PAINT	(10)	SCREEN TROUGH
CLEAN	(11)	CENTER SCRAPER BLADES
PAINT	(12)	SKIMMER ARMS
REPLACE	(13)	CHAIN
REPLACE	(14)	CHAIN SUPPORT
REPLACE	(15)	CHAIN PULLEY
REPLACE	(16)	PIPE HANGER
PAINT	(17)	MISCELLANEOUS METALS, PIPES
REPLACE	(18)	BEARINGS / BUSHINGS, MAIN SHAFTS

REVISIONS		
Date	Description	By

DRAWN BY: R. C. H. DATE: SEPTEMBER 1987

SEWAGE TREATMENT PLANT
CLARIFIER REHABILITION - CD XIII

CITY OF DUQUESNE

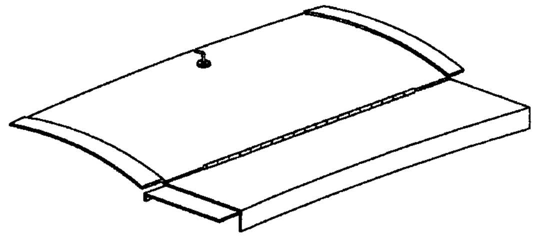
ALLEGHENY COUNTY, PA.

TYPICAL TANK
PLAN AND SECTION

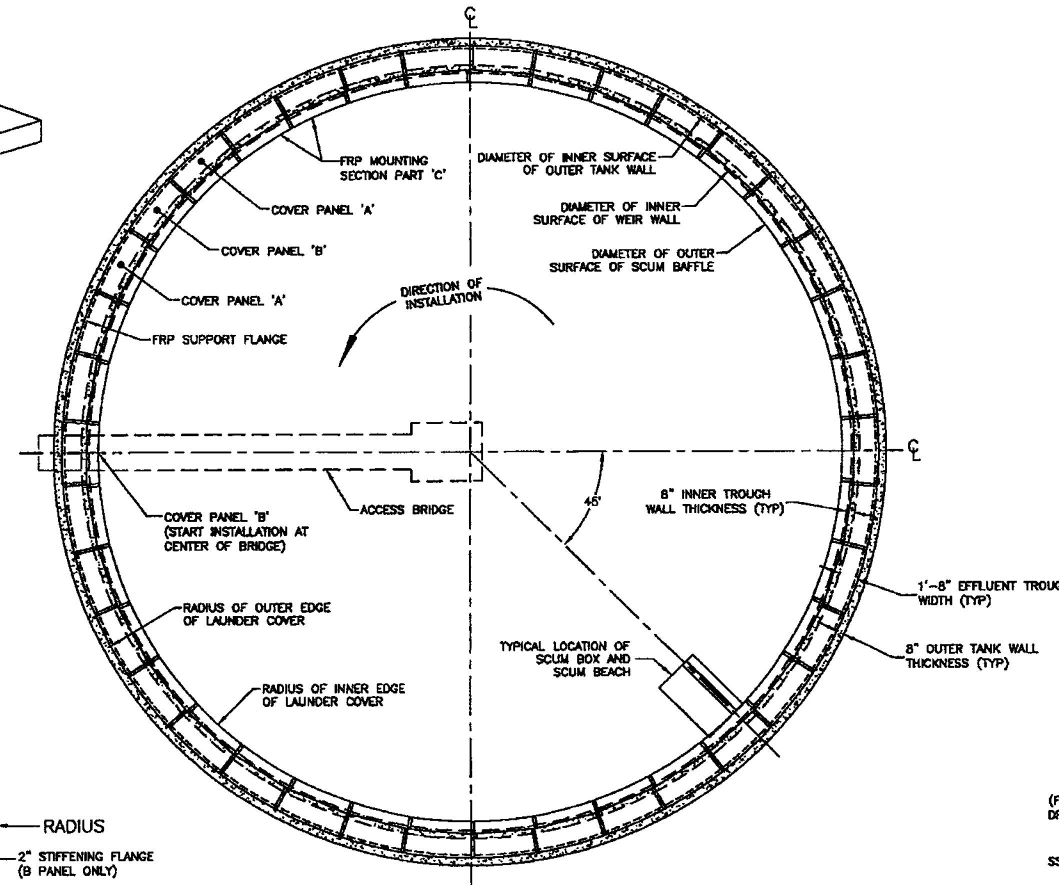
GLENN ENGINEERING & ASSOCIATES LTD.
Registered Engineers — North Versailles, Pa.

SCALE: 3/8" = 1'

SHEET Nº 1 of 1

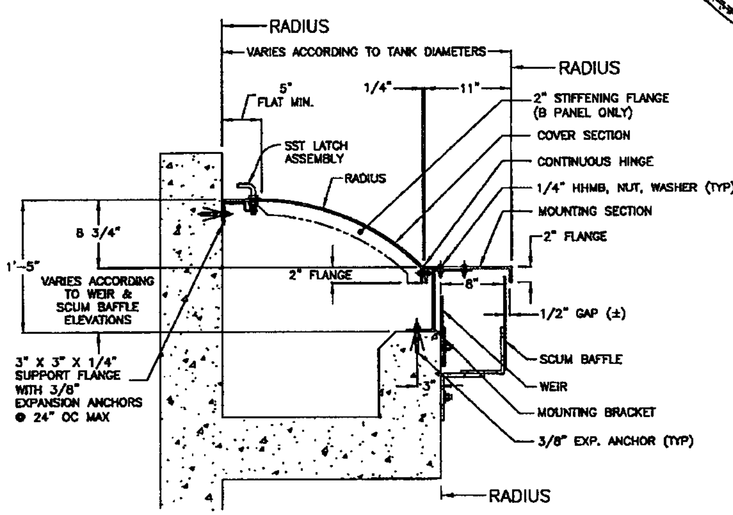


PERSPECTIVE VIEW

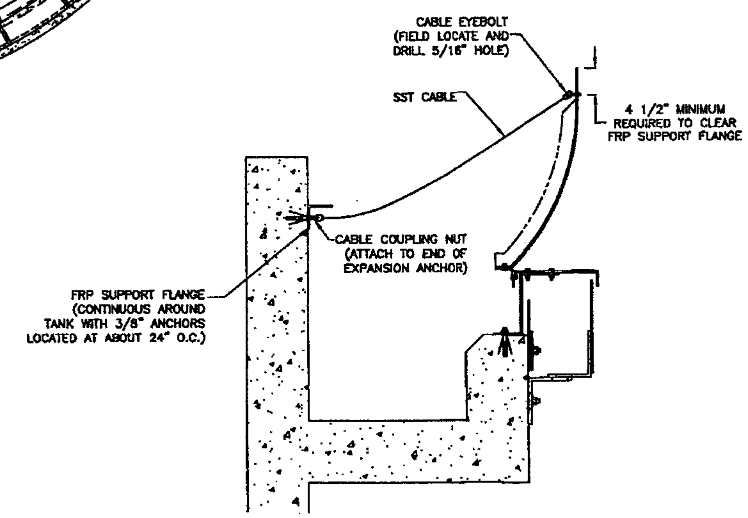


COVER LAYOUT PLAN VIEW

(NO SCALE)



SECTION A–A



COVER CABLE RESTRAINT ASSEMBLY

(XX PCS/TANK – XX TOTAL)

REVISION:

NEFCO, INC.
4362 NORTHLAKE BLVD. SUITE 213
PALM BEACH GARDENS, FL 33410
(561) 775-9303

NEFCO

ENGINEER:

CONTRACTOR:

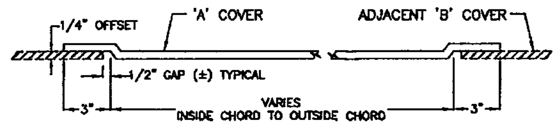
PURCHASE ORDER:

PROJECT NAME:

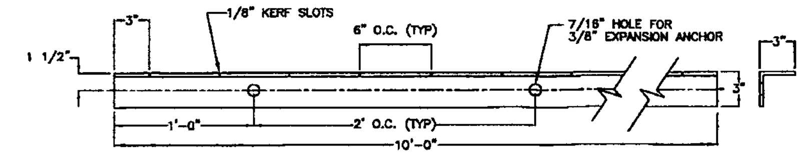
TITLE:
TYPICAL LAUNDER COVER WEIR–WALL MOUNT CONFIGURATION

DWG BY: TJK
CHK BY:
SCALE: N.T.S
DATE: 10/17/08

DWG NO. TYPICAL
SHEET NO: 1 OF 2

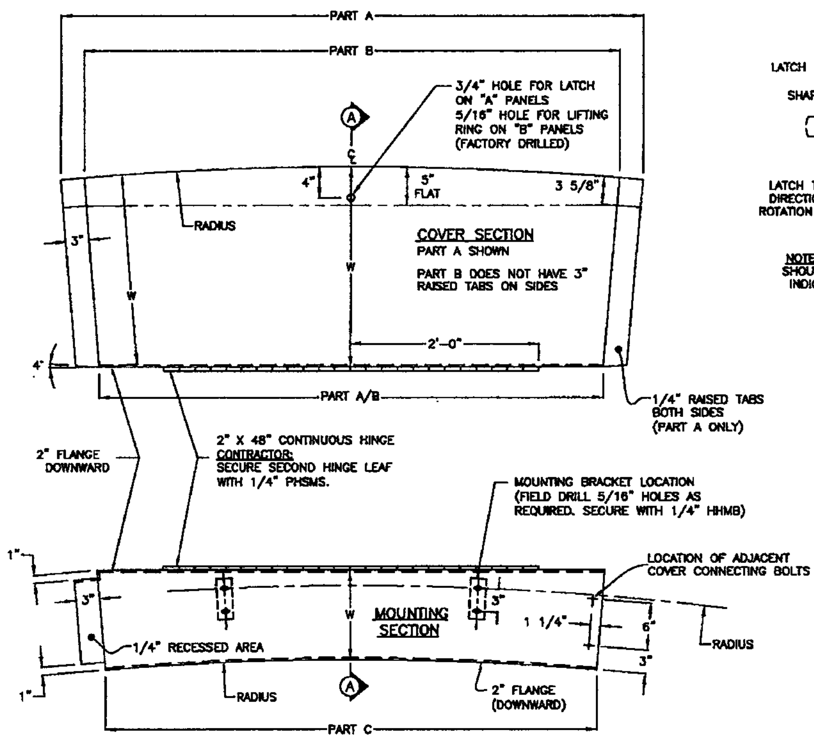


RAISED TAB PROFILE



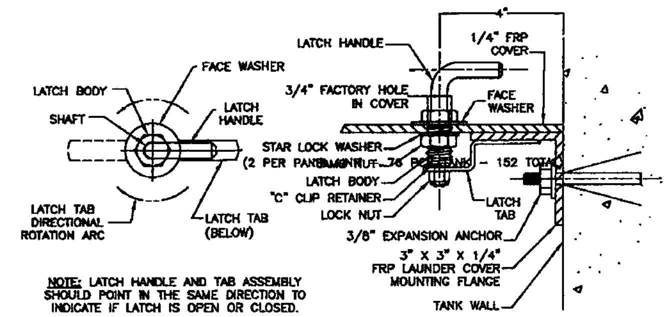
FRP SUPPORT FLANGE

(XX PCS/TANK – XX TOTAL)



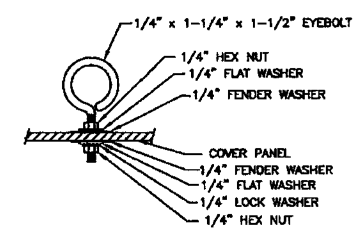
LAUNDER COVER PANEL UNIT

TOP VIEW



"A" PANEL LATCH

(XX PCS/TANK – XX TOTAL)



"B" PANEL LIFTING RING

(XX PCS/TANK – XX TOTAL)

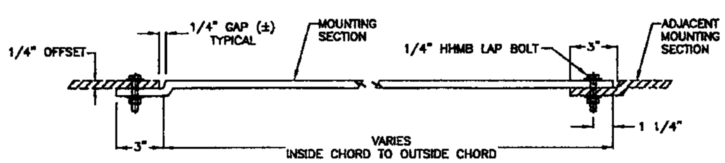
NOTES:

1. DIAMETER AT COVER = XX'-X"
2. COVER PANELS ARE CHOPPED STRAND FRP WITH 1/4" MINIMUM THICKNESS
3. MINIMUM 20 MIL GELCOAT ON UPPER PANEL SURFACE (MARINE WHITE COLOR)
4. 357-211 PLN CTC GLASS REINFORCEMENT OR EQUIVALENT. ADDITIONAL SUPPORT/REINFORCEMENT AS REQ'D.
5. COREZYN, COR75-AQ-010, ISOPHTHALIC RESIN OR OR EQUIVALENT, WITH MINIMUM .05% BLACK PIGMENT, MAX 5% FILL AND UV SUPRESSED
6. PARTS SHALL BE OPAQUE BLACK BENEATH GELCOAT SURFACE, WITH NO FIBER SHOWING
7. GELCOAT TO BE MARINE WHITE
8. LAMINATE SHALL NOT HAVE LESS THAN 30% GLASS CONTENT
9. ONE-EIGHTH INCH RADIUS ON ALL CORNERS
10. PARTS ARE KNIFE TRIMMED, WITH EDGES SANDED AND HOT COATED
11. MOUNTING HOLES ARE FIELD DRILLED (7/16")
12. ALL FASTENERS ARE 304 SST UNLESS OTHERWISE NOTED
13. FIELD CUT PANELS AS REQUIRED PER MANUFACTURERS INSTRUCTIONS
14. EACH PANEL SHALL HAVE THE FOLLOWING MINIMUM PHYSICAL PROPERTIES:

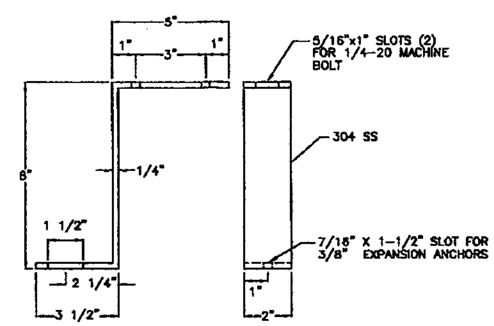
PROPERTY	TEST	MINIMUM VALUE
TENSILE STRENGTH	ASTM D-638	12,000 PSI
FLEXURAL STRENGTH	ASTM D-790	20,000 PSI
FLEXURAL MODULUS	ASTM D-790	1.0x10^6 PSI
BARCOL HARDNESS	ASTM D-2583	40
NOTCHED IZOD IMPACT	ASTM D-256	12 FT-LBS/IN
WATER ABSORPTION	ASTM D-570	0.2%

PATENTS:

U.S. PATENT NO. 5,670,045
5,965,023
6,216,881
6,712,222



MOUNTING SECTION
RECESSED TAB PROFILE



MOUNTING BRACKET

(2 PER PANEL UNIT – XX PCS/TANK – XX TOTAL)

MATERIALS / TANK		
ITEM	QTY.	DESCRIPTION
1	XX	FRP COVER SECTIONS – PART A (WITH TABS)
2	XX	FRP COVER SECTIONS – PART B (WITHOUT TABS)
3	XX	FRP MOUNTING SECTIONS – PART C
4	XX	FRP SUPPORT FLANGE
5	XX	SST MOUNTING BRACKETS
6	XX	SST LATCH
7	XX	SST LIFTING RING
8	XX	SST 3/8" X 3 3/4" EXPANSION ANCHOR, NUT, WASHER
9	XX	SST 2-1/2" X 48" CONTINUOUS HINGE WITH 1/4" x 3/4" PANHEADSLOT MACHINE SCREW, NUT, WASHER, LOCK WASHER
10	XX	SST 1/4 X 1 1/4" HHMB, NUT, (2) WASHERS, LOCK WASHER
11	XX	SST COVER RESTRAINT ASSEMBLY

REVISION:

NEFCO, INC.
4362 NORTHLAKE BLVD. SUITE 213
PALM BEACH GARDENS, FL 33410
(561) 775-9303

ENGINEER:

CONTRACTOR:

PURCHASE ORDER:

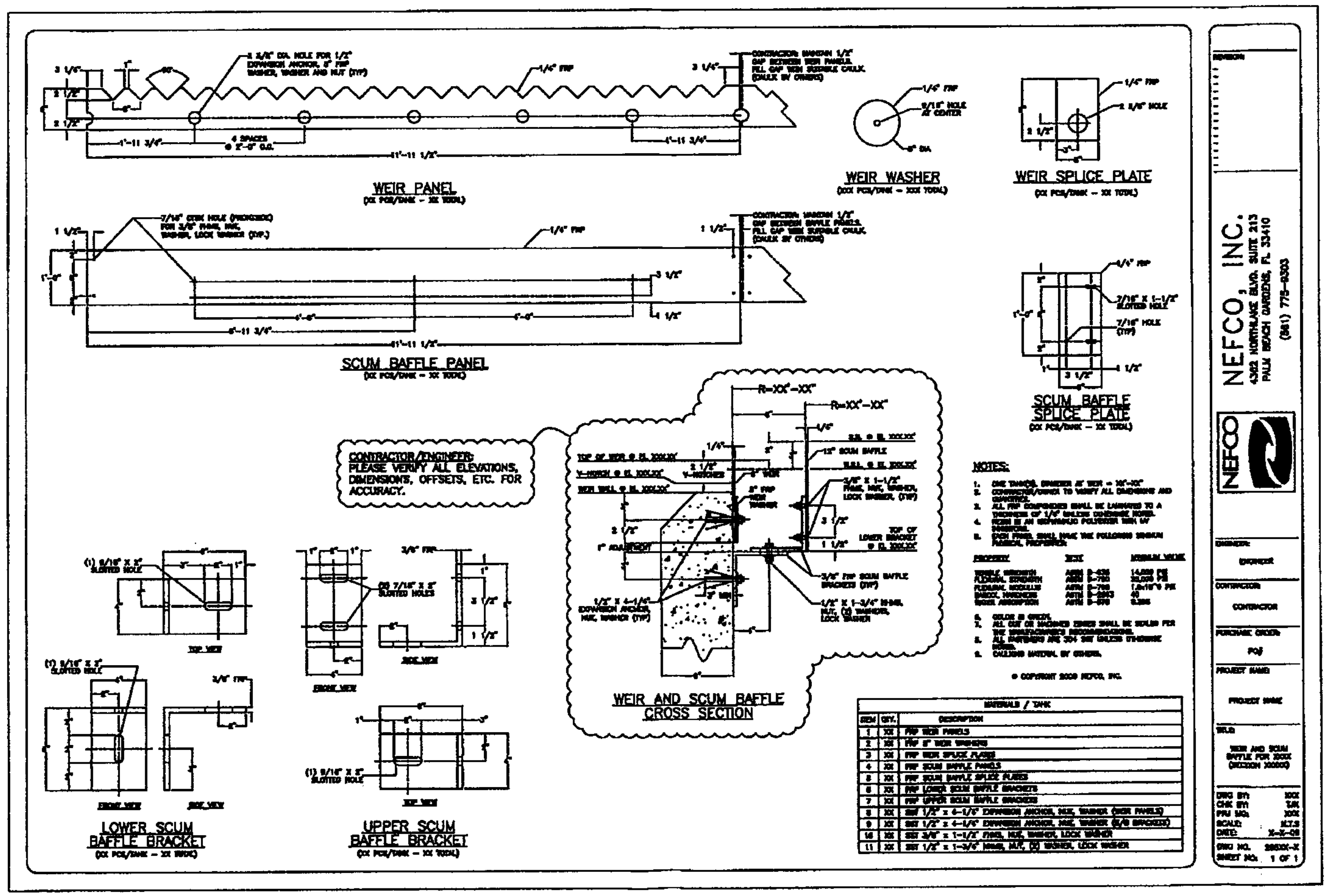
PROJECT NAME:

TITLE:

TYPICAL
LAUNDER COVER
WEIR-WALL MOUNT
CONFIGURATION

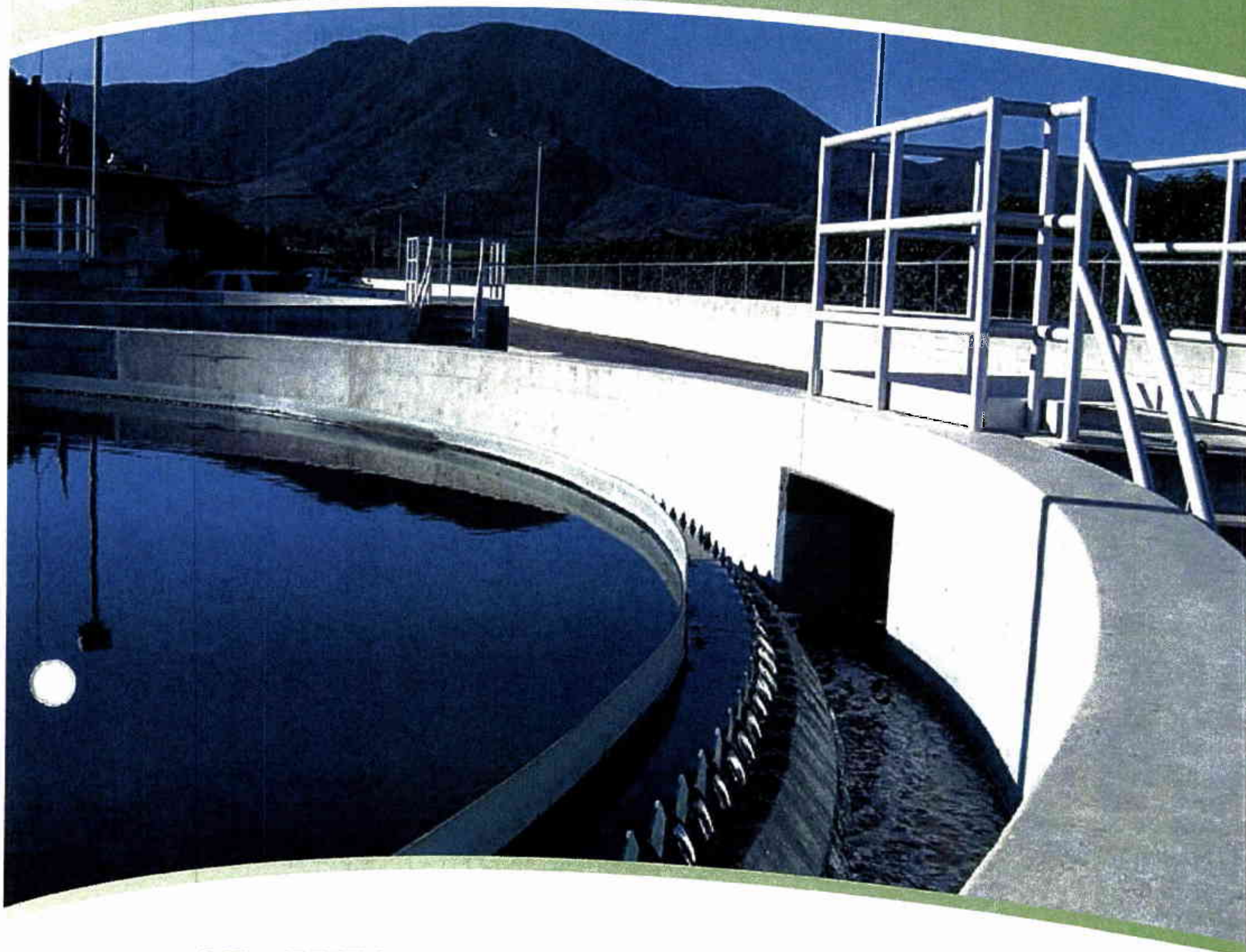
DWG BY: TJK
CHK BY:
SCALE: N.T.S
DATE: 10/17/08

DWG NO. TYPICAL
SHEET NO: 2 OF 2



WEIR PANEL
SCUM BAFFLE PANEL
WEIR WASHER
WEIR SPLICE PLATE
SCUM BAFFLE SPLICE PLATE
CONTRACTOR/ENGINEER: PLEASE VERIFY ALL ELEVATIONS, DIMENSIONS, OFFSETS, ETC. FOR ACCURACY.
WEIR AND SCUM BAFFLE CROSS SECTION
NOTES:
LOWER SCUM BAFFLE BRACKET
UPPER SCUM BAFFLE BRACKET
NEFCO, INC.
4302 NORTHLAKE BLVD. SUITE 213
PALM BEACH GARDENS, FL 33410
(561) 775-6303

WEIRS AND SCUM BAFFLES



WEIRS AND SCUM BAFFLES

BENEFITS

- Complete range of notch patterns
- Fiberglass construction
- Full range of height and thickness
- Lengths to 20 feet

FEATURES

- Fiberglass construction
- Corrosion resistant
- UV suppressed
- Custom fabrication available
- Available in ISO, VE, NSF61

NEFCO

THE CLEAR DIFFERENCE

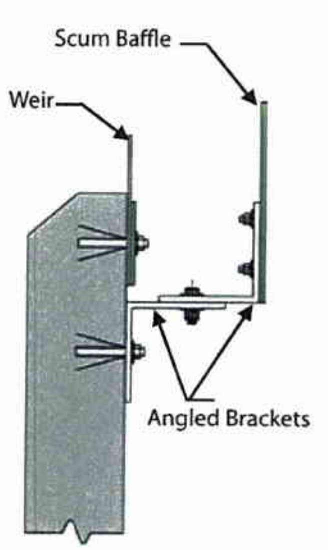
COST-EFFECTIVE WEIR AND SCUM BAFFLE SYSTEMS

THE BASICS

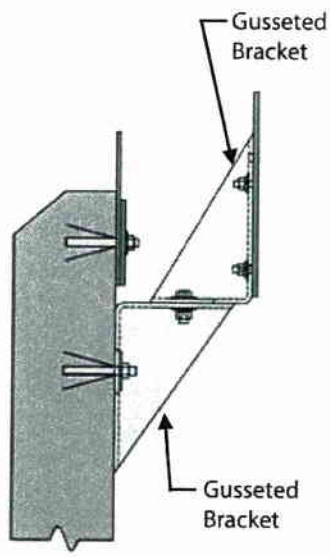
- Custom engineered to clarifier/system dimensions
- Corrosion resistant fiberglass
- Retains floatables and scum
- Maintains even effluent flow into trough
- Stainless steel hardware
- Vast array of shapes and sizes available
- Easily retrofitted to existing systems
- Most cost-effective corrosion resistant material

MOUNTING OPTIONS

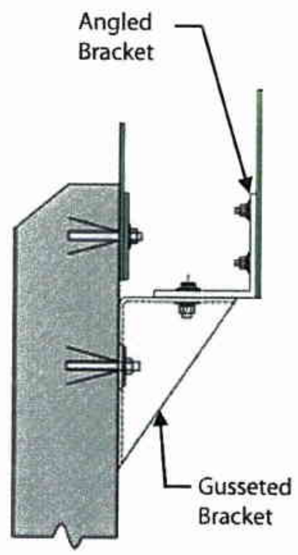
Angled Bracket Configuration



Gusseted Bracket Configuration



Mixed Bracket Configuration



For more information visit our web site www.nefcoinnovations.com

NEFCO
4362 Northlake Blvd, Ste 213
Palm Beach Gardens, FL 33410

STAMFORD BAFFLE 2.0™

STAMFORD BAFFLE 2.0™

BENEFITS

- Reduces clarifier TSS by as much as 70%
- Reduces turbidity
- Improves hydraulic capacity
- Installs in half the time of other baffles

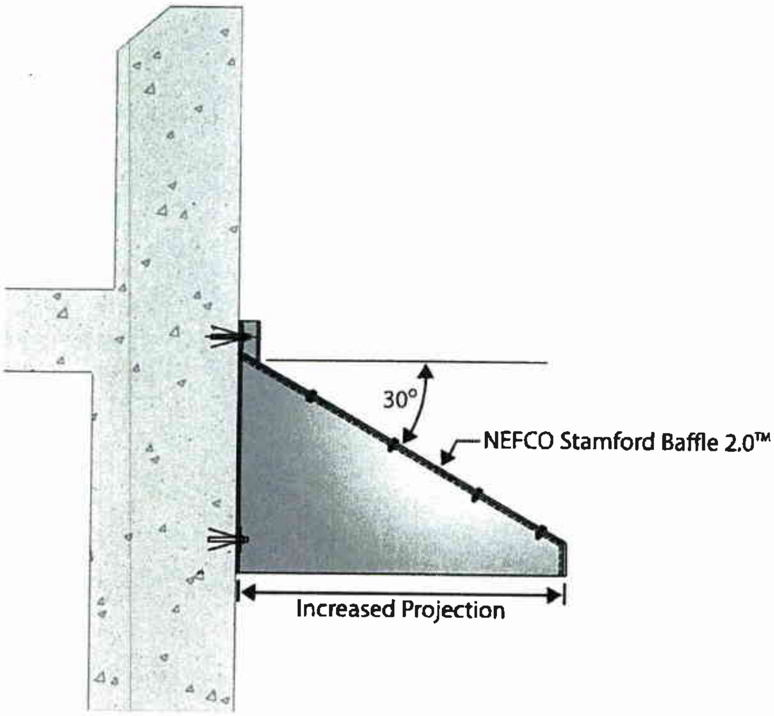
FEATURES

- Increased horizontal projection
- 30° Inclination angle
- Integrally molded bracket
- Rugged construction
- Corrosion resistant
- 5 Year warranty

NEFCO

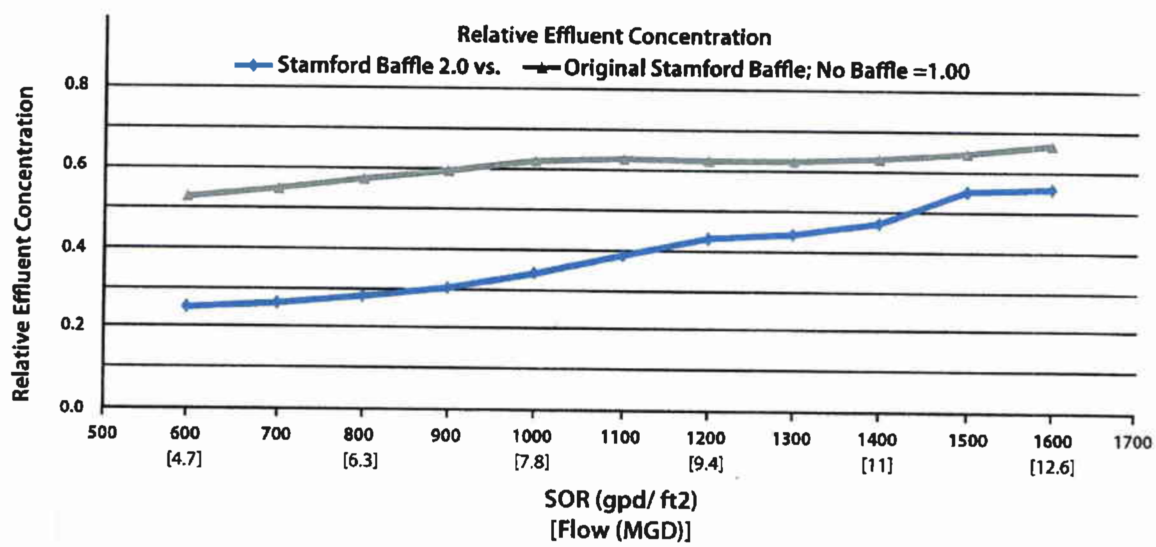
THE CLEAR DIFFERENCE.

THE FIRST IMPROVEMENT IN DENSITY CURRENT BAFFLE PERFORMANCE IN 30 YEARS



THE STUDY

NEFCO has recently completed a multi-year CFD Baffle Design Study that led to the development of Stamford Baffle 2.0, which is over 30% more effective than the original 45° Stamford Baffle. The new 30° baffle will improve clarifier performance by reducing overflow TSS as much as 70%!

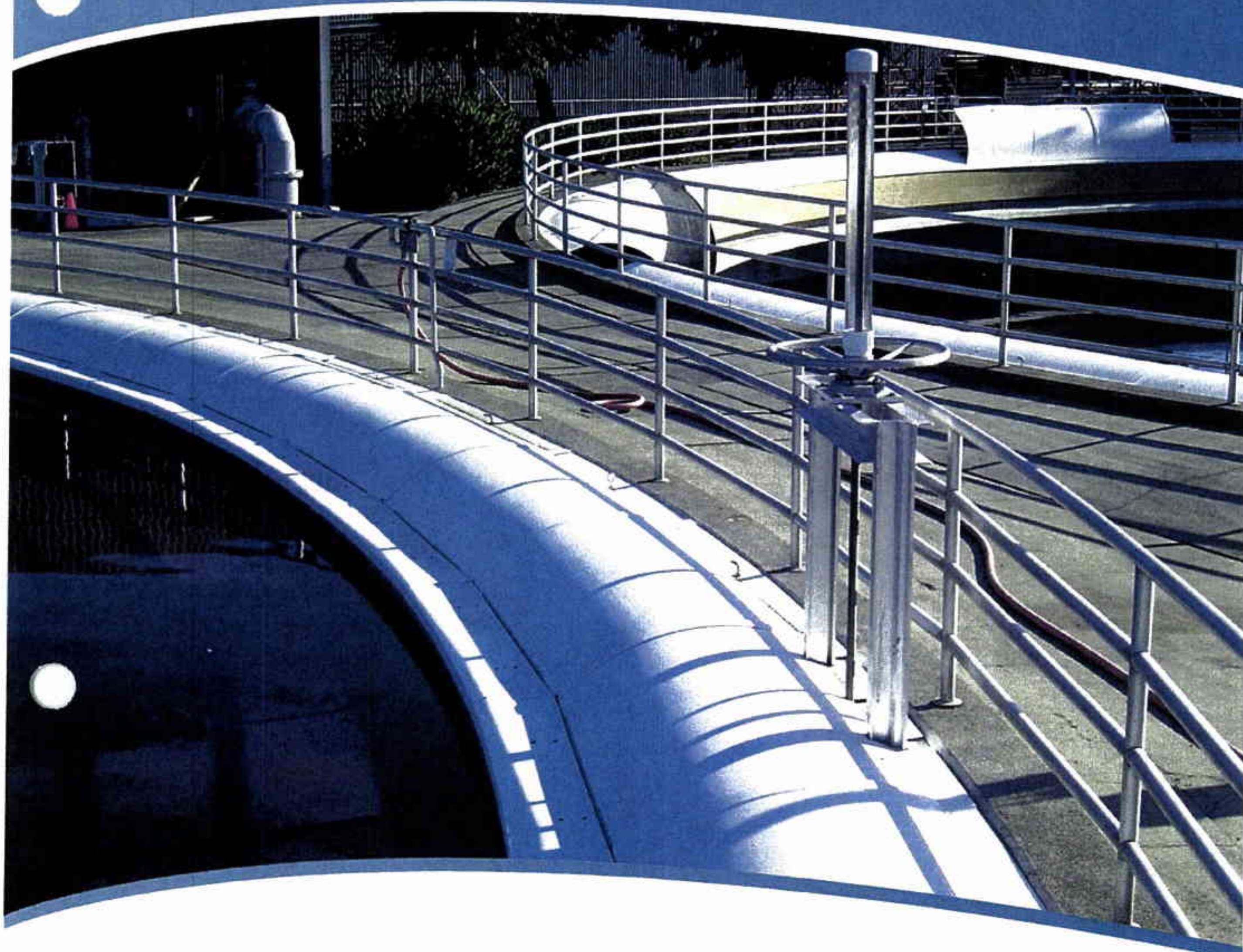


For more information visit our web site www.nefcoinnovations.com

Patent # 5,252,205
Patent # 5,596,483
Additional patents applied for

NEFCO
4362 Northlake Blvd, Ste 213
Palm Beach Gardens, FL 33410
(561) 775-9303

LAUNDER COVER SYSTEMS



LAUNDER COVER SYSTEMS

BENEFITS

- Inhibits algae growth
- Contains odors
- Operates 24/7
- Reduces manpower
- Maintenance free

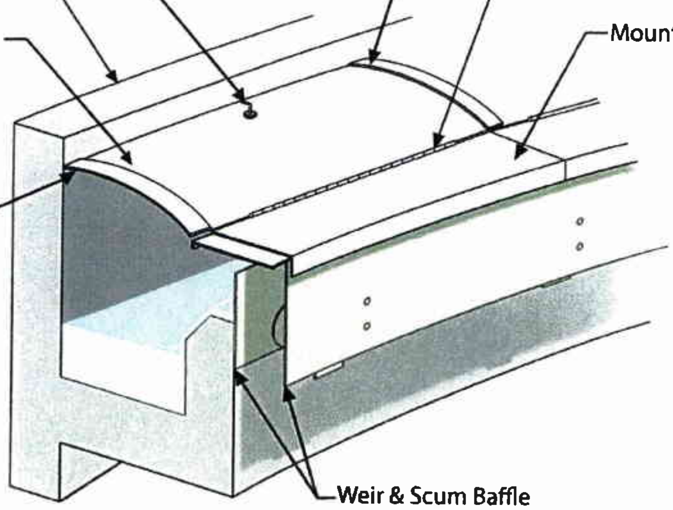
FEATURES

- Hinged cover panels open to tank center
- Stainless steel latch/handle for safety and security
- Attractive arched design
- Restraint cable

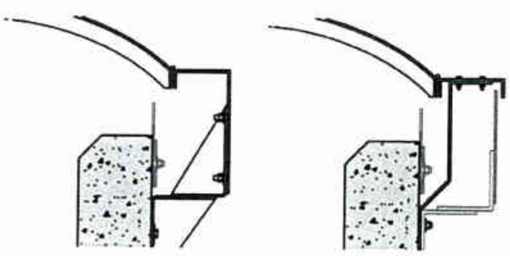
NEFCO

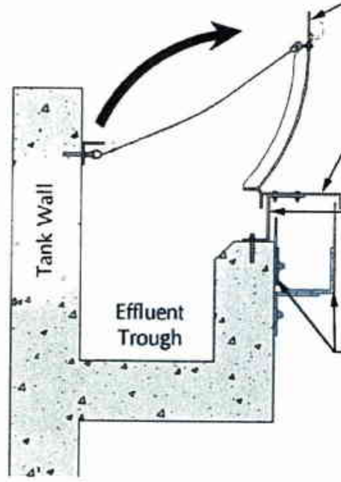
THE CLEAR DIFFERENCE.

REVOLUTIONIZING THE WAY TREATMENT PLANTS DEAL WITH ALGAE



MOUNTING OPTIONS





OTHER COVER PRODUCTS

- Tank-wall mounted
- Weir-wall mounted
- Walk-on
- Inboard launder
- Dual inboard launder
- Channel Covers

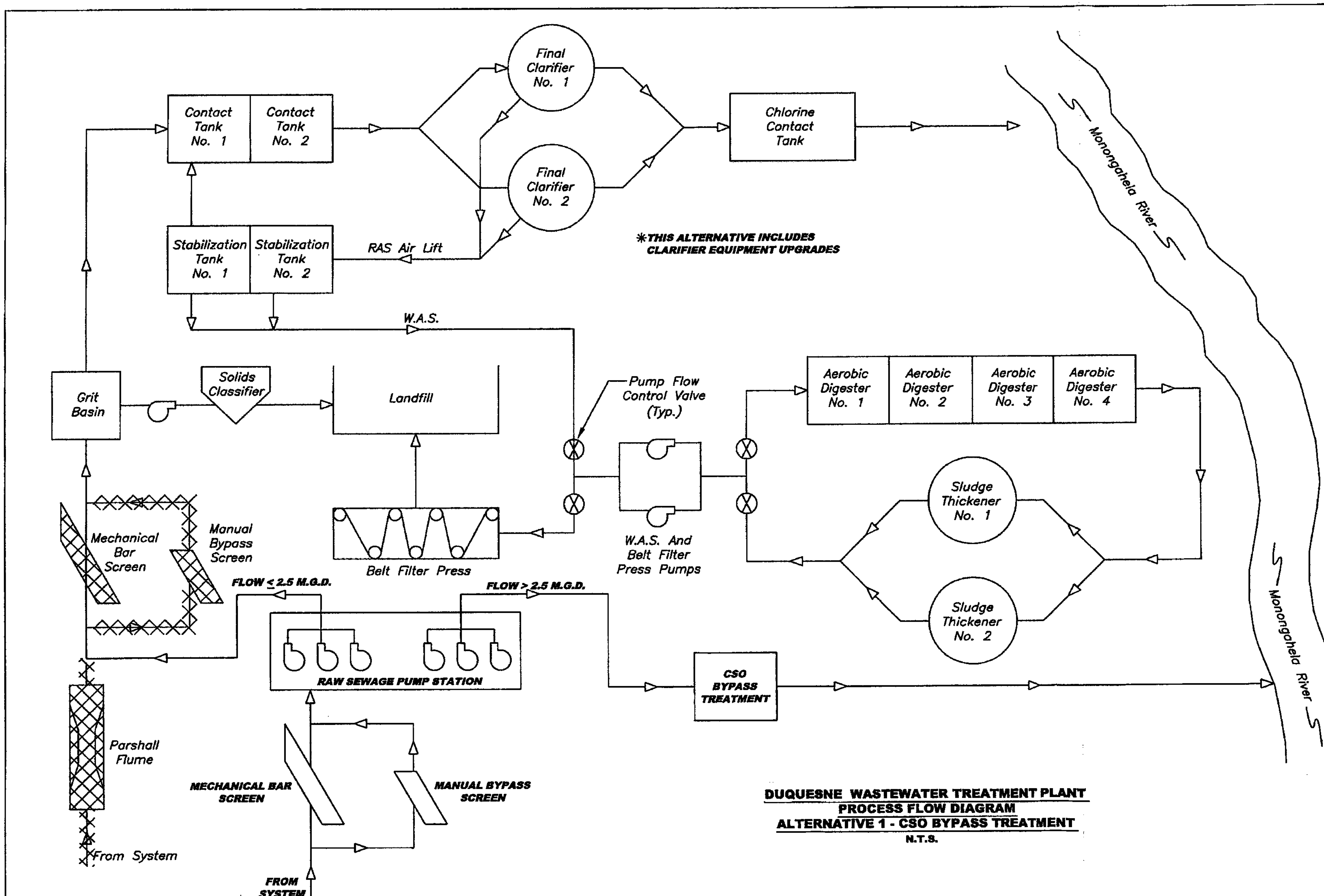
For more information visit our web site www.nefcoinnovations.com

Patent No. 5,670,045
Patent No. 5,965,023
Patent No. 6,216,881
Patent No. 6,712,222
Patent No. 7,473,358
Patent No. 7,591,381

NEFCO
4362 Northlake Blvd, Ste 213
Palm Beach Gardens, FL 33410
(561) 775-9303

Appendix O

Alternative 1
Process Flow Diagram



Scale:	As Shown
Date:	August 2014
Drawn By:	EHD
Checked By:	BMC
Approved By:	SHG

Order No. 220-53

Drawing No. EX5

Sheet No. 1 of 1

BOROUGH OF DUQUESNE
ALLEGHENY COUNTY, PENNSYLVANIA
EXISTING WASTEWATER TREATMENT PLANT
ALTERNATIVE 1 - PROCESS FLOW DIAGRAM

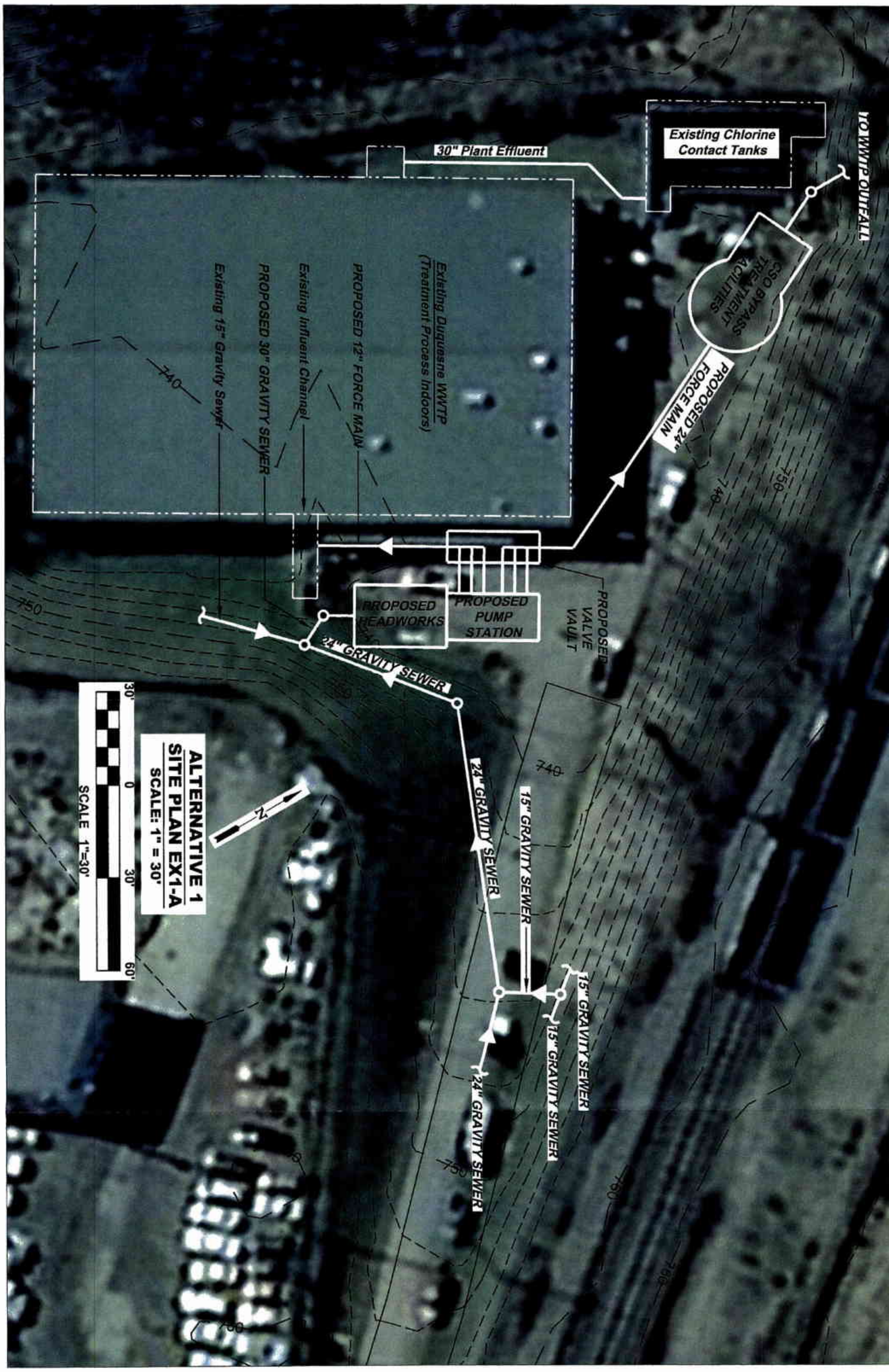
KLH ENGINEERS, INC

5173 Campbells Run Road
Pittsburgh, PA 15205
Phone: 412.494.0610
Fax: 412.494.0426
info@klhengineers.com

Date	Revisions	Date	Revisions

Appendix P

Alternative 1
Site Plan



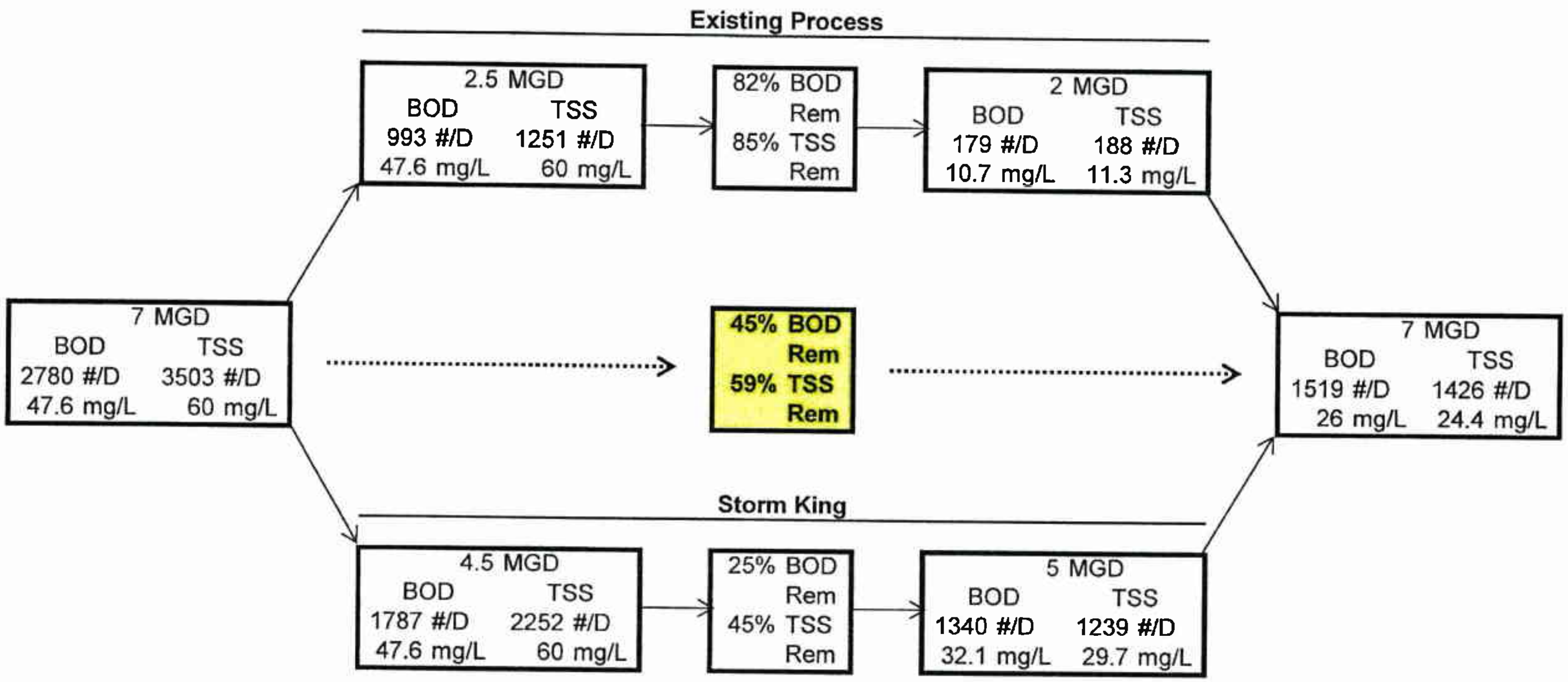
Scale: As Shown	BOROUGH OF DUQUESNE	KLH ENGINEERS, INC	Date	Revisions	Date	Revisions
Date: August 2014	ALLEGHENY COUNTY, PENNSYLVANIA	5173 Campbells Run Road, Pittsburgh, PA 15205				
Drawn By: EHD	WASTEWATER TREATMENT PLANT	Phone: 412.484.0510				
Checked By: BMC	ALTERNATIVE 1 SITE PLAN	Fax: 412.484.0426				
Approved By: SHG		info@klhengineers.com				

Order No. 220-53
Drawing No. EX1
Sheet No. 1 of 1

APPENDIX Q

ALTERNATIVE 1
PROCESS CALCULATIONS

Duquesne WWTP CSO Bypass Treatment
BOD and TSS Removal Mass Balance



Wet Weather Solutions

Hydro International

CSO Solutions for the Future...®

STORM KING® DETAIL INFORMATION

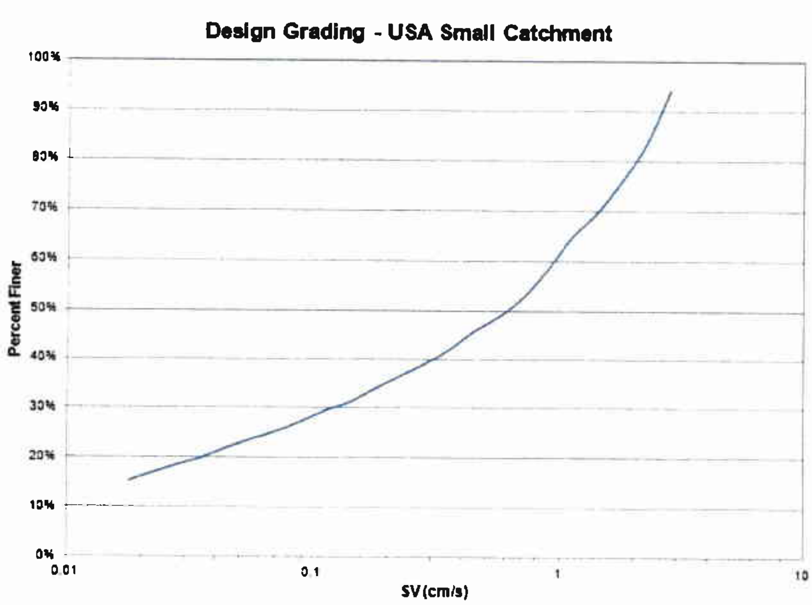
To:	KLH
Project:	Duquesne WWTP
Location:	Duquesne, PA
Hydro Ref:	14-3107-A
Date:	June 25, 2014

The Storm King shall use an induced vortex and a Swirl Cleanse screen with 4mm diameter opening apertures to separate solids from liquids. The Storm King shall be self-activating and shall not require instrumentation or external power. The Storm King shall be reliable, essentially non-clogging, self-cleansing and contain no moving or interchangeable parts.

DESIGN SPECIFICATIONS

A. **Performance Objective:** The Storm King shall treat combined sewage to primary treatment levels while removing gross solids, grit, sand, silts and sediment, and floatable debris greater than 4mm in two directions while providing in vessel disinfection. The equipment shall require no external power source and shall have no moving parts. All captured pollutants (both floatable and settleable solids), shall be removed from a centrally located sump within the separator or via gravity. The Storm King shall provide an induced hydrodynamic mixing regime in the unit with sufficient detention time conducive for high rate disinfection using sodium hypochlorite.

B. **Grading Curve – Particle Settling Velocity vs. Percent Finer**



Hydro International (Wet Weather), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

C. Treatment Target

	Treatment Objective	Peak Design Flow Rate
1.	Total Suspended Solids Reduction	45 - 50%
2.	Total Gross BOD_5 Reduction	25 - 30%
3.	Effluent Fecal/E. coli Concentration	≤200 cfu/100mL
4.	Screening (in two directions)	~4mm
5.	Grit Removal	95% of 106 micron

D. Design Criteria

1.	Peak Design Inflow Rate	12.00	mgd
2.	Spill Flow Rate	11.10	mgd
3.	Underflow Rate	0.90	mgd
4.	Number of Units	1	No.
5.	Chamber Diameter	30	ft.
6.	Inlet Pipe Diameter	30	in.
7.	Underflow Pipe Diameter	8	in.
8.	Overspill Pipe Diameter	6	in.
9.	Separator Headloss at Peak Design Inflow Rate	6	in.
10.	Siphon Driving Head	48	in.
11.	Predicted TSS Removal Efficiency	50	%
12.	Storage Volume before Discharge	86,500	gallons
13.	Bacteria Removal from Underflow	75	%
14.	Maximum Influent Bacteria Concentration	$2.0x10^6$	cfu/100mL
15.	NaClO Feedrate at Peak Design Flow	15.36	mg/L
16.	Approximate in Vessel Detention Time	9.5	minutes

MATERIALS

A. Unless otherwise noted, the Storm King components and fixing accessories shall be fabricated from 316 stainless steel. The Swirl Cleanse perforated screen shall be fabricated in polymer coated 316 stainless steel. The support frame shall be fabricated in galvanized carbon steel. The treatment device shall be shipped to the site, preassembled to the maximum extent possible. Final assembly of the bolted connections shall be the responsibility of the General Contractor.

B. All welding shall conform to the most recent standards of the American Welding Society and American Society of Mechanical Engineers (ASME).

C. The device shall be designed to withstand all loadings which may occur during fabrication, shipping, installation, and operation of the equipment.

D. The internal components shall be supplied with all weld spatter and flux residue removed, all rough and uneven welds ground smooth, and shall be free of any sharp edges. Components shall have an acid washed surface finish.

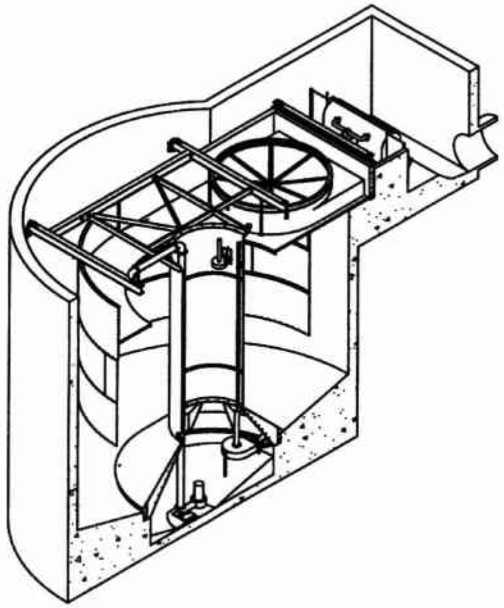
E. All supporting materials shall be installed so as not to impede the smooth circular flow within the unit.

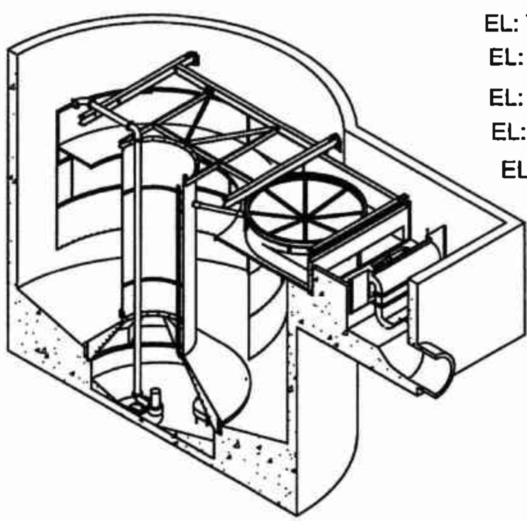
F. Interior tank walls and all benching shall be filleted to form a smooth cylindrical surface.

G. Superstructure shall be reinforced concrete supplied by the General Contractor.

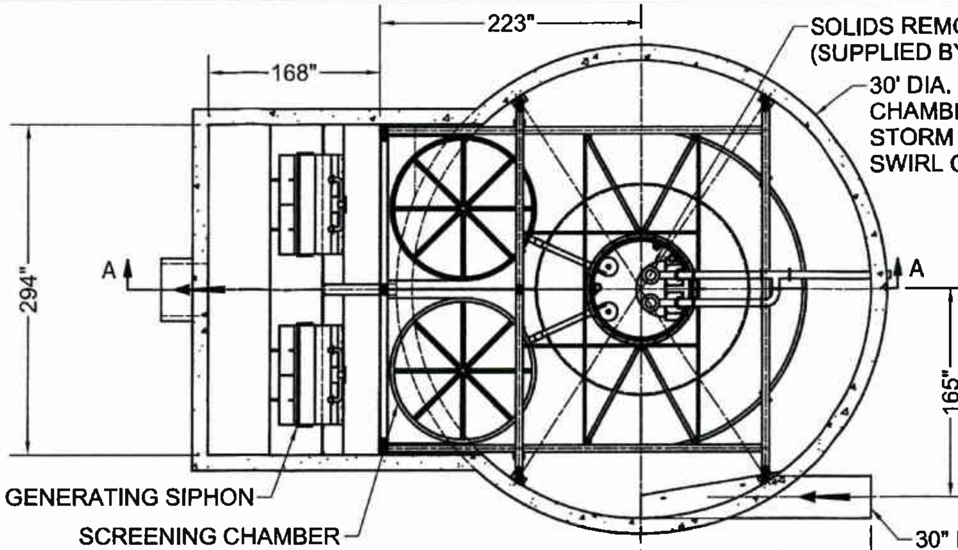
H. The Swirl Cleanse component shall capture floatables and neutrally buoyant materials. The Swirl Cleanse shall be back washed automatically by an air-regulated siphon located in the overflow channel. Floatables retained on the screen shall be washed to the center and discharged through the center overspill pipe.

I. The Swirl Cleanse screen to be 14 gauge (minimum) grade 316 stainless steel punched plate containing 6mm holes with 51% open area (flat panel). Each plate is then shaped to fit the chamber and covered in a polythene or powder coat (black) approximately 1mm (1/32 inch) thick reducing the aperture size to 4mm (1/6 inch). The screen will incorporate approximately an 8 degree slope towards the screenings removal outlet.

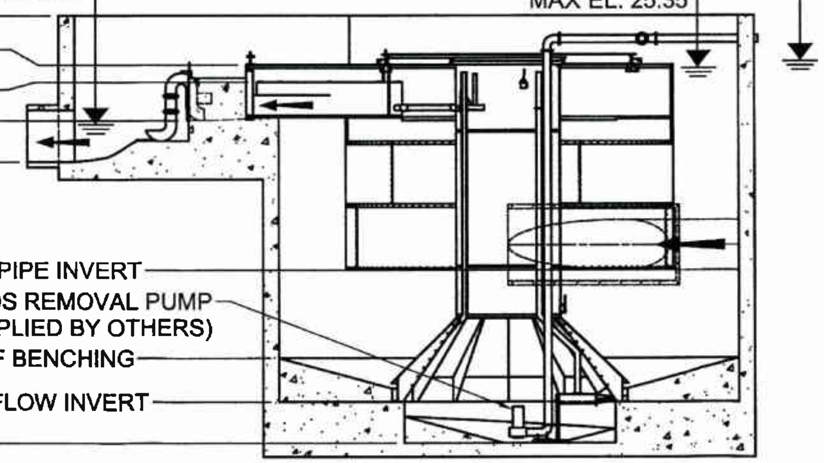




ISOMETRIC VIEWS



PLAN VIEW



VIEW A-A

* WATER LEVELS ARE CONSERVATIVE. HYDRO CAN PROVIDE A SCALE DRAWING TO SUIT THE SITE REQUIREMENTS UPON REQUEST.

PROJECTION

1. THIS DRAWING IS A SCHEMATIC TYPE DRAWING THAT IS INTENDED FOR INFORMATIONAL PURPOSES ONLY. IF A SCALE DRAWING IS REQUIRED PLEASE NOTIFY HYDRO.

REV	BY	DATE	DESCRIPTION
-	DR	6/24/14	FIRST ISSUE

REVISION HISTORY

Date	Scale
06/24/2014	NTS

Drawn By	Checked By	Approved By
DR	-	LS

Title
30' STORM KING WITH SWIRL CLEANSE

DUQUESNE CSO
DUQUESNE, PA

GENERAL ARRANGEMENT

Hydro International

94 Hutchins Drive
Portland, ME 04102
Tel: (207) 756-6200
Fax: (207) 756-6212
email: hiltech@hil-tech.com

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. TOLERENCES ARE:

FRACTIONS ±1/16

DECIMALS ± .06

ANGLES ±1°

Approximate Weight: N/A	
Finish: -	
Treatment: -	
Sheet Size: B	Sheet: 1 OF 1

Next Assembly:	N/A
Ref. No.	14-3107
Drawing No. 14-3107-01	Rev -

Storm King®

Sedimentation, Screening, & Disinfection in One Device

Product Profile

The Storm King® is an advanced hydrodynamic vortex separator that incorporates an optional self-cleansing, non-powered Swirl Cleanse screening system to provide screening to 4mm in diameter. The Storm King® is a proven technology which combines grit removal, primary treatment equivalency (TSS and BOD removal), floatables control and in-vessel disinfection within a single unit process. The system is ideal for satellite or centralized treatment at overflow sites because it is self-activating, has no moving parts and requires no power to separate solids.

Applications

- Floatables control, primary treatment equivalency and disinfection of combined sewer overflows (CSOs) and wet weather induced flows
- Remote or unmanned treatment facilities
- Treatment of excess wet weather flows at centralized facilities or POTWs
- Retrofit or new wet weather treatment facilities
- Preliminary treatment prior to storage or equalization

Advantages

- No power and no moving parts
- Self-activating with a small footprint
- Fine grit removal and primary treatment equivalency
- Combines three unit processes in a single device
- Higher effluent standards can be achieved with the addition of coagulants and flocculants
- Captured material returned to sanitary flow thereby eliminating the need for residuals handling capabilities at remote sites

How it Works

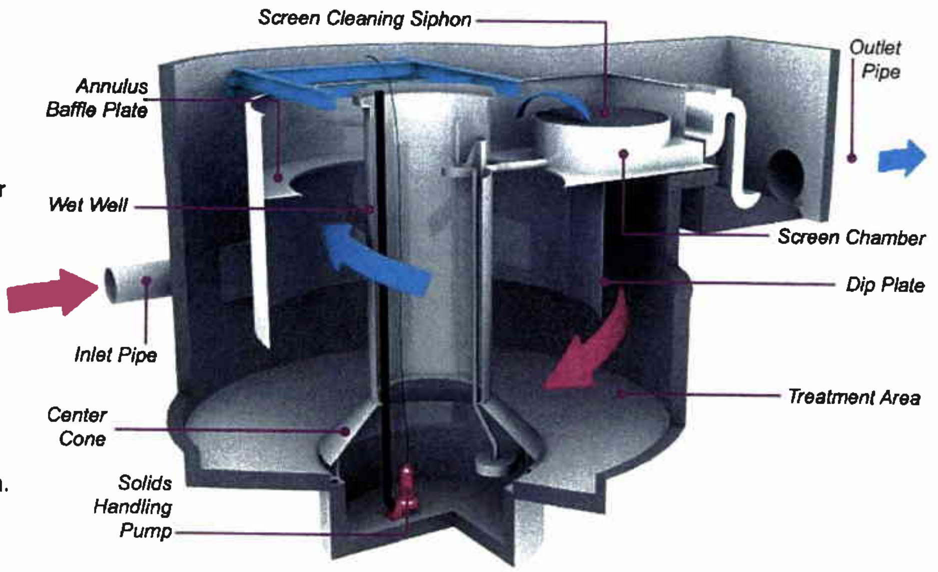
Flow is introduced tangentially into the side of the Storm King® barrel causing the contents to rotate slowly about the vertical axis. The flow spirals down the perimeter allowing solids to settle out by gravity. This process is aided by rotary forces, shear forces and drag forces at the boundary layer on the wall and base of the vessel.

The internal components direct the main flow away from the perimeter and back up the middle of the vessel as a broad spiraling column, rotating at a slower velocity than the outer downward flow. A dip plate locates the shear zone, the interface between the outer downward circulation and the inner upward circulation, where a marked difference in velocity encourages further solids separation. Settled solids are directed to the helical channel located under the center cone and are conveyed out of the main chamber through the underflow outlet.

The flow passes down through the Swirl Cleanse screen which captures all floatables and neutrally buoyant material greater than 4mm in diameter. The air regulated siphon provides an effective backwash mechanism to prevent the screen from blinding. Screened effluent is discharged into a receiving watercourse, a storage facility, or continues on to receive further treatment. (light blue arrow).

The collected screenings and settled solids from the underflow are pumped or gravity fed from the base of the unit and returned to the sanitary flow to continue on to the wastewater treatment facility.

Bacteria reduction is achieved within the Storm King® by introducing chemicals such as Sodium Hypochlorite, Peracetic Acid, or Chlorine Dioxide into the upstream diversion structure or into the inlet pipe of the vessel. The spiraling action integral to the system combined with the predictable flow path of the separator allows the unit to combine its solids and grit removal duties with disinfection. Dechlorination (if applicable) is performed at the discharge of the siphon.



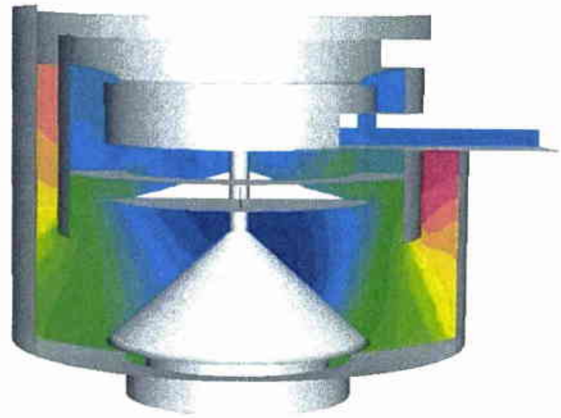
Performance

- Screening to 4mm in diameter
- Proven high rate disinfection in less than 8 minutes

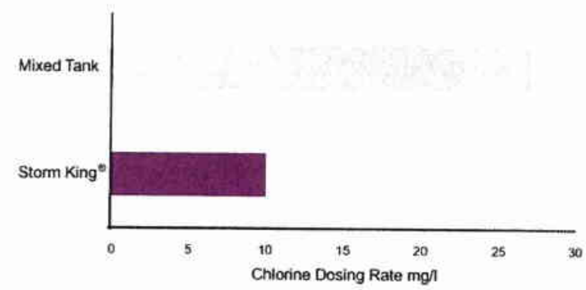
Disinfection

The Storm King® has a long history of providing protection to watercourses. However, it is not widely known that the Storm King® can provide solids removal and disinfection in the same vessel. Taking advantage of the separator's complex flow paths created by the unique internal components, the Storm King® can provide excellent efficiencies while occupying less than 30% of the area required for conventional disinfection solutions.

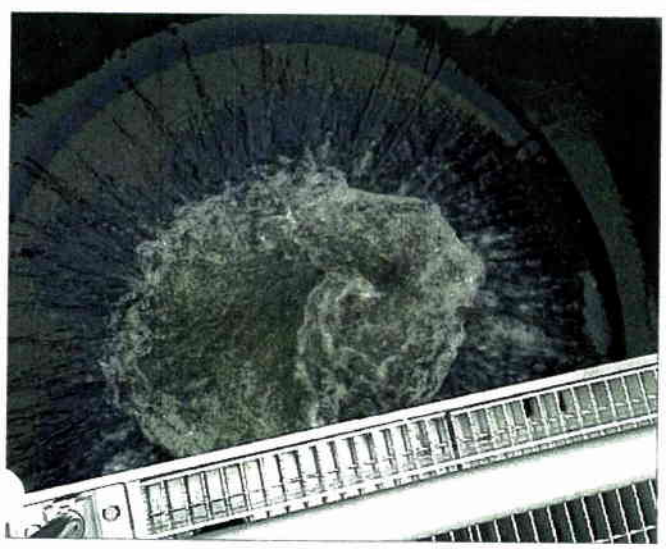
The Storm King® is able to achieve 3 to 4 log kills of total or fecal coliform bacteria within an 8 minute hydraulic retention time and handle commonly available disinfectants such as Sodium Hypochlorite, Peracetic Acid, or Chlorine Dioxide.



CFD simulation showing predicted fecal coliform kills in Storm King® (survival color code: Red is alive and blue is dead).



Comparisons of Disinfection Area Required for Storm King® and Conventional Disinfection Tanks



Maintenance

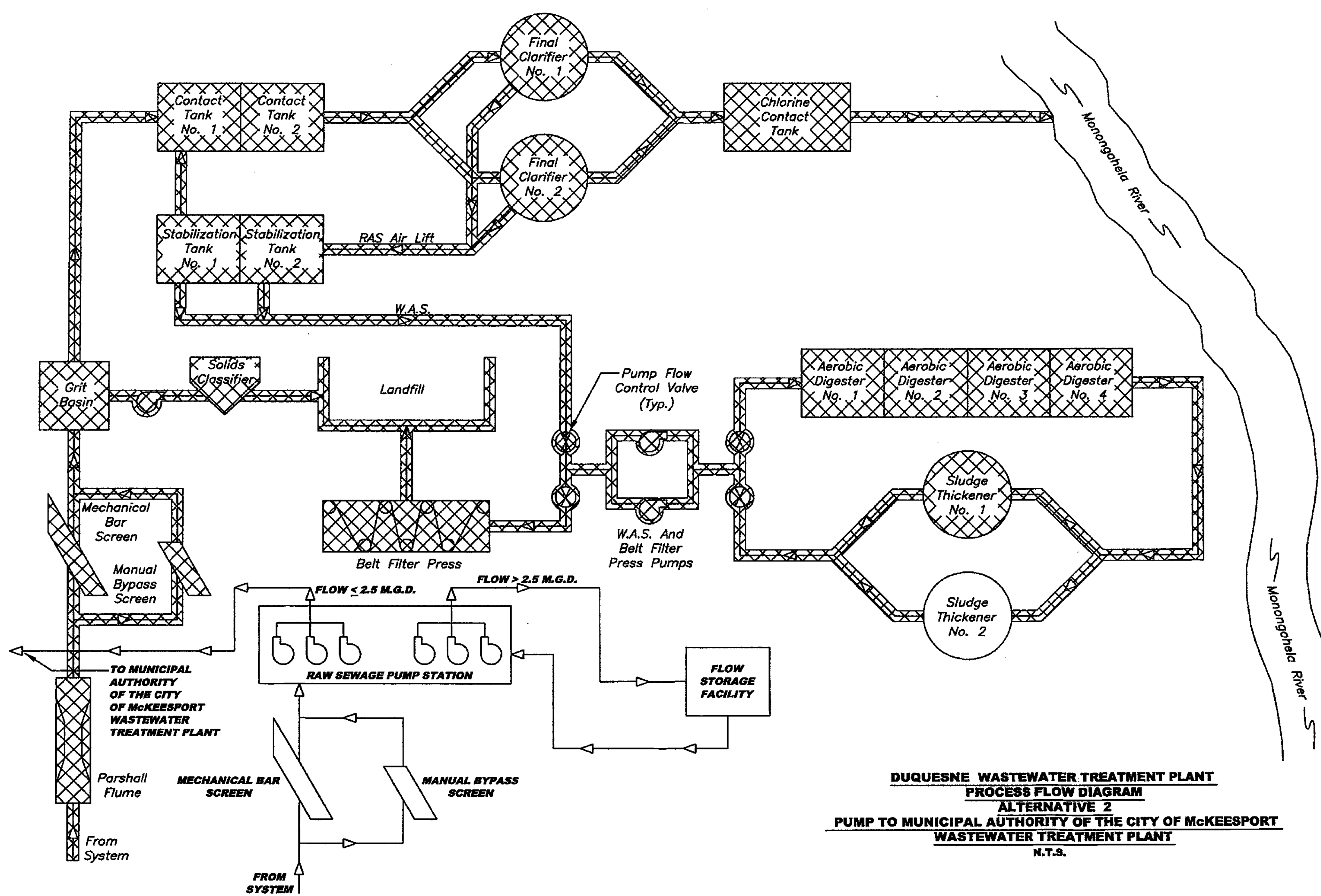
The Storm King® with Swirl Cleanse has no moving parts and typically requires no higher maintenance commitment than the sewer system in which it is placed.

The maintenance requirement is dependent upon the influent characteristics, which in turn are dependent upon the nature of the contributing system.

Once the device has been brought on-line, the Storm King® and Swirl Cleanse screen should be visually inspected after the first two spill events. After the initial inspections, visual inspection of the equipment should be carried out twice per year, or as deemed appropriate for the location.

APPENDIX R

ALTERNATIVE 2
PROCESS FLOW DIAGRAM



DUQUESNE WASTEWATER TREATMENT PLANT
PROCESS FLOW DIAGRAM
ALTERNATIVE 2
PUMP TO MUNICIPAL AUTHORITY OF THE CITY OF McKEESPORT
WASTEWATER TREATMENT PLANT
N.T.S.

BOROUGH OF DUQUESNE
ALLEGHENY COUNTY, PENNSYLVANIA
WASTEWATER TREATMENT PLANT
ALTERNATIVE 2 - PROCESS FLOW DIAGRAM

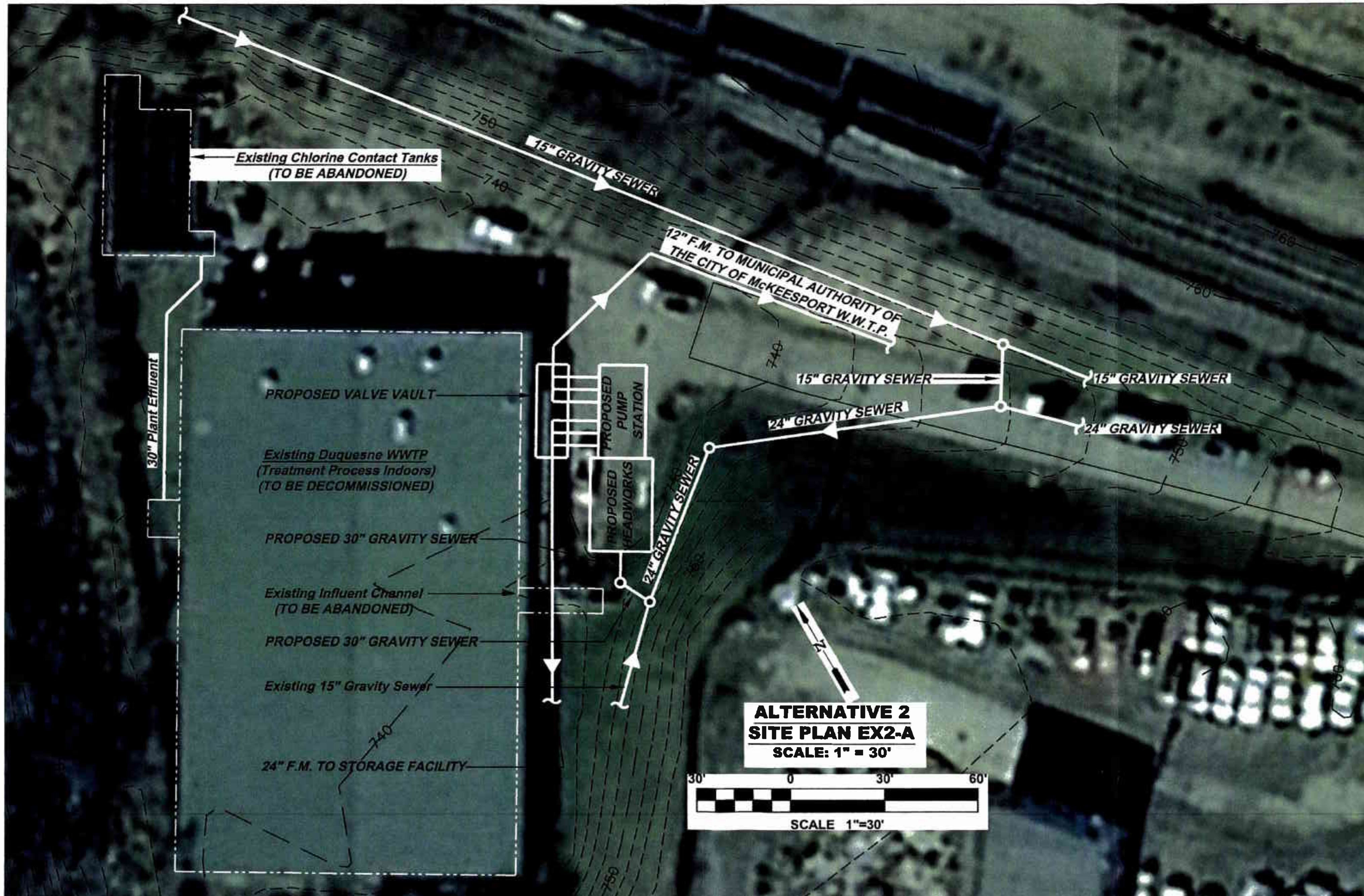
KLH ENGINEERS, INC
5173 Campbells Run Road
Pittsburgh, PA 15205
Phone: 412.494.0510
Fax: 412.494.0426
info@klhengineers.com

Date	Revisions	Date	Revisions

Scale:	As Shown
Date:	August 2014
Drawn By:	EHD
Checked By:	BMC
Approved By:	SHG
Order No.	220-53
Drawing No.	EX6
Sheet No.	1 of 1

APPENDIX S

ALTERNATIVE 2
SITE PLAN



Date	Revisions	Date	Revisions

KLH ENGINEERS, INC

5173 Campbells Run Road
Pittsburgh, PA 15205
Phone: 412.494.0510
Fax: 412.494.0426
info@klhengineers.com

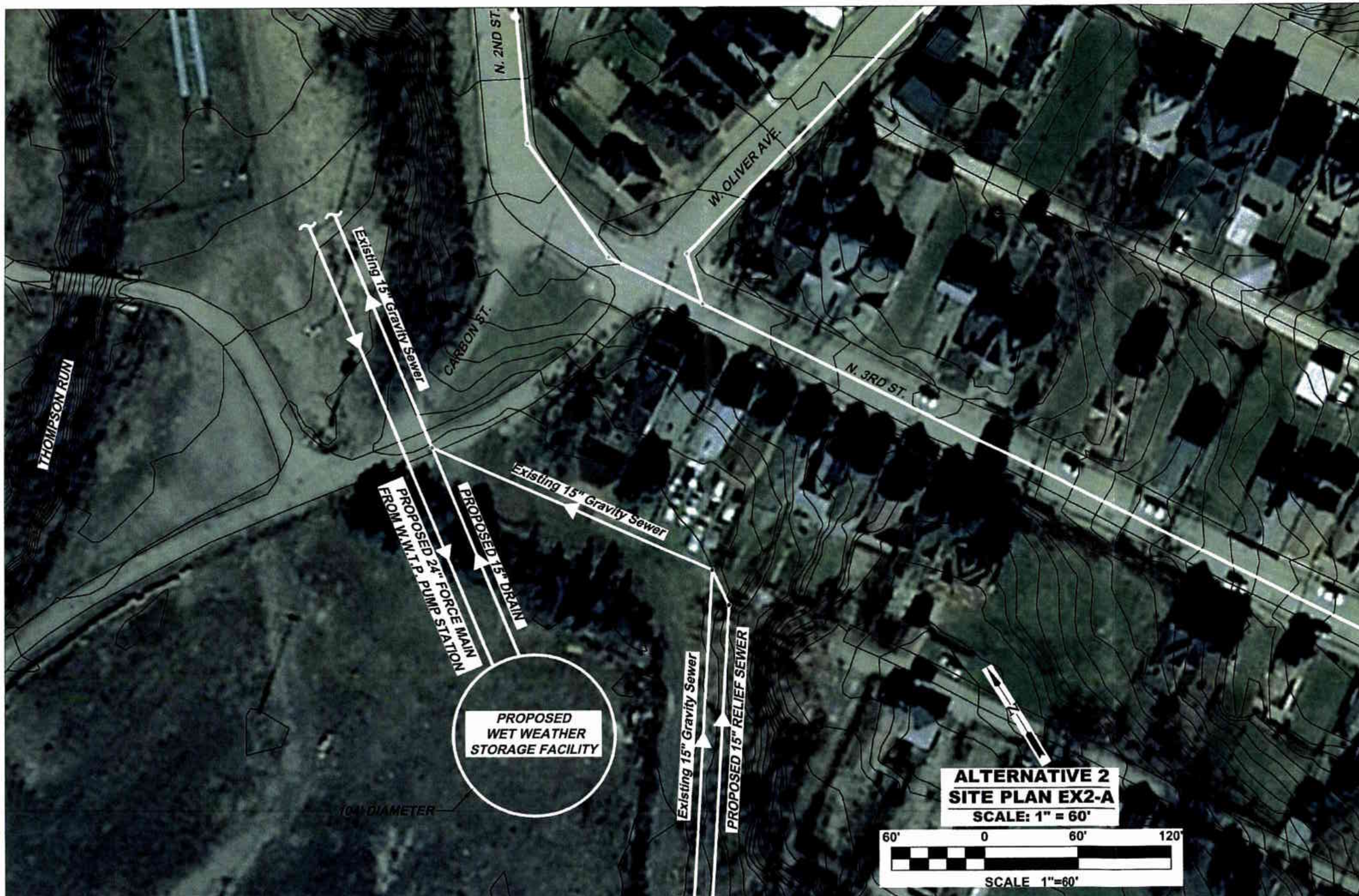
BOROUGH OF DUQUESNE
ALLEGHENY COUNTY, PENNSYLVANIA
WASTEWATER TREATMENT PLANT
ALTERNATIVE 2 SITE PLAN

Scale:	As Shown
Date:	August 2014
Drawn By:	EHD
Checked By:	BMC
Approved By:	SHG

Order No. 220-53

Drawing No. EX2

Sheet No. 1 of 2



Date	Revisions	Date	Revisions

KLH ENGINEERS, INC
5173 Campbells Run Road
Pittsburgh, PA 15205
Phone: 412.494.0510
Fax: 412.494.0436
info@klhengineers.com

BOROUGH OF DUQUESNE
ALLEGHENY COUNTY, PENNSYLVANIA
WASTEWATER TREATMENT PLANT
ALTERNATIVE 2 STORAGE SITE PLAN

Scale:	As Shown
Date:	August 2014
Drawn By:	EHO
Checked By:	BMC
Approved By:	SHG

Order No. 220-53
Drawing No. EX2
Sheet No. 2 of 2

APPENDIX T

ALTERNATIVE 2
FORCE MAIN ALIGNMENT

MUNICIPAL AUTHORITY OF THE CITY OF MCKEESPORT
ALLEGHENY COUNTY, PENNSYLVANIA
DRAVOSBURG-DUQUESNE AREA ACT 537 & LONG TERM CONTROL PLAN

FORCE MAIN EXHIBIT

Scale:	NTS
Date:	May 2014
Drawn By:	VLB
Checked By:	BMC
Approved By:	SHG

Order No. 220-53

Drawing No. FM-EX3

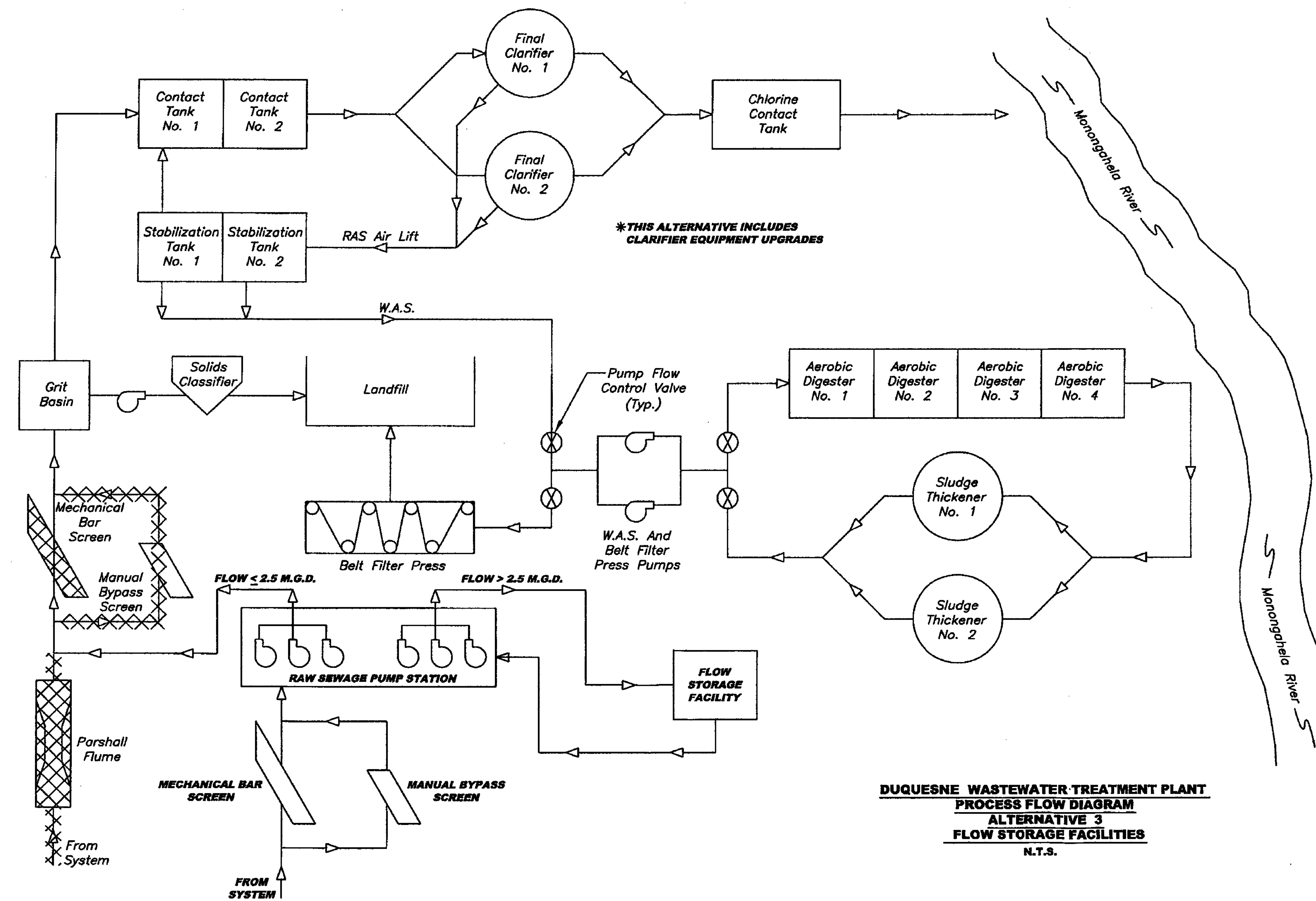
Sheet No. 1 of 1

KLH ENGINEERS, INC
5173 Campbells Run Road
Pittsburgh, PA 15205
Phone: 412.494.0510
Fax: 412.494.0426
info@klhengineers.com

Date	Revisions	Date	Revisions

APPENDIX U

ALTERNATIVE 3
PROCESS FLOW DIAGRAM



DUQUESNE WASTEWATER TREATMENT PLANT
PROCESS FLOW DIAGRAM
ALTERNATIVE 3
FLOW STORAGE FACILITIES
N.T.S.

BOROUGH OF DUQUESNE
ALLEGHENY COUNTY, PENNSYLVANIA
WASTEWATER TREATMENT PLANT
ALTERNATIVE 3 - PROCESS FLOW DIAGRAM

KLH ENGINEERS, INC
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info@klhengineers.com

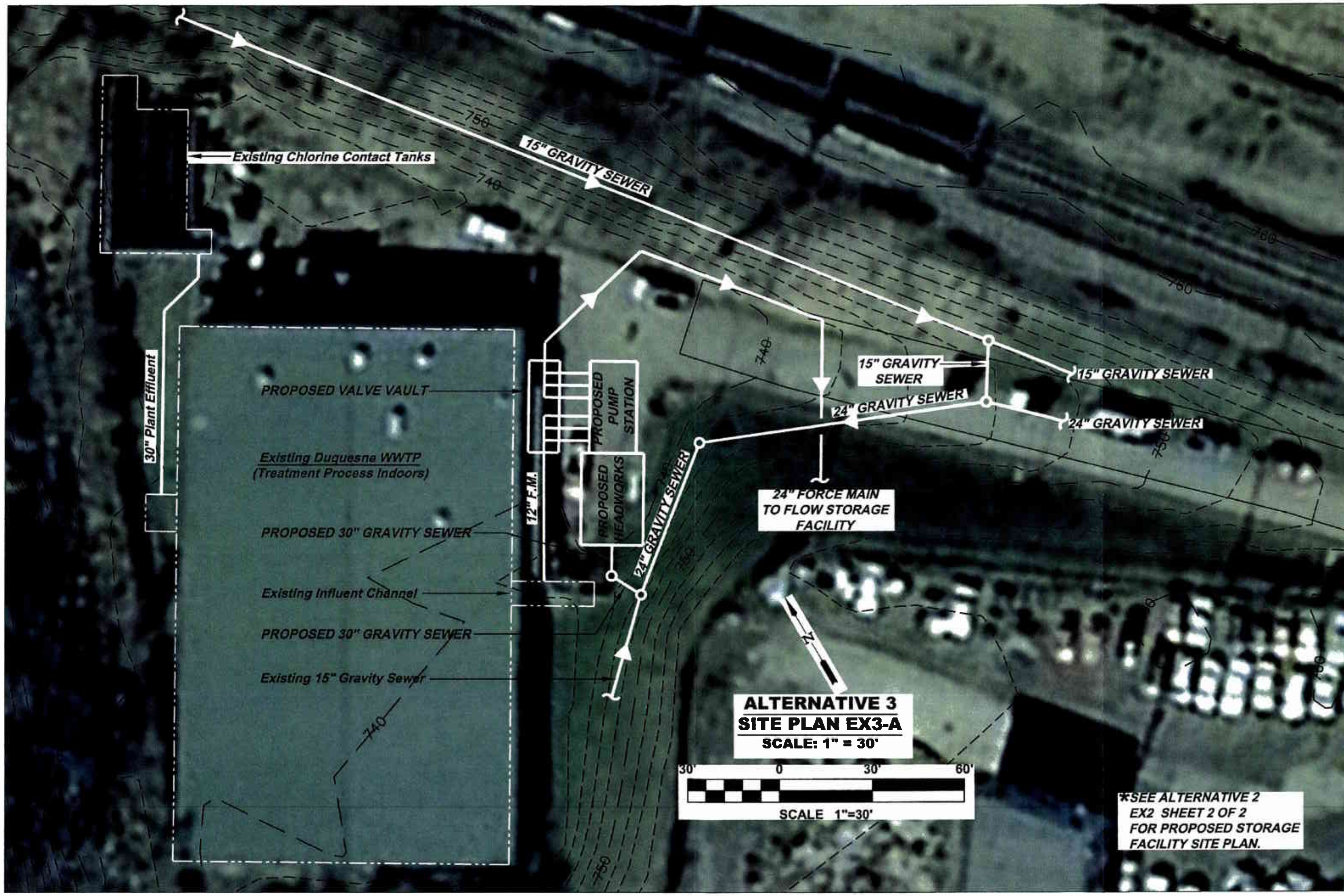
Date	Revisions	Date	Revisions

Scale:	As Shown
Date:	August 2014
Drawn By:	EHD
Checked By:	BMC
Approved By:	SHG

Order No. 220-53
Drawing No. EX7
Sheet No. 1 of 1

APPENDIX V

ALTERNATIVE 3
SITE PLAN



Date	Revisions	Date	Revisions

KLH ENGINEERS, INC
5173 Campbells Run Road
Pittsburgh, PA 15205
Phone: 412.494.0610
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info@klhengineers.com

BOROUGH OF DUQUESNE
ALLEGHENY COUNTY, PENNSYLVANIA
WASTEWATER TREATMENT PLANT
ALTERNATIVE 3 SITE PLAN

Scale: As Shown
Date: August 2014
Drawn By: EHD
Checked By: BMC
Approved By: BHG

Order No. 220-53
Drawing No. EX3
Sheet No. 1 of 1

Appendix W

Project Cost Estimates

Duquesne WWTP Long Term Control Plan

Summary of Alternatives

Planning Cost Estimate

Alternative	Construction Cost	Project Cost
Alternative 1 - Peak Flow Treatment	$ 5,939,000	$ 7,424,000
Alternative 2 - Pump to MACM with Storage	$ 12,408,000	$ 15,511,000
Alternative 3 - WWTP Improvements with Storage	$ 10,325,000	$ 12,907,000

Duquesne WWTP Long Term Control Plan

Conveyance System Upgrades

Planning Cost Estimate

ITEM	COST
Gravity Relief Sewers	$ 170,000
SUBTOTAL CONSTRUCTION COST	**$ 170,000**
Mobilization/Demobilization/Bonds/Insurance (15%)	$ 26,000
Contingency (30%)	$ 51,000
TOTAL CONSTRUCTION COST	**$ 247,000**
Engineering, Permitting, Legal (15%)	$ 38,000
Construction Administration (10%)	$ 25,000
TOTAL PROJECT COST	**$ 310,000**

Gravity Relief Sewers

	Description	Qnty	Unit	Cost	Total
Div 2	Sitework				
	Sewer Pipe				
	24" Sewer Pipe				
	0' – 8'	310	LF	$ 114.00	$ 35,340.00
	15" Sewer Pipe				
	8' – 12'	715	LF	$ 132.00	$ 94,380.00
	M.H. 0-6' Deep with Standard Frame and Cover (4' Diameter)	5	EA	$ 2,150.00	$ 10,750.00
	Watertight Manhole Frame and Cover	5	EA	$ 499.00	$ 2,495.00
	Manhole Barrel over 6VF (4' Dia)	12	VF	$ 115.00	$ 1,380.00
	Select Backfill	364	CY	$ 29.00	$ 10,568.89
	Filter Fence	1,025	LF	$ 3.00	$ 3,075.00
	Municipal Road Trench Repair	100	LF	$ 42.00	$ 4,200.00
	Exploratory Excavation	10	EA	$ 270.00	$ 2,700.00
	Closed Circuit TV Inspection-Sewers	1,025	LF	$ 2.00	$ 2,050.00
	Inflow Protectors	5	EA	$ 63.00	$ 315.00
	Mismarked or Unmarked Utility Restoration				
	Natural Gas - 1/2" to 8"	10	EA	$ 52.00	$ 520.00
	Electric - Any Size or Voltage	10	EA	$ 52.00	$ 520.00
	Telephone - Any Size	10	EA	$ 52.00	$ 520.00
	Storm Sewer - Any Size	10	EA	$ 52.00	$ 520.00
	Waterline - Any Size	10	EA	$ 52.00	$ 520.00
	Subtotal Gravity Construction =				**$ 169,854**
	Cost per LF =				**$ 165.71**

Duquesne WWTP Long Term Control Plan

Alternative 1 - Upgrade WWTP

Planning Cost Estimate

ITEM	COST
General Site Work	$ 182,000
Headworks	$ 743,000
Influent Pump Station	$ 996,000
Peak Flow Treatment	$ 1,039,000
Clarifier Efficiency Improvements	$ 533,000
SUBTOTAL CONSTRUCTION COST	**$ 3,493,000**
Electrical Costs (25%)	$ 874,000
Mobilization/Demobilization/Bonds/Insurance (15%)	$ 524,000
Contingency (30%)	$ 1,048,000
TOTAL CONSTRUCTION COST	**$ 5,939,000**
Engineering, Permitting, Legal (15%)	$ 891,000
Construction Administration (10%)	$ 594,000
TOTAL PROJECT COST	**$ 7,424,000**

Site Work

			Qty	Unit	Price per Unit	Materials	Total
Division 2	Site Work						
		E&S Controls	1	lot	$ 10,000.00	$ 10,000.00	$ 10,000.00
		By-Pass Pumping	1	lot	$ 50,000.00	$ 50,000.00	$ 50,000.00
		Site Paving	478	s.y.	$ 50.00	$ 23,888.89	$ 23,888.89
		Lawn Restoration	1	lot	$ 5,000.00	$ 5,000.00	$ 5,000.00
Division 3	Concrete						
		Repairs/Rehabilitation	1	lot	$ 10,000.00	$ 10,000.00	$ 10,000.00
		Manholes (0'-8' Deep)	3	ea	$2,500.00	$ 7,500.00	$ 7,500.00
		Manhole VF over 8' Deep	25	v.f.	$110.00	$ 2,750.00	$ 2,750.00
						$ -	
Division 15	Mechanical						
		24" D.I. Pipe - F.M.	100	L.F.	$ 125.00	$ 12,500.00	$ 12,500.00
		30" PVC Pipe (Buried) - Gravity	300	L.F.	$ 200.00	$ 60,000.00	$ 60,000.00

Subtotal Construction = $ 181,638.89

Headworks

			Qty	Unit	Price per Unit	Materials	Total
Division 2	Site Work						
		Excavation	416.7	c.y.	$ 50.00	$ 20,833.33	$ 20,833.33
		Backfill	104.2	c.y.	$ 50.00	$ 5,208.33	$ 5,208.33
		Stone Backfill	66.67	c.y.	$ 172.00	$ 11,466.67	$ 11,466.67
Division 3	Concrete						
		Foundation Slab	84.33	c.y.	$ 532.10	$ 44,873.77	$ 44,873.77
		First Floor Slab	56.22	c.y.	$ 1,123.40	$ 63,157.55	$ 63,157.55
		Walls	53.33	c.y.	$ 1,123.40	$ 59,914.67	$ 59,914.67
Division 4	Masonry						
		Block	1200	s.f.	$ 8.35	$ 10,020.00	$ 14,923.83
Division 5	Metals						
		Aluminum Grating	150	s.f.	$ 65.00	$ 9,750.00	$ 9,750.00
		Aluminum Handrail	200	L.F.	$ 70.00	$ 14,000.00	$ 14,000.00
		4'x4' Aluminum Hatchway	1	each	$ 3,500.00	$ 3,500.00	$ 5,212.91
		Stairs	60	riser	$ 185.00	$ 11,100.00	$ 16,532.39
Division 7	Thermal and Moisture						
		Masonry Insulation	1200	s.f.	$ 1.31	$ 1,572.00	$ 2,341.34
		Roofing	1	Lot	$ 25,000.00	$ 25,000.00	$ 37,235.10
		Alum Fascia	100	s.f.	$ 5.35	$ 535.00	$ 796.83
		Alum Soffit	404	s.f.	$ 7.65	$ 3,090.60	$ 4,603.15
		Alum Gutters	100	L.F.	$ 5.00	$ 500.00	$ 744.70
		Downspouts	48	L.F.	$ 4.84	$ 232.32	$ 346.02
Division 8	Doors and Windows						
		7'x3' Mandoor w/window	1	each	$ 1,000.00	$ 1,000.00	$ 1,489.40
		7'x6' Door	1	each	$ 2,500.00	$ 2,500.00	$ 3,723.51
		10'x14' Rolling Garage	1	each	$ 7,000.00	$ 7,000.00	$ 10,425.83
		3'x3' window	2	each	$ 500.00	$ 1,000.00	$ 1,489.40
		4'x4' skylight	2	each	$ 200.00	$ 400.00	$ 595.76
Division 9	Coatings						
		Paints	10000	s.f.	$ 2.00	$ 20,000.00	$ 29,788.08
Division 11	Equipment						
		Coarse Screen (Mechanical)	1	each	$ 234,000.00	$ 234,000.00	$ 304,200.00
		Coarse Screen (Manual)	1	each	$ 7,500.00	$ 7,500.00	$ 7,500.00
Division 15	Mechanical						
		Sluice Gates	4	each	$ 3,500.00	$ 14,000.00	$ 20,851.66
		HVAC	1	Lot	$ 50,000.00	$ 50,000.00	$ 50,000.00

Subtotal Construction = $ 742,004.25

Influent Pump Station and Valve Vault

			Qty	Unit	Price per Unit	Materials	Total
Division 2	Site Work						
		Excavation	305	c.y.	$ 50.00	$ 15,231.48	$ 15,231.48
		Backfill	76	c.y.	$ 50.00	$ 3,807.87	$ 3,807.87
		Stone Backfill	21	c.y.	$ 172.00	$ 3,612.00	$ 3,612.00
		Shoring/Dewatering	1	LOT	$ 50,000.00	$ 50,000.00	$ 50,000.00
Division 3	Concrete						
		Foundation Slab	62	c.y.	$ 532.10	$ 32,990.20	$ 32,990.20
		Elevated Slabs and Walls		c.y.	$1,123.40	$ -	
Division 5	Metals						
		6'x6' Aluminum Hatchway	2	each	$ 5,000.00	$ 10,000.00	$ 10,000.00
Division 11	Equipment						
		Normal Flow Pumps (1 MGD EA)	3	each	$ 50,000.00	$ 150,000.00	$ 150,000.00
		Storm Pumps (5 MGD EA)	3	each	$ 75,000.00	$ 225,000.00	$ 225,000.00
		MCC	1	each	$ 300,000.00	$ 300,000.00	$ 300,000.00
		PLC and Controls	1	each	$ 100,000.00	$ 100,000.00	$ 100,000.00
		Bridge Crane	1	each	$ 25,000.00	$ 25,000.00	$ 25,000.00
Division 15	Mechanical						
		Wet Well and Valve Vault Piping	1	LOT	$ 80,000.00	$ 80,000.00	$ 80,000.00

Subtotal Construction = $ **995,641.55**

Peak Flow Treatment

			Qty	Unit	Price per Unit	Total
Division 2	Site Work					
		Excavation	74.07	c.y.	$ 50.00	$ 3,703.70
		Backfill	18.52	c.y.	$ 50.00	$ 925.93
		Stone Backfill	165.3	c.y.	$ 172.00	$ 28,436.76
		Excavation/Shoring/Dewatering/Backfill	1	LOT	$ 50,000.00	$ 50,000.00
Division 3	Concrete					
		Foundation Slab	110.2	c.y.	$ 532.10	$ 58,637.42
		First Floor Slab	0	c.y.	$ 1,123.40	$ -
		Walls	68.18	c.y.	$ 1,123.40	$ 76,593.41
		Columns/Beams		c.y.		
Division 5	Metals					
		Lintels		each	$ 34.50	
		Aluminum Grating	1488	s.f.	$ 65.00	$ 96,720.00
		Aluminum Handrail	145.2	L.F.	$ 70.00	$ 10,163.01
Division 11	Equipment					
		Storm Water Treatment	1	each	$ 541,000.00	$ 703,300.00
		Solids Removal Pump	2	each	$ 5,000.00	$ 10,000.00
		Chlorine System Upgrades	1	each	$ 50,000.00	$ 50,000.00
						$ 1,038,480.23

Clarifier Upgrades

			Qty	Unit	Price per Unit	Materials	Total
Division 11	Equipment						
		Demolition of Existing Equipment	2	each	$ 10,000.00	$ 20,000.00	$ 20,000.00
		Secondary Clarifier Mechanisms	2	each	$ 84,250.00	$ 168,500.00	$ 387,550.00
		FRP Weirs, Baffles, Launder Covers	2	each	$ 41,750.00	$ 83,500.00	$ 125,250.00

Subtotal Construction = $ 532,800.00

Duquesne WWTP Long Term Control Plan

Alternative 2 - Pump to MACM with Storage

Planning Cost Estimate

ITEM	COST	
General Site Work	$	120,000
Headworks	$	743,000
Property Acquisition and Remediation	$	1,097,000
Pump Station and Valve Vault	$	1,474,000
Storage Tank	$	2,175,000
Force Main to MACM	$	1,689,000
SUBTOTAL CONSTRUCTION COST	**$**	**7,298,000**
Electrical Costs (25%)	$	1,825,000
Mobilization/Demobilization/Bonds/Insurance (15%)	$	1,095,000
Contingency (30%)	$	2,190,000
TOTAL CONSTRUCTION COST	**$**	**12,408,000**
Engineering, Permitting, Legal (15%)	$	1,862,000
Construction Administration (10%)	$	1,241,000
TOTAL PROJECT COST	**$**	**15,511,000**

Site Work

			Qty	Unit	Price per Unit	Materials	Total
Division 2	Site Work						
		E&S Controls	1	lot	$ 10,000.00	$ 10,000.00	$ 10,000.00
		By-Pass Pumping	1	lot	$ 50,000.00	$ 50,000.00	$ 50,000.00
		Site Paving	478	s.y.	$ 50.00	$ 23,888.89	$ 23,888.89
		Lawn Restoration	1	lot	$ 5,000.00	$ 5,000.00	$ 5,000.00
Division 3	Concrete						
		Repairs/Rehabilitation	1	lot	$ 10,000.00	$ 10,000.00	$ 10,000.00
		Manholes (0'-8' Deep)	3	ea	$2,500.00	$ 7,500.00	$ 7,500.00
		Manhole VF over 8' Deep	25	v.f.	$110.00	$ 2,750.00	$ 2,750.00
						$ -	
Division 15	Mechanical						
		30" PVC Pipe (Buried) - Gravity	50	L.F.	$ 200.00	$ 10,000.00	$ 10,000.00

Subtotal Construction = $ 119,138.89

Headworks

			Qty	Unit	Price per Unit	Materials	Total
Division 2	Site Work						
		Excavation	416.7	c.y.	$ 50.00	$ 20,833.33	$ 20,833.33
		Backfill	104.2	c.y.	$ 50.00	$ 5,208.33	$ 5,208.33
		Stone Backfill	66.67	c.y.	$ 172.00	$ 11,466.67	$ 11,466.67
Division 3	Concrete						
		Foundation Slab	84.33	c.y.	$ 532.10	$ 44,873.77	$ 44,873.77
		First Floor Slab	56.22	c.y.	$ 1,123.40	$ 63,157.55	$ 63,157.55
		Walls	53.33	c.y.	$ 1,123.40	$ 59,914.67	$ 59,914.67
Division 4	Masonry						
		Block	1200	s.f.	$ 8.35	$ 10,020.00	$ 14,923.83
Division 5	Metals						
		Aluminum Grating	150	s.f.	$ 65.00	$ 9,750.00	$ 9,750.00
		Aluminum Handrail	200	L.F.	$ 70.00	$ 14,000.00	$ 14,000.00
		4'x4' Aluminum Hatchway	1	each	$ 3,500.00	$ 3,500.00	$ 5,212.91
		Stairs	60	riser	$ 185.00	$ 11,100.00	$ 16,532.39
Division 7	Thermal and Moisture						
		Masonry Insulation	1200	s.f.	$ 1.31	$ 1,572.00	$ 2,341.34
		Roofing	1	Lot	$ 25,000.00	$ 25,000.00	$ 37,235.10
		Alum Fascia	100	s.f.	$ 5.35	$ 535.00	$ 796.83
		Alum Soffit	404	s.f.	$ 7.65	$ 3,090.60	$ 4,603.15
		Alum Gutters	100	L.F.	$ 5.00	$ 500.00	$ 744.70
		Downspouts	48	L.F.	$ 4.84	$ 232.32	$ 346.02
Division 8	Doors and Windows						
		7'x3' Mandoor w/window	1	each	$ 1,000.00	$ 1,000.00	$ 1,489.40
		7'x6' Door	1	each	$ 2,500.00	$ 2,500.00	$ 3,723.51
		10'x14' Rolling Garage	1	each	$ 7,000.00	$ 7,000.00	$ 10,425.83
		3'x3' window	2	each	$ 500.00	$ 1,000.00	$ 1,489.40
		4'x4' skylight	2	each	$ 200.00	$ 400.00	$ 595.76
Division 9	Coatings						
		Paints	10000	s.f.	$ 2.00	$ 20,000.00	$ 29,788.08
Division 11	Equipment						
		Coarse Screen (Mechanical)	1	each	$ 234,000.00	$ 234,000.00	$ 304,200.00
		Coarse Screen (Manual)	1	each	$ 7,500.00	$ 7,500.00	$ 7,500.00
Division 15	Mechanical						
		Sluice Gates	4	each	$ 3,500.00	$ 14,000.00	$ 20,851.66
		HVAC	1	Lot	$ 50,000.00	$ 50,000.00	$ 50,000.00
						Subtotal Construction = $	742,004.25

Influent Pump Station and Valve Vault

			Qty	Unit	Price per Unit	Materials	Total
Division 2	Site Work						
		Excavation	513	c.y.	$ 50.00	$ 25,648.15	$ 25,648.15
		Backfill	128	c.y.	$ 50.00	$ 6,412.04	$ 6,412.04
		Stone Backfill	21	c.y.	$ 172.00	$ 3,612.00	$ 3,612.00
		Shoring/Dewatering	1	LOT	$ 50,000.00	$ 50,000.00	$ 50,000.00
Division 3	Concrete						
		Foundation Slab	62	c.y.	$ 532.10	$ 32,990.20	$ 32,990.20
		Elevated Slabs and Walls	191	c.y.	$1,123.40	$ 214,569.40	$ 214,569.40
Division 5	Metals						
		6'x6' Aluminum Hatchway	2	each	$ 5,000.00	$ 10,000.00	$ 10,000.00
Division 11	Equipment						
		Normal Flow Pumps	3	each	$ 75,000.00	$ 225,000.00	$ 225,000.00
		Storm Pumps	3	each	$ 100,000.00	$ 300,000.00	$ 300,000.00
		MCC	1	each	$ 300,000.00	$ 300,000.00	$ 300,000.00
		PLC and Controls	1	each	$ 100,000.00	$ 100,000.00	$ 100,000.00
		Bridge Crane	1	each	$ 25,000.00	$ 25,000.00	$ 25,000.00
		Grinder Unit	1	each	$ 100,000.00	$ 100,000.00	$ 100,000.00
Division 15	Mechanical						
		Wet Well and Valve Vault Piping	1	LOT	$ 80,000.00	$ 80,000.00	$ 80,000.00

Subtotal Construction = $ 1,473,231.79

Storage Tanks

			Qty	Unit	Price per Unit	Materials	Total
Division 2	Site Work						
		Excavation	2909	c.y.	$ 50.00	$ 145,444.10	$ 145,444.10
		Backfill	727	c.y.	$ 50.00	$ 36,361.03	$ 36,361.03
		Stone Backfill	908	c.y.	$ 172.00	$ 156,162.29	$ 156,162.29
Division 3	Concrete						
		Foundation Slab	605	c.y.	$ 532.10	$ 322,069.59	$ 322,069.59
Division 11	Equipment						
		Storage Tanks	1	LOT	$ 950,230.67	$ 950,230.67	$ 950,230.67
		Walkways	1	LOT	$ 200,000.00	$ 200,000.00	$ 200,000.00
		Storage Basin Dewatering Pumps	2	each	$ 30,000.00	$ 60,000.00	$ 60,000.00
Division 15	Mechanical						
		24" D.I. Pipe (Force Main)	2025	L.F.	$ 150.00	$ 303,750.00	$ 303,750.00
							$ 2,174,017.68

Force Main to MACM							
			Qty	Unit	Price per Unit	Materials	Total
Division 2	Site Work						
		Select Backfill	1215	c.y.	$ 30.00	$ 36,444.44	$ 36,444.44
		Filter Fence	16400	L.F.	$ 2.50	$ 41,000.00	$ 41,000.00
		Municipal Road Repavement	1500	s.y.	$ 50.00	$ 75,000.00	$ 75,000.00
		Exploratory Excavation	10	ea	$ 270.00	$ 2,700.00	$ 2,700.00
Division 3	Concrete						
		Manhole 0-8' Deep - 4'-0" Diameter	10	ea	$ 2,150.00	$ 21,500.00	$ 21,500.00
		Watertight Manhole Frame and Cover	5	ea	$ 500.00	$ 2,500.00	$ 2,500.00
Division 15	Mechanical						
		12" D.I. Pipe (Buried)	16400	L.F.	$ 75.00	$ 1,230,000.00	$ 1,230,000.00
		Bore 20" Stl. Casing Pipe	1290	L.F.	$ 190.00	$ 245,100.00	$ 245,100.00
		CCTV Inspection	16400	L.F.	$ 1.50	$ 24,600.00	$ 24,600.00
		Force Main Testing	16400	L.F.	$ 0.60	$ 9,840.00	$ 9,840.00
						Subtotal Construction =	**$ 1,688,684.44**

Duquesne WWTP Long Term Control Plan

Alternative 3 - Upgrade WWTP with Storage

Planning Cost Estimate

ITEM	COST	
General Site Work	$	126,000
Headworks	$	743,000
Property Acquisition and Remediation	$	1,097,000
Pump Station and Valve Vault	$	1,399,000
Storage Tank	$	2,175,000
Clarifier Upgrades	$	533,000
SUBTOTAL CONSTRUCTION COST	**$**	**6,073,000**
Electrical Costs (25%)	$	1,519,000
Mobilization/Demobilization/Bonds/Insurance (15%)	$	911,000
Contingency (30%)	$	1,822,000
TOTAL CONSTRUCTION COST	**$**	**10,325,000**
Engineering, Permitting, Legal (15%)	$	1,549,000
Construction Administration (10%)	$	1,033,000
TOTAL PROJECT COST	**$**	**12,907,000**

Site Work

			Qty	Unit	Price per Unit	Materials	Total
Division 2	Site Work						
		E&S Controls	1	lot	$ 10,000.00	$ 10,000.00	$ 10,000.00
		By-Pass Pumping	1	lot	$ 50,000.00	$ 50,000.00	$ 50,000.00
		Site Paving	478	s.y.	$ 50.00	$ 23,888.89	$ 23,888.89
		Lawn Restoration	1	lot	$ 5,000.00	$ 5,000.00	$ 5,000.00
Division 3	Concrete						
		Repairs/Rehabilitation	1	lot	$ 10,000.00	$ 10,000.00	$ 10,000.00
		Manholes (0'-8' Deep)	3	ea	$2,500.00	$ 7,500.00	$ 7,500.00
		Manhole VF over 8' Deep	25	v.f.	$110.00	$ 2,750.00	$ 2,750.00
						$ -	
Division 15	Mechanical						
		24" D.I. Pipe - F.M.	50	L.F.	$ 125.00	$ 6,250.00	$ 6,250.00
		30" PVC Pipe (Buried) - Gravity	50	L.F.	$ 200.00	$ 10,000.00	$ 10,000.00

Subtotal Construction = $ 125,388.89

Headworks

			Qty	Unit	Price per Unit	Materials	Total
Division 2	Site Work						
		Excavation	416.7	c.y.	$ 50.00	$ 20,833.33	$ 20,833.33
		Backfill	104.2	c.y.	$ 50.00	$ 5,208.33	$ 5,208.33
		Stone Backfill	66.67	c.y.	$ 172.00	$ 11,466.67	$ 11,466.67
Division 3	Concrete						
		Foundation Slab	84.33	c.y.	$ 532.10	$ 44,873.77	$ 44,873.77
		First Floor Slab	56.22	c.y.	$ 1,123.40	$ 63,157.55	$ 63,157.55
		Walls	53.33	c.y.	$ 1,123.40	$ 59,914.67	$ 59,914.67
Division 4	Masonry						
		Block	1200	s.f.	$ 8.35	$ 10,020.00	$ 14,923.83
Division 5	Metals						
		Aluminum Grating	150	s.f.	$ 65.00	$ 9,750.00	$ 9,750.00
		Aluminum Handrail	200	L.F.	$ 70.00	$ 14,000.00	$ 14,000.00
		4'x4' Aluminum Hatchway	1	each	$ 3,500.00	$ 3,500.00	$ 5,212.91
		Stairs	60	riser	$ 185.00	$ 11,100.00	$ 16,532.39
Division 7	Thermal and Moisture						
		Masonry Insulation	1200	s.f.	$ 1.31	$ 1,572.00	$ 2,341.34
		Roofing	1	Lot	$ 25,000.00	$ 25,000.00	$ 37,235.10
		Alum Fascia	100	s.f.	$ 5.35	$ 535.00	$ 796.83
		Alum Soffit	404	s.f.	$ 7.65	$ 3,090.60	$ 4,603.15
		Alum Gutters	100	L.F.	$ 5.00	$ 500.00	$ 744.70
		Downspouts	48	L.F.	$ 4.84	$ 232.32	$ 346.02
Division 8	Doors and Windows						
		7'x3' Mandoor w/window	1	each	$ 1,000.00	$ 1,000.00	$ 1,489.40
		7'x6' Door	1	each	$ 2,500.00	$ 2,500.00	$ 3,723.51
		10'x14' Rolling Garage	1	each	$ 7,000.00	$ 7,000.00	$ 10,425.83
		3'x3' window	2	each	$ 500.00	$ 1,000.00	$ 1,489.40
		4'x4' skylight	2	each	$ 200.00	$ 400.00	$ 595.76
Division 9	Coatings						
		Paints	10000	s.f.	$ 2.00	$ 20,000.00	$ 29,788.08
Division 11	Equipment						
		Coarse Screen (Mechanical)	1	each	$ 234,000.00	$ 234,000.00	$ 304,200.00
		Coarse Screen (Manual)	1	each	$ 7,500.00	$ 7,500.00	$ 7,500.00
Division 15	Mechanical						
		Sluice Gates	4	each	$ 3,500.00	$ 14,000.00	$ 20,851.66
		HVAC	1	Lot	$ 50,000.00	$ 50,000.00	$ 50,000.00

Subtotal Construction = $ 742,004.25

Influent Pump Station and Valve Vault

			Qty	Unit	Price per Unit	Materials	Total
Division 2	Site Work						
		Excavation	513	c.y.	$ 50.00	$ 25,648.15	$ 25,648.15
		Backfill	128	c.y.	$ 50.00	$ 6,412.04	$ 6,412.04
		Stone Backfill	21	c.y.	$ 172.00	$ 3,612.00	$ 3,612.00
		Shoring/Dewatering	1	LOT	$ 50,000.00	$ 50,000.00	$ 50,000.00
Division 3	Concrete						
		Foundation Slab	62	c.y.	$ 532.10	$ 32,990.20	$ 32,990.20
		Elevated Slabs and Walls	191	c.y.	$1,123.40	$ 214,569.40	$ 214,569.40
Division 5	Metals						
		6'x6' Aluminum Hatchway	2	each	$ 5,000.00	$ 10,000.00	$ 10,000.00
Division 11	Equipment						
		Normal Flow Pumps	3	each	$ 50,000.00	$ 150,000.00	$ 150,000.00
		Storm Pumps	3	each	$ 100,000.00	$ 300,000.00	$ 300,000.00
		MCC	1	each	$ 300,000.00	$ 300,000.00	$ 300,000.00
		PLC and Controls	1	each	$ 100,000.00	$ 100,000.00	$ 100,000.00
		Bridge Crane	1	each	$ 25,000.00	$ 25,000.00	$ 25,000.00
		Grinder Unit	1	each	$ 100,000.00	$ 100,000.00	$ 100,000.00
Division 15	Mechanical						
		Wet Well and Valve Vault Piping	1	LOT	$ 80,000.00	$ 80,000.00	$ 80,000.00

Subtotal Construction = $ **1,398,231.79**

Storage Tanks

			Qty	Unit	Price per Unit	Materials	Total
Division 2	Site Work						
		Excavation	2909	c.y.	$ 50.00	$ 145,444.10	$ 145,444.10
		Backfill	727	c.y.	$ 50.00	$ 36,361.03	$ 36,361.03
		Stone Backfill	908	c.y.	$ 172.00	$ 156,162.29	$ 156,162.29
Division 3	Concrete						
		Foundation Slab	605	c.y.	$ 532.10	$ 322,069.59	$ 322,069.59
Division 11	Equipment						
		Storage Tanks	1	LOT	$ 950,230.67	$ 950,230.67	$ 950,230.67
		Walkways	1	LOT	$ 200,000.00	$ 200,000.00	$ 200,000.00
		Storage Basin Dewatering Pumps	2	each	$ 30,000.00	$ 60,000.00	$ 60,000.00
Division 15	Mechanical						
		24" D.I. Pipe (Force Main)	2025	L.F.	$ 150.00	$ 303,750.00	$ 303,750.00
							$ 2,174,017.68

Clarifier Upgrades

			Qty	Unit	Price per Unit	Materials	Total
Division 11	Equipment						
		Demolition of Existing Equipment	2	each	$ 10,000.00	$ 20,000.00	$ 20,000.00
		Secondary Clarifier Mechanisms	2	each	$ 84,250.00	$ 168,500.00	$ 387,550.00
		FRP Weirs, Baffles, Launder Covers	2	each	$ 41,750.00	$ 83,500.00	$ 125,250.00

Subtotal Construction = $ 532,800.00

APPENDIX X

FINANCIAL CAPABILITY ASSESSMENT
ALTERNATIVE 1

Schedule 6.
AFFORD
(FORM LTCP-EZ)

Schedule 6. CSO AFFORDABILITY

➢ Attach to FORM LTCP-EZ

Attachment Sequence # **06**

Community name shown on FORM LTCP-EZ	NPDES number	Date
City of Duquesne - Municipal Authority of the City of McKeesport *ALTERNATIVE 1*	*PA0026981*	8/25/14

Current Costs	1	Annual operations and maintenance expenses (excluding depreciation). *See instructions.*	1	$488,267
	2	Annual debt service (principal and interest). *See instructions.*	2	$534,660
	3	**Current Costs.** *Add lines 1 and 2.*	3	$1,022,927
Projected Costs (Current Dollars)	4	Projected annual operations and maintenance expenses (excluding depreciation). *See instructions.*	4	$50,000
	5	Present value adjustment factor. *See instructions.*	5	1.0000
	6	Present value of projected costs. *Multiply line 4 by line 5.*	6	$50,000
	7	Projected debt costs. *See instructions.*	7	$7,424,000
	8	Annualization factor. *See instructions.*	8	0.0620
	9	Annual debt service (principal and interest) for projected WWT facilities and CSO controls. *Multiply line 7 by line 8.*	9	$459,920
	10	**Projected Costs.** *Add lines 6 and 9.*	10	$509,920
Total Costs	11	**Total current and projected WWT and CSO costs.** *Add lines 3 and 10*	11	$1,532,846
Cost Per Household	12	Residential WWT flow (MGD). *See instructions*	12	2.500
	13	Total WWT flow (MGD). *See instructions*	13	2.500
	14	Fraction of total WWT flow attributable to residential users. *Divide line 12 by line 13.*	14	1.000
	15	Residential share of total costs. *Mulitply line 11 by line 14.*	15	$1,532,846
	16	Number of households in service area. *See instructions.*	16	1,919
	17	**Cost Per Household (CPH).** *Divide line 15 by line 16.*	17	**$799**
Median Household Income	18	Census Year MHI. *See instructions.*	18	$20,333
	19	MHI adjustment factor. *See instructions.*	19	1.0363
	20	**Adjusted MHI.** *Multiply line 18 by line 19.*	20	$21,072
Residential Indicator	21	Annual WWT/CSO control CPH as % adjusted MHI. *Divide line 17 by line 20, then multiply by 100.*	21	**3.79**
	22	**Residential Indicator.** *See instructions.*	22	High
Bond Rating	23 a	Date of most recent general obligation bond	23a	N/A
	b	Rating agency (Moody's or Standard and Poor's)	23b	N/A
	c	Rating (Moody's Aaa-C or Standard and Poor's AAA-D)	23c	N/A
	24 a	Date of most recent revenue (water or sewer) bond	24a	N/A
	b	Rating agency (Moody's or Standard and Poor's)	24b	N/A
	c	Bond insurance (Yes/No)	24c	N/A
	d	Rating (Moody's Aaa-C or Standard and Poor's AAA-D)	24d	N/A
	25	**Bond Rating Benchmark.** *See instructions.*	25	N/A
Overall Net Debt	26	Direct net debt (G.O. bonds excluding double-barreled bonds). *See instructions.*	26	$1,964,002
	27	Debt of overlapping entities (proportionate share of multijurisdictional debt). *See instructions.*	27	$0
	28	Overall net debt. *Add lines 26 and 27.*	28	$1,964,002
	29	Full market property value (MPV). *See instructions.*	29	$141,660,440
	30	Overall net debt as a percent of full MPV. *Divide line 28 by line 29, then multiply by 100.*	30	1.39
	31	**Net Debt Benchmark.** *See instructions*	31	Strong
Unemployment Rate	32	Unemployment rate for permittee service area. *See instructions.* *Source:* ***Census 2008-2012 American Community Survey***	32	21.7%
	33	Unemployment rate for permitee's county (use if permittee's rate is unavailable). *See instructions.* *Source:* ***Census 2008-2012 American Community Survey***	33	7.5%
	34	Average national unemployment rate. *See instructions.* *Source:* ***Census 2008-2012 American Community Survey***	34	6.7%
	35	**Unemployment Rate Benchmark.** *See instructions.*	35	Weak

Schedule 6.
AFFORD
(FORM LTCP-EZ)

Schedule 6. AFFORD - CSO Affordability

➤ Attach to FORM LTCP-EZ

Attachment Sequence #

Community name shown on FORM LTCP-EZ	NPDES number	Date
City of Duquesne - Municipal Authority of the City of McKeesport ***ALTERNATIVE 1***	*PA0026981*	8/25/14

Median Household Income	36	Median household income - permittee. *Copy from line 20.* Source: ***Census 2008-2012 American Community Survey***	36	$21,072
	37	Census Year national MHI. *See instructions.* Source: ***Census 2008-2012 American Community Survey***	37	$53,046
	38	MHI adjustment factor. *Copy from line 19.*	38	1.0363
	39	Adjusted national MHI. *Multiply line 37 by line 38.*	39	$54,973
	40	**MHI Benchmark.** *See instructions.*	40	**Weak**
Financial Management Indicators	41	Full market value of real property. *Copy from line 29.*	41	$141,660,440
	42	Property tax revenues. *See instructions.*	42	$1,136,286
	43	Property tax revenues as a percent of full MPV. *Divide line 42 by line 41, then multiply by 100.*	43	0.80
	44	**Property Tax Benchmark.** *See instructions.*	44	**Strong**
Property Tax and Collection Rate	45	Property Taxes Levied. *See instructions.*	45	$1,455,050
	46	Property Tax Revenue Collection Rate. *Divide line 42 by line 45, then multiply by 100.*	46	78.09
	47	**Collection Rate Benchmark.** *See instructions.*	47	**Weak**
Matrix Score	48	Enter benchmark and corresponding score		

		Benchmark	Score
a Bond Rating. *From line 25.*	48a		
b Net Debt. *From line 31.*	48b	Strong	3
c Unemployment Rate. *From line 35.*	48c	Weak	1
d Median Household Income. *From line 40.*	48d	Weak	1
e Property Tax. *From line 44.*	48e	Strong	3
f Collection Rate. *From line 47.*	48f	Weak	1
g Sum. *Sum up scores.*	48g		9

49	Permittee indicators score. *Divide line 48g by number of scores.*	49	1.80
50	**Permittee Financial Capability Indicators Benchmark.** *See instructions.*	50	**Mid-Range**
51	Residential indicator benchmark. *Copy from line 22.*	51	High
52	**Financial Capability (High Burden, Medium Burden, or Low Burden).** *See instructions.*	52	HIGH

APPENDIX Y

FINANCIAL CAPABILITY ASSESSMENT
ALTERNATIVE 2

Schedule 6.
AFFORD
(FORM LTCP-EZ)

Schedule 6. CSO AFFORDABILITY

➤ Attach to FORM LTCP-EZ

Attachment Sequence # **06**

Community name shown on FORM LTCP-EZ	NPDES number	Date
City of Duquesne - Municipal Authority of the City of McKeesport *ALTERNATIVE 2*	*PA0026981*	*8/25/14*

Current Costs	1	Annual operations and maintenance expenses (excluding depreciation). *See instructions.*	1	$488,267
	2	Annual debt service (principal and interest). *See instructions.*	2	$534,660
	3	**Current Costs.** *Add lines 1 and 2.*	3	$1,022,927
Projected Costs (Current Dollars)	4	Projected annual operations and maintenance expenses (excluding depreciation). *See instructions*	4	$0
	5	Present value adjustment factor. *See instructions.*	5	1.0000
	6	Present value of projected costs. *Multiply line 4 by line 5.*	6	$0
	7	Projected debt costs. *See instructions.*	7	$15,511,000
	8	Annualization factor. *See instructions.*	8	0.0620
	9	Annual debt service (principal and interest) for projected WWT facilities and CSO controls. *Multiply line 7 by line 8.*	9	$960,913
	10	**Projected Costs.** *Add lines 6 and 9.*	10	$960,913
Total Costs	11	**Total current and projected WWT and CSO costs.** *Add lines 3 and 10*	11	$1,983,839
Cost Per Household	12	Residential WWT flow (MGD). *See instructions*	12	2.500
	13	Total WWT flow (MGD). *See instructions*	13	2.500
	14	Fraction of total WWT flow attributable to residential users. *Divide line 12 by line 13.*	14	1.000
	15	Residential share of total costs. *Mulitply line 11 by line 14.*	15	$1,983,839
	16	Number of households in service area. *See instructions.*	16	1,919
	17	**Cost Per Household (CPH).** *Divide line 15 by line 16.*	17	**$1,034**
Median Household Income	18	Census Year MHI. *See instructions.*	18	$20,333
	19	MHI adjustment factor. *See instructions.*	19	1.0363
	20	**Adjusted MHI.** *Multiply line 18 by line 19.*	20	$21,072
Residential Indicator	21	Annual WWT/CSO control CPH as % adjusted MHI. *Divide line 17 by line 20, then multiply by 100.*	21	**4.91**
	22	**Residential Indicator.** *See instructions.*	22	**High**
Bond Rating	23 a	Date of most recent general obligation bond	23a	N/A
	b	Rating agency (Moody's or Standard and Poor's)	23b	N/A
	c	Rating (Moody's Aaa-C or Standard and Poor's AAA-D)	23c	N/A
	24 a	Date of most recent revenue (water or sewer) bond	24a	N/A
	b	Rating agency (Moody's or Standard and Poor's)	24b	N/A
	c	Bond insurance (Yes/No)	24c	N/A
	d	Rating (Moody's Aaa-C or Standard and Poor's AAA-D)	24d	N/A
	25	**Bond Rating Benchmark.** *See instructions.*	25	**N/A**
Overall Net Debt	26	Direct net debt (G.O. bonds excluding double-barreled bonds). *See instructions.*	26	$1,964,002
	27	Debt of overlapping entities (proportionate share of multijurisdictional debt). *See instructions.*	27	$0
	28	Overall net debt. *Add lines 26 and 27.*	28	$1,964,002
	29	Full market property value (MPV). *See instructions.*	29	$141,660,440
	30	Overall net debt as a percent of full MPV. *Divide line 28 by line 29, then multiply by 100.*	30	1.39
	31	**Net Debt Benchmark.** *See instructions*	31	**Strong**
Unemployment Rate	32	Unemployment rate for permittee service area. *See instructions.* *Source:* ***Census 2008-2012 American Community Survey***	32	21.7%
	33	Unemployment rate for permitee's county (use if permittee's rate is unavailable). *See instructions.* *Source:* ***Census 2008-2012 American Community Survey***	33	7.5%
	34	Average national unemployment rate. *See instructions.* *Source:* ***Census 2008-2012 American Community Survey***	34	6.7%
	35	**Unemployment Rate Benchmark.** *See instructions.*	35	**Weak**

Schedule 6.
AFFORD
(FORM LTCP-EZ)

Schedule 6. AFFORD - CSO Affordability

➤ Attach to FORM LTCP-EZ

Attachment Sequence #

Community name shown on FORM LTCP-EZ	NPDES number	Date
City of Duquesne - Municipal Authority of the City of McKeesport *ALTERNATIVE 2*	*PA0026981*	8/25/14

Median Household Income	36	Median household income - permittee. *Copy from line 20.* *Source:* ***Census 2008-2012 American Community Survey***	36	$21,072
	37	Census Year national MHI. *See instructions.* *Source:* ***Census 2008-2012 American Community Survey***	37	$53,046
	38	MHI adjustment factor. *Copy from line 19.*	38	1.0363
	39	Adjusted national MHI. *Multiply line 37 by line 38.*	39	$54,973
	40	**MHI Benchmark.** *See instructions.*	40	**Weak**
Financial Management Indicators	41	Full market value of real property. *Copy from line 29.*	41	$141,660,440
	42	Property tax revenues. *See instructions.*	42	$1,136,286
	43	Property tax revenues as a percent of full MPV. *Divide line 42 by line 41, then multiply by 100.*	43	0.80
	44	**Property Tax Benchmark.** *See instructions.*	44	**Strong**
Property Tax and Collection Rate	45	Property Taxes Levied. *See instructions.*	45	$1,455,050
	46	Property Tax Revenue Collection Rate. *Divide line 42 by line 45, then multiply by 100.*	46	78.09
	47	**Collection Rate Benchmark.** *See instructions.*	47	**Weak**

Matrix Score 48 Enter benchmark and corresponding score

		Benchmark	Score
a Bond Rating. *From line 25.*	48a		
b Net Debt. *From line 31.*	48b	Strong	3
c Unemployment Rate. *From line 35.*	48c	Weak	1
d Median Household Income. *From line 40.*	48d	Weak	1
e Property Tax. *From line 44.*	48e	Strong	3
f Collection Rate. *From line 47.*	48f	Weak	1
g Sum. *Sum up scores.*	48g		9

49	Permittee indicators score. *Divide line 48g by number of scores.*	49	1.80
50	**Permittee Financial Capability Indicators Benchmark.** *See instructions.*	50	**Mid-Range**
51	Residential indicator benchmark. *Copy from line 22.*	51	**High**
52	**Financial Capability (High Burden, Medium Burden, or Low Burden).** *See instructions.*	52	**HIGH**

APPENDIX Z

FINANCIAL CAPABILITY ASSESSMENT
ALTERNATIVE 3

Schedule 6.
AFFORD
(FORM LTCP-EZ)

Schedule 6. CSO AFFORDABILITY

➢ Attach to FORM LTCP-EZ

Attachment Sequence # **06**

Community name shown on FORM LTCP-EZ	NPDES number	Date
City of Duquesne - Municipal Authority of the City of McKeesport *ALTERNATIVE 3*	*PA0026981*	*8/25/14*

Current Costs	1	Annual operations and maintenance expenses (excluding depreciation). *See instructions.*	1	$488,267
	2	Annual debt service (principal and interest). *See instructions.*	2	$534,660
	3	**Current Costs.** *Add lines 1 and 2.*	3	$1,022,927
Projected Costs (Current Dollars)	4	Projected annual operations and maintenance expenses (excluding depreciation). *See instruction*	4	$50,000
	5	Present value adjustment factor. *See instructions.*	5	1.0000
	6	Present value of projected costs. *Multiply line 4 by line 5.*	6	$50,000
	7	Projected debt costs. *See instructions.*	7	$12,907,000
	8	Annualization factor. *See instructions.*	8	0.0620
	9	Annual debt service (principal and interest) for projected WWT facilities and CSO controls. *Multiply line 7 by line 8.*	9	$799,594
	10	**Projected Costs.** *Add lines 6 and 9.*	10	$849,594
Total Costs	11	**Total current and projected WWT and CSO costs.** *Add lines 3 and 10*	11	$1,872,520
Cost Per Household	12	Residential WWT flow (MGD). *See instructions*	12	2.500
	13	Total WWT flow (MGD). *See instructions*	13	2.500
	14	Fraction of total WWT flow attributable to residential users. *Divide line 12 by line 13.*	14	1.000
	15	Residential share of total costs. *Mulitply line 11 by line 14.*	15	$1,872,520
	16	Number of households in service area. *See instructions.*	16	1,919
	17	**Cost Per Household (CPH).** *Divide line 15 by line 16.*	17	**$976**
Median Household Income	18	Census Year MHI. *See instructions.*	18	$20,333
	19	MHI adjustment factor. *See instructions.*	19	1.0363
	20	**Adjusted MHI.** *Multiply line 18 by line 19.*	20	$21,072
Residential Indicator	21	Annual WWT/CSO control CPH as % adjusted MHI. *Divide line 17 by line 20, then multiply by 100*	21	**4.63**
	22	**Residential Indicator.** *See instructions.*	22	High
Bond Rating	23 a	Date of most recent general obligation bond	23a	N/A
	b	Rating agency (Moody's or Standard and Poor's)	23b	N/A
	c	Rating (Moody's Aaa-C or Standard and Poor's AAA-D)	23c	N/A
	24 a	Date of most recent revenue (water or sewer) bond	24a	N/A
	b	Rating agency (Moody's or Standard and Poor's)	24b	N/A
	c	Bond insurance (Yes/No)	24c	N/A
	d	Rating (Moody's Aaa-C or Standard and Poor's AAA-D)	24d	N/A
	25	**Bond Rating Benchmark.** *See instructions.*	25	N/A
Overall Net Debt	26	Direct net debt (G.O. bonds excluding double-barreled bonds). *See instructions.*	26	$1,964,002
	27	Debt of overlapping entities (proportionate share of multijurisdictional debt). *See instructions.*	27	$0
	28	Overall net debt. *Add lines 26 and 27.*	28	$1,964,002
	29	Full market property value (MPV). *See instructions.*	29	$141,660,440
	30	Overall net debt as a percent of full MPV. *Divide line 28 by line 29, then multiply by 100.*	30	1.39
	31	**Net Debt Benchmark.** *See instructions*	31	Strong
Unemployment Rate	32	Unemployment rate for permittee service area. *See instructions.* *Source:* ***Census 2008-2012 American Community Survey***	32	21.7%
	33	Unemployment rate for permitee's county (use if permittee's rate is unavailable). *See instructions.* *Source:* ***Census 2008-2012 American Community Survey***	33	7.5%
	34	Average national unemployment rate. *See instructions.* *Source:* ***Census 2008-2012 American Community Survey***	34	6.7%
	35	**Unemployment Rate Benchmark.** *See instructions.*	35	Weak

Schedule 6.
AFFORD
(FORM LTCP-EZ)

Schedule 6. AFFORD - CSO Affordability

➢ Attach to FORM LTCP-EZ

Attachment Sequence #

Community name shown on FORM LTCP-EZ	NPDES number	Date
City of Duquesne - Municipal Authority of the City of McKeesport **ALTERNATIVE 3**	PA0026981	8/25/14

Median Household Income	36	Median household income - permittee. *Copy from line 20.* Source: **Census 2008-2012 American Community Survey**	36	$21,072
	37	Census Year national MHI. *See instructions.* Source: **Census 2008-2012 American Community Survey**	37	$53,046
	38	MHI adjustment factor. *Copy from line 19.*	38	1.0363
	39	Adjusted national MHI. *Multiply line 37 by line 38.*	39	$54,973
	40	**MHI Benchmark.** *See instructions.*	40	Weak
Financial Management Indicators	41	Full market value of real property. *Copy from line 29.*	41	$141,660,440
	42	Property tax revenues. *See instructions.*	42	$1,136,286
	43	Property tax revenues as a percent of full MPV. *Divide line 42 by line 41, then multiply by 100.*	43	0.80
	44	**Property Tax Benchmark.** *See instructions.*	44	Strong
Property Tax and Collection Rate	45	Property Taxes Levied. *See instructions.*	45	$1,455,050
	46	Property Tax Revenue Collection Rate. *Divide line 42 by line 45, then multiply by 100.*	46	78.09
	47	**Collection Rate Benchmark.** *See instructions.*	47	Weak

Matrix Score 48 Enter benchmark and corresponding score

		Benchmark	Score
a Bond Rating. *From line 25.*	48a		
b Net Debt. *From line 31.*	48b	Strong	3
c Unemployment Rate. *From line 35.*	48c	Weak	1
d Median Household Income. *From line 40.*	48d	Weak	1
e Property Tax. *From line 44.*	48e	Strong	3
f Collection Rate. *From line 47.*	48f	Weak	1
g Sum. *Sum up scores.*	48g		9

49	Permittee indicators score. *Divide line 48g by number of scores.*	49	1.80
50	**Permittee Financial Capability Indicators Benchmark.** *See instructions.*	50	Mid-Range
51	Residential indicator benchmark. *Copy from line 22.*	51	High
52	**Financial Capability (High Burden, Medium Burden, or Low Burden)**. *See instructions.*	52	HIGH

APPENDIX D

BOROUGH OF DRAVOSBURG
COMBINED SEWER SYSTEM
LONG TERM CONTROL PLAN

MUNICIPAL AUTHORITY OF THE CITY OF MCKEESPORT
BOROUGH OF DRAVOSBURG

Combined Sewer System
Long Term Control Plan
August 2014

KLH

ENGINEERS, INC
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205-9733

MUNICIPAL AUTHORITY OF THE CITY OF MCKEESPORT

BOROUGH OF DRAVOSBURG

COMBINED SEWER SYSTEM LONG TERM CONTROL PLAN

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ABBREVIATIONS

AAF	Annual Average Flow
BNR	Biological Nutrient Removal
BOD	Biological Oxygen Demand
CSO	Combined Sewer Overflow
CSS	Combined Sewer System
DEP	Pennsylvania Department of Environmental Protection
EDU	Equivalent Dwelling Unit
EPA	United States Environmental Protection Agency
FEMA	Federal Emergency Management Agency
GPD	Gallons Per Day
GPM	Gallons Per Minute
LF	Linear Feet
LTCP	Long-Term Control Plan
lb/day	Pounds Per Day
mg/L	Milligrams Per Liter
MGD	Million Gallons Per Day
/100ml	Colony Forming Units Per 100 Milliliter
MMF	Maximum Monthly Average Flow
NH_3-N	Ammonia Nitrogen
NO_2	Nitrite
NO_3	Nitrate
NPDES	National Pollutant Discharge Elimination System
PDF	Peak Daily Flow
PIF	Peak Instantaneous Flow
PHF	Peak Hourly Flow
PLC	Programmable Logic Controller
POTW	Publicly Owned Treatment Works
SBR	Sequencing Batch Reactor
SCS	United States Natural Resources Conservation Service
SOR	Surface Overflow Rate
SWMM	Storm Water Management Model
TF	Trickling Filter
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
UV	Ultraviolet
VFD	Variable Frequency Drive
WWTP	Wastewater Treatment Plant

1.0 EXECUTIVE SUMMARY

The Long-Term Control Plan (LTCP) was completed in order to address wastewater treatment plant (WWTP) and combined sewer system (CSS) upgrades necessary to meet Federal and State regulatory requirements. The goal of the LTCP is to decrease volume of combined sewage overflows on an annual basis and subsequently, increase the volume that receives treatment at the WWTP.

The focus of this LTCP update is to:

1. Develop WWTP design loadings required in order to address combined sewer overflow (CSO) regulatory requirements.

2. Evaluate the capacity of the existing Borough of Dravosburg WWTP processes relative to design loadings.

3. Complete evaluation of feasible alternatives developed to address WWTP process deficiencies relative to design loadings.

It was determined that no CSS upgrades are required to convey the 10-year, 24-hour design storm flow while maintaining greater than 85% capture of all combined flow during a typical year, given a free discharge at the WWTP pump station. Detailed evaluation was completed for two (2) alternatives.

- Alternative 1 – Modify existing WWTP to Sequencing Batch Reactor (SBR).

- Alternative 2 – Pump Station to MACM WWTP + existing tanks as flow storage.

Detailed evaluation of the proposed alternatives led to the recommendation of Alternative 2 for Borough's LTCP upgrades. The total estimated project cost is $5,503,000. This alternative is recommended for the following reasons:

- Alternative 1 project cost is $3,371,000 more than the recommended Alternative 2.

- Alternative 2 eliminates operation and maintenance requirements of a WWTP.

The following LTCP schedule is proposed.

Milestone	Date
Submit draft LTCP	September 1, 2014
Submit final LTCP with MACM ACT 537	November 1, 2015
DEP approval of LTCP and ACT 537	January 1, 2016
Obtain funding for design related services	January 1, 2017
Begin design of upgrades	January 1, 2017
Apply for MACM WWTP re-rate	July 1, 2017
Apply for Part II Permit for pump station	July 1, 2018
Receive Part II Permit for pump station	January 1, 2019
Obtain funding for construction	January 1, 2021
Begin construction for CSS upgrades	March 1, 2021
Complete construction	March 1, 2023
Submit post construction compliance monitoring plan	September 1, 2023

*DEP LTCP approval and Part II Permit dates are beyond the control of the Borough and KLH, therefore schedule dates will be adjusted based on actual DEP milestone completion dates.

2.0 INTRODUCTION

2.1 BACKGROUND

The Borough of Dravosburg is located in Allegheny County, Pennsylvania; it is situated along the Monongahela River. The population was 1,792 at the 2010 Census. For all intents and purposes, 100% of the Borough is provided sewer service and the service area does not go beyond the corporate limits. The Borough's combined sewer system (CSS) presently serves 609 customers. Utilizing the U.S. Census data for 2010, which indicates an average of 2.01 persons per household, it is estimated that the WWTP serves approximately 1,224 persons. The WWTP is located in the eastern area of Dravosburg and discharges directly into the Monongahela River. The plant is owned by the Municipal Authority of the City of McKeesport and operated under NPDES Permit No. PA0028401.

The Borough has selected to utilize the EPA CSO Control Policy "presumption" approach criteria ii through their Long Term Control Plan (LTCP) process. The criteria are as follows:

> *"The elimination or capture for treatment of no less than 85% by volume of combined sewage collected in the CSS during precipitation events on a system-wide annual average basis."*

In order to assess the overflow volumes relative to total CSS conveyance on an annual average basis, the Borough completed a system characterization survey, a comprehensive flow monitoring study (from January 1, 2013 through July 1, 2013), and computer modeling, utilizing SWMM, of CSS hydraulic and hydrologic characteristics. The results of the flow monitoring and modeling study are described through this report.

This report will summarize sewer system upgrades/modifications required in order to allow for the "presumption" approach criteria to be met.

The monitoring and modeling established peak flow instantaneous flow as 3.812 MGD, based on 10-year, 24-hour rain event with no manhole overflows. This peak flow value is far in excess of the existing WWTP's peak capacity, but the system was capable of conveying the flow to the WWTP. Therefore, no sewer system upgrades or modifications will be necessary to meet the EPA CSO Control Policy.

The focus of this Long-Term Control Plan is to:

1. Develop WWTP design loadings required in order to address combined sewer overflow (CSO) regulatory requirements.
2. Evaluate the capacity of the existing Borough of Dravosburg WWTP processes relative to design loadings.

3. Complete evaluation of feasible alternatives developed to address WWTP process deficiencies relative to design loadings.

2.2 DOCUMENT INTENTION

This document is intended for planning purposes only. Evaluation of specific processes is limited to confirming feasibility and estimating planning level project costs. Once this LTCP update report is approved, the basis of design study can commence. This study will focus on the process modeling, detailed equipment evaluation, and development of process control logic for the recommended alternative. The Basis of Design Report will serve as the basis for all design phase work.

3.0 SYSTEM CHARACTERIZATION

3.1 SERVICE AREA

The Borough of Dravosburg presently serves 609 customers. The system includes 8.5 miles of interceptor and collector sewers, two (2) pump stations, and one (1) diversion chamber, and two (2) CSO outfalls. The only un-sewered service areas are in the northern section of Pittsburgh-McKeesport Boulevard from Sixth Street to Bettis Road, Luscombe Lane, and the homes around Sandy Lake. The Borough's collection system is split into the following sewersheds:

Dravosburg Sewersheds

Table 3.1

Sewershed	Flow Type	Location from WWTP
Dravosburg	Combined	North
Bettis Road	Sanitary	North-Eastern
Richland Ave	Sanitary	North-Western
Scott Drive	Sanitary	Western
Clay Street	Sanitary	Eastern

3.2 DIVERSION CHAMBERS

The CSS includes two (2) CSO outfalls. The CSO identification numbers and locations are listed in Table 3.2 below. The locations of these CSO's are shown on the drawing set included in Appendix A.

Dravosburg CSO's

Table 3.2

CSO ID No.	Location	Comments
001	WWTP	WWTP Outfall
002	Along SR 837 at WWTP	Diversion Chamber to WWTP Outfall

3.3 PUMP STATIONS

The Dravosburg sewage collection system and WWTP has two (2) pump stations. The first is the Bettis Road Pump Station which collects sanitary only flow from the north-central portion of the Borough. The pump station houses two (2) identical pumps rated for 0.252 MGD (175 GPM) at 75-feet total dynamic head (TDH).

There is a second pump station located at the headworks of the plant. The influent station pumps flow from the wet well to the grit chamber influent channel. The pump station has three (3) dry-pit submersible pumps. Two (2) of the pumps are identical, rated at 0.576 MGD (400 GPM) at 31-feet TDH. The third pump is rated for 0.72 MGD (500 GPM) at 33-feet TDH.

During wet weather flow, the two (2) smaller pumps produce the same flow rate as the single larger pump. The WWTP is rated for an average flow rate of 0.48 MGD, and wet weather flow equal to 1.5 times average, or 0.72 MGD.

3.3.1 Interceptor Sewer

The Dravosburg conveyance system consists of the following.

Dravosburg Conveyance System

Table 3.3

Pipe Diameter [inches]	Length [feet]
8	24,577
10	7,957
12	7,396
15	320
18	2,376
20	360
24	1,440
60	428
72	2,227
Brick Eggshape	613
6-inch Forcemain	1,100
Total [feet]	**48,794**
Total [miles]	**9.24**

A copy of the Dravosburg field survey data is included in Appendix B.

3.4 CSS UPGRADES REQUIRED

Flow monitoring and SWMM modeling was completed for the Borough's CSS. It was determined that no upgrades are required within the system to allow for conveyance of the peak core flow, 85% capture, and no manhole overflows given 10-year, 24-hour rain event and a free discharge at the WWTP pump station.

4.0 FLOW MONITORING STUDY

4.1 SITE SELECTION

Flow monitoring site locations were selected based on their importance in the collection system. Meters were installed and maintained by Drnach Environmental, Inc. (DE). Monitoring sites were selected to ensure all areas of the system were accounted for. In total, five (5) meters were required to account for all flow. These areas are as follows:

- Scott Drive Area (West)
- Clay Street Area(East)
- Bettis Road Area (North East)
- Richland Avenue Area (North West)
- Total North Area

The total north area meter accounted for the Bettis Road area, Richland Avenue area, and the remaining portion in the center of Dravosburg. By subtracting the Bettis and Richland flows from the total meter, the inflow from the center portion of Dravosburg was determined. DE site inspection forms are included in Appendix C. Table 4.1 shows the flow monitoring sites and monitoring period.

Dravosburg Flow Monitoring Sites

Table 4.1

Sites	Location	Monitoring Period	Comments
M-3	Front of WWTP	January 1 – June 1, 2013	Total North Area
M-4A	Behind 181 Duquesne Ave	January 1 – June 1, 2013	Bettis Road Area
M-5	110 Maple Ave	January 1 – June 1, 2013	Richland Avenue Area
M-6A	Washington Ave SW of WWTP	January 1 – June 1, 2013	Scott Drive Area
M-7A	Gravel road adjacent WWTP	January 1 – June 1, 2013	Clay Street Area

A map illustrating the metered areas of Dravosburg is included in Appendix A.

4.2 EQUIPMENT DESCRIPTION

The meters installed, by DE, for the flow monitoring study were area-velocity (A-V) meters. The A-V meters are capable of measuring head and flow velocity over the full range of sewer flow, from free-flow to surcharged as well as reverse flow.

Rain gauges utilized were tipping-bucket type.

4.3 FIELD QUALITY CONTROL

The A-V meters were installed, maintained, and downloaded by DE. Each site was visited on a weekly basis in order to ensure that the equipment was functioning properly. This approach allowed for issues to be corrected without significant loss of data and time.

4.4 OFFICE QUALITY ASSURANCE

Flow data provided to Dravosburg was reviewed by KLH Engineers, Inc. (KLH) in order to ensure that the data was reliable. Reliability of flow data was evaluated in terms of precision and accuracy.

Precision, repeatability of measurements, is best evaluated through use of scattergraphs. KLH reviewed scattergraphs provided by DE in order to confirm that the data being provided had a reasonable level of precision. Drnach scattergraphs and hydrographs for the meter sites are included in Appendix D.

Accuracy, how well meter values compare to actual values, was also evaluated. This evaluation is more difficult given that the actual flow or velocities at any given time are difficult to know for certain. However, accuracy was evaluated from a magnitude standpoint. Comparisons of total daily flows from the meter sites to the WWTP were made as well as individual site evaluations with respect to hydraulic evaluation tools such as Manning's Equation.

The data from all sites was determined by KLH to have reasonable levels of precision and accuracy and therefore the data was considered to be reliable for the purposes of this study.

4.5 RAIN EVENT SUMMARY

The major rainfall monitoring began on January 1, 2013 and ended on June 1, 2013. During this time period three (3) significant rain events occurred. These events are listed in Table 4.2 below. A significant rain event was defined as an event where rainfall depth was greater than or equal to one inch.

Significant Rain Events

Table 4.2

Event No.	Start Date	End Date	Duration [hrs]	Depth [in]
1	1/30/2013	1/31/2013	22.25	1.08
2	2/26/2013	2/27/2013	24.75	1.01
3	4/16/2013	4/17/2013	8.75	1.13

During this time period, the total rainfall depth was 13.08 inches. Annual average rainfall for the National Oceanic and Atmospheric Administration (NOAA) McKeesport, PA site (nearest rain gage site to Dravosburg) is 37.05 inches. The rainfall recorded during the monitoring period is a slightly less than the annual average rain event.

$$(13.08 \text{ inches}) \times (12 \text{ months/year}) \div (5 \text{ months}) = 31.39 \text{ inches/year}$$

5.0 COMBINED SEWER SYSTEM MODELING

5.1 METHODOLOGY

The Dravosburg CSS was modeled utilizing Innovyze InfoSWMM (SWMM). SWMM is a dynamic rainfall-runoff simulation model used for single event or long-term (continuous) simulation of runoff quantity and quality from primarily urban areas. The runoff component of SWMM operates on a collection of sub-catchment areas that receive precipitation and generate runoff and pollutant loads. The routing portion of SWMM transports this runoff through a system of pipes, channels, storage/treatment devices, pumps, and regulators.

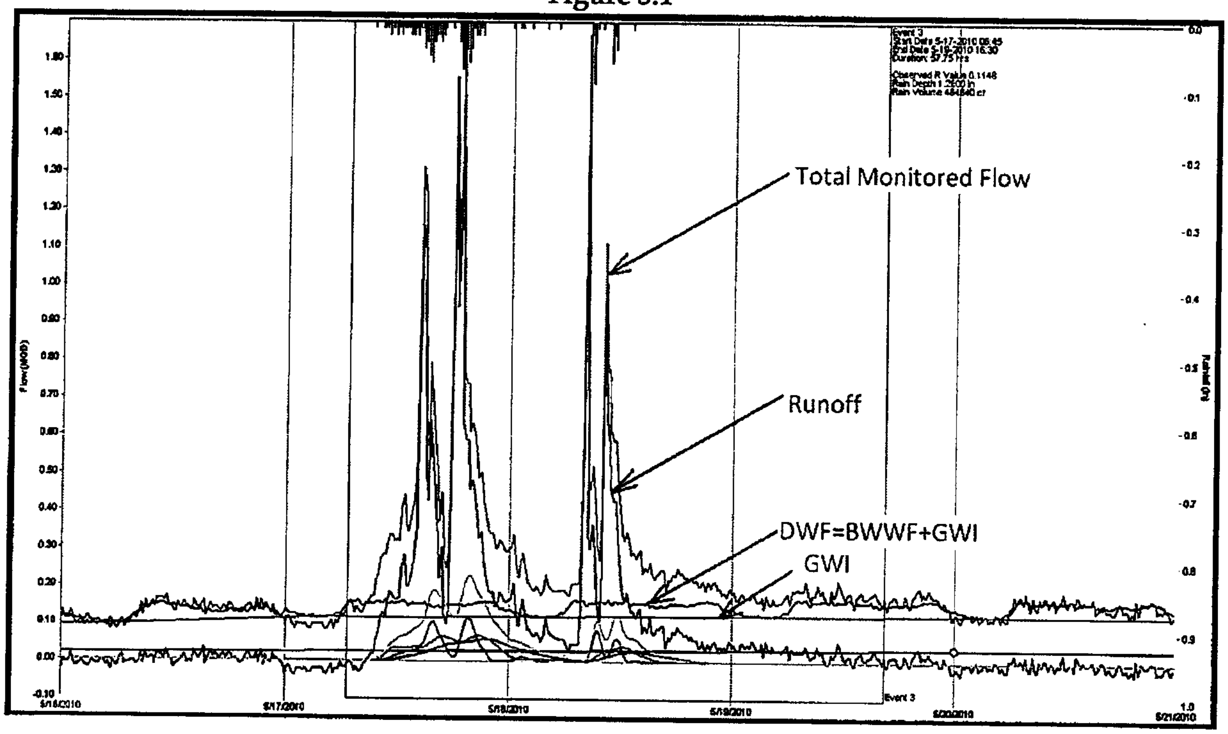
5.1.1 Model Hydrology

There are three (3) major components of the total sewer flow in combined sewer system. Dry weather flow (DWF) includes two components (groundwater infiltration and base wastewater flow). The third component is runoff. Groundwater infiltration (GWI) represents groundwater that enters the collection system through defective pipes, pipe joints, and leaking manhole walls during dry weather. Base wastewater flow (BWWF) is the residential, industrial and commercial flow discharged to the sewer system for collection and treatment. GWI and BWWF together comprise the base flow, or dry weather portion of sewer flow. Runoff represents the wet-weather contribution that enters a combined sewer system during and after a rainfall event.

Accurate dry weather flow plays an important role in hydrologic and hydraulic (H&H) modeling. Dry weather flow loadings were determined through analysis of flow monitoring data during dry weather days from each flow monitoring location as well as the total system flow monitored at the WWTP. Hydrograph decomposition is the process of analyzing a total monitored sewer flow hydrograph and estimating the three components of wastewater flow (Runoff, BWWF and GWI). Hydrograph decomposition was performed using EPA Sanitary Sewer Overflow Analysis and Planning (SSOAP) Toolbox. Although SSOAP Toolbox is mainly used in sanitary sewer overflow analysis, its capability of hydrograph decomposition can also be utilized in combined sewer overflow analysis. Figure 5.1 illustrates the hydrograph decomposition of monitored wastewater flow. The average base flow (BWWF and GWI) time series is projected through the monitored wet weather hydrograph. The area between the wet-weather hydrograph and the average base flow time series represents the Runoff volume.

Hydrograph Decomposition of Total Monitored Flow

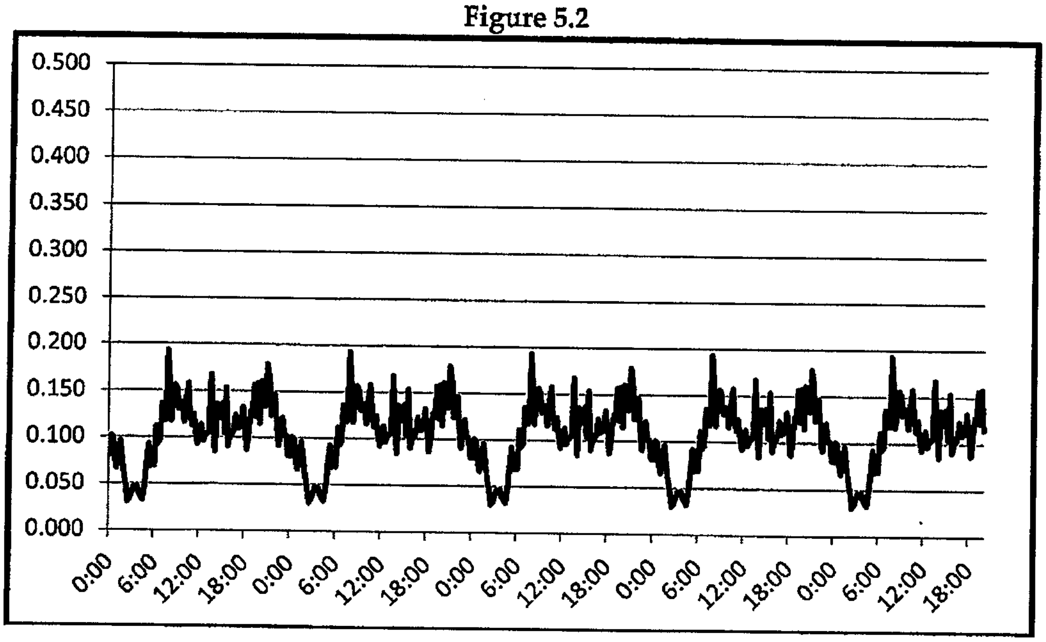
Figure 5.1



Generally, the dry weather flow varies with time in a day, with two peaks at about 7:00AM and 7:00PM, two bottoms at about 3:00AM and 3:00PM. The dry weather flows were loaded in corresponding upstream manholes. Figure 5.2 shows the typical dry weather flow pattern.

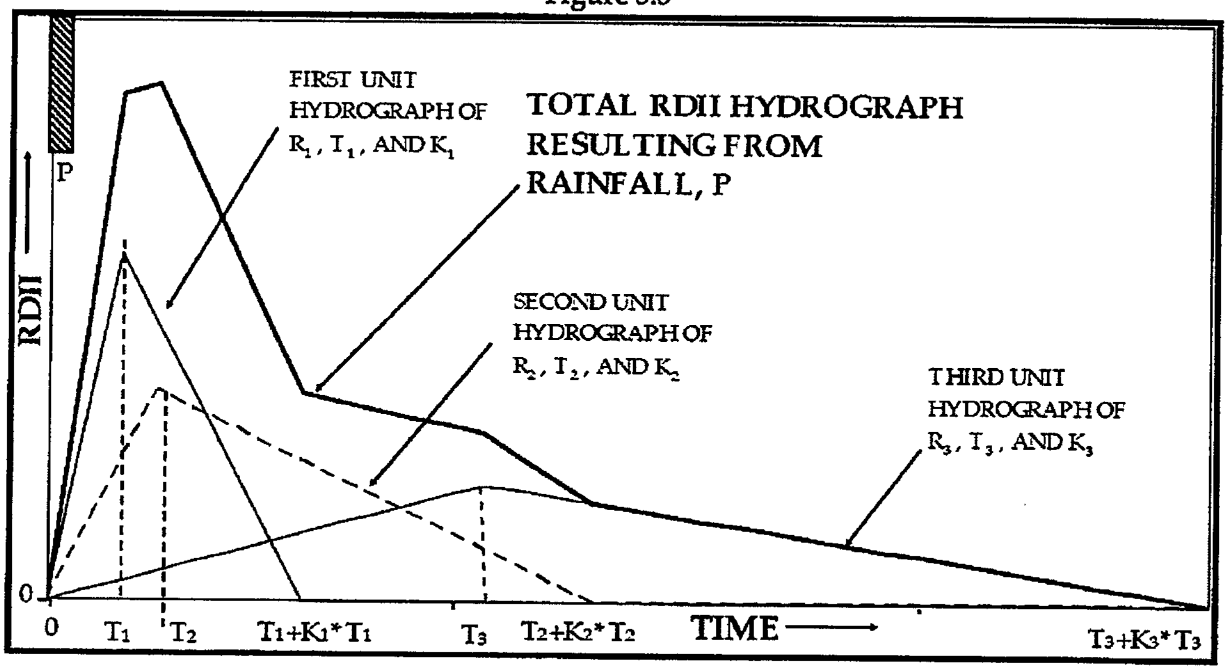
Typical Dry Weather Flow Pattern

Figure 5.2



Wet weather flows were simulated using InfoSWMM by utilizing the RTK unit hydrograph method. Figure 5.3 illustrates how SWMM generates three unit hydrographs based on the RTK parameters for a given unit rainfall input. It also demonstrates that the total RDII unit hydrograph is the summation of three individual unit hydrographs. The three unit hydrographs can be related with fast (first unit hydrograph), medium (second unit hydrograph), and slow (third unit hydrograph) RDII responses typically observed in the sanitary sewer system. In some cases, only one or two unit hydrographs are required to adequately define observed RDII hydrographs.

Summation of Three Unit Hydrographs
Figure 5.3



The following general guidelines should be followed in selecting the RTK parameters to ensure that the calculated RDII hydrograph meets the goal of visual curve fittings:

- Total R value = $R_1 + R_2 + R_3$, if all three unit hydrographs used.
- The T and K parameters should be similar for rainfall events for a given sewershed tributary to the flow monitor since they depend on the geometry and sewer system layout.
- In all cases, $T_1 < T_2 < T_3$.
- In most cases, $K_1 < K_2 < K_3$.
- The necessity to change T and K significantly for a particular event to match the observed flows is often a sign that the rainfall data being used is not representative of the rainfall that fell over the basin for the event or the system experienced operational challenges resulting in an altered shape of the hydrograph.

- The event specific R-values will vary, generally being higher for wet antecedent moisture conditions and lower for dryer antecedent conditions. Similarly, R-values will typically be higher in a wet season.
- T and K for the three triangular unit hydrograph should generally be within the ranges shown in Table 5.1.

Ranges of Values for Unit Hydrograph Parameters
Table 5.1

Curve	T (Hours)	K
1	0.5 – 2	1 – 2
2	3 – 5	2 – 3
3	5 – 10	3 – 7

5.1.2 Model Hydraulics

Flows in the collection system, which include dry-weather flows and the wet-weather flows, are routed through the hydraulic configuration of the model. The hydraulic configuration of a model is the representation of the various hydraulic elements of the system, which can broadly be classified as nodes and links. Nodes in the model are the manholes, diversion chambers, wet well, and outfalls, while the links are the conduits, orifices, diversion weirs, and pumps connecting the nodes.

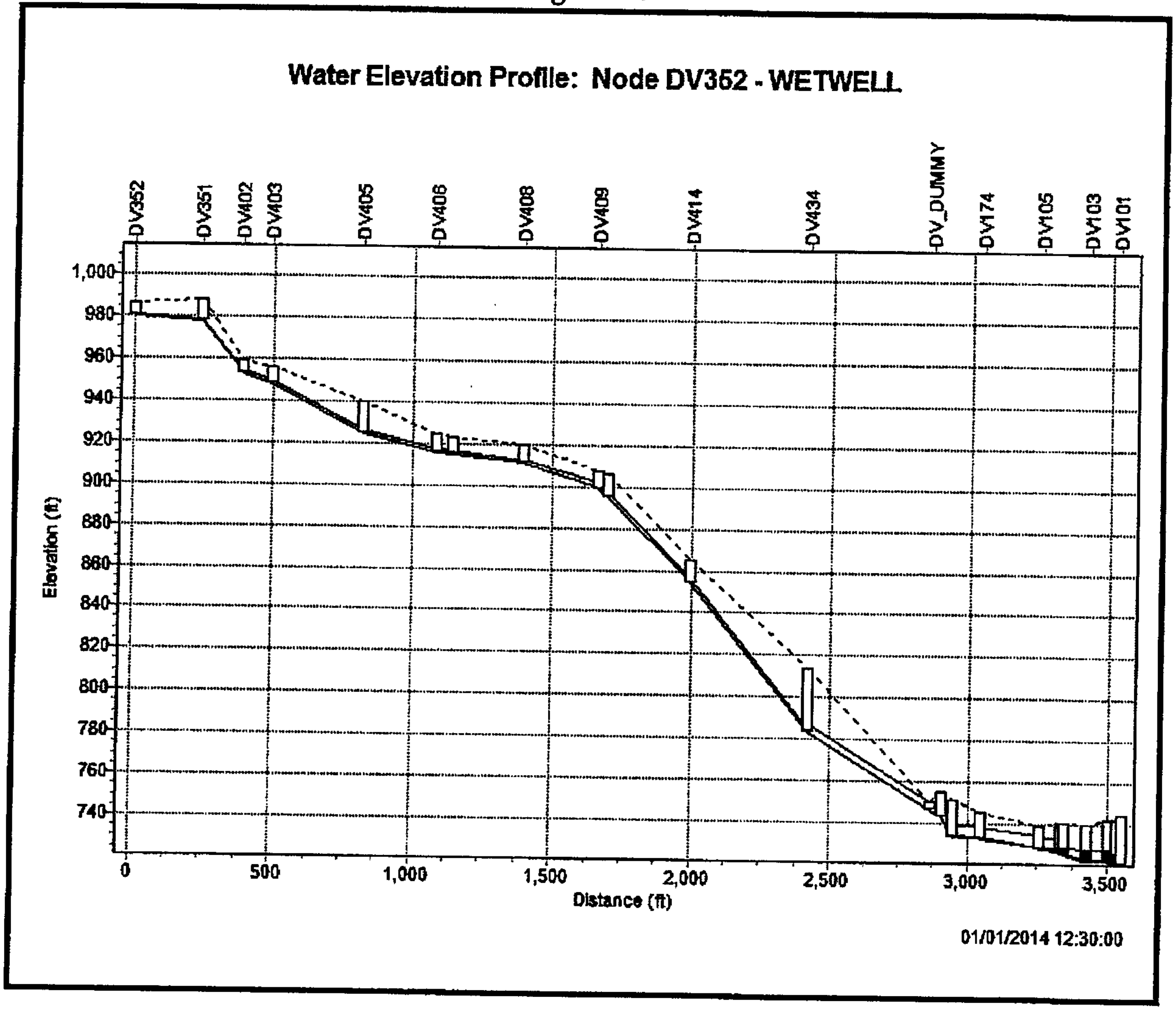
The purpose of a diversion chamber is to intercept and convey all of the dry-weather flow, and a regulated fraction of wet-weather flow, to the wastewater treatment plant. The diverted dry- and wet-weather flow is conveyed by a connector pipe to the interceptor, while wet-weather flows in excess of the design capacity of the regulator are diverted through a diversion weir or overflow pipe to a receiving stream. Wet wells are drainage system nodes that provide storage volume. Physically they could represent storage facilities as small as a catch-basin or as large as a lake. The volumetric properties of a storage unit are described by a function or table of surface area versus height. Outfalls are terminal nodes of the drainage system used to define final downstream boundaries under Dynamic Wave flow routing or discharge overflow to the receiving stream.

An orifice diversion structure is a modification of the dam structure consisting of a fixed plate or gate. At the entrance to the connector pipe, the gate or plate is designed to place additional hydraulic restrictions beyond that of the connector pipe on flow diverted to the interceptor. Usually the incoming municipal pipe and the overflow pipe are the same size while the connector pipe to the interceptor is smaller. As higher flows increase the hydraulic grade line (HGL) or water level in the structure, wet-weather overflow in excess of the engineered conveyance capacity of the regulator device and connector pipe is diverted through an outfall pipe to a receiving stream. Pumps are links used to lift water to higher elevations. A pump curve describes the relation between a pump's flow rate and conditions at its inlet and outlet nodes.

The Dravosburg interceptor system consists of north, west, and east sections with the treatment plant in the south. Example profiles of the interceptor are shown in Figure 5.4.

Interceptor Profile Between Manhole DV352 and Outfall WWTP-OF

Figure 5.4



Hydraulic routing of dry and wet weather flows was accomplished utilizing dynamic wave. Dynamic wave is the full solution of the Saint-Venant Equations, which describe one-dimensional unsteady flow through conservation of mass and momentum. The dynamic wave method is capable of estimating hydraulic parameters for free-flow, open channel with backwater effects, surcharged, full pipe, and reverse flow conditions. Although analysis utilizing this method is complex and time consuming, it is well suited to CSS which are subject to a variety of hydraulic conditions.

5.2 MODEL DEVELOPMENT

The major characteristics of interceptors in the model, which include conduit length, size, manhole invert, manhole depth, were developed using KLH survey data. Unlike sub-catchment hydrological parameters, the major characteristics of interceptors were deemed fixed and were not adjusted during model validation process, unless reliable investigation showed that there was an update for the manhole or conduit.

Additionally, field data collected by DE were used. Data collected by DE are manhole inspection with site photographs, precipitation data, and flow monitoring data.

Totally, the model contains 5 sub-catchments, 29 manhole structures, 30 conduits, one (1) outfall structure, one (1) orifice, three (3) storage structure. Appendix E shows a system map of the Dravosburg model. Appendix F shows the model components details in text format.

5.3 VALIDATION

Model validation is the process of adjusting both hydrologic (flow development) and hydraulic (flow routing) variables to best match actual measured flow data. The result is a hydrologic and hydraulic model of an existing collection system that best represents dry weather conditions and the flow responses to wet weather conditions and hydraulic grade lines (HGL) within the sewer system. A properly validated hydrologic and hydraulic model provides a valuable tool for many types of analyses including simple capacity analyses and CSO alternatives evaluation.

The Dravosburg model will be used as a predictive tool to characterize the sewage collection system under existing and future conditions. Therefore, it is imperative that the model accurately represents wastewater flows in the collection systems. To calibrate the Dravosburg model, extensive basin-wide flow monitoring was conducted to collect the required data. This data, once subjected to quality assurance procedures, was compared to the modeled response at the monitored locations. The model input parameters were then subject to validation to facilitate a closer correlation between the observed data and the simulated response.

5.3.1 Validation Criteria

The accuracy of the developed model during wet-weather events is essential when recommending appropriate wet-weather control facilities. To make sure that the model accurately represents the best available information, rigorous wet-weather validation criteria were applied to the Dravosburg model using a large quantity of quality-assured monitoring data.

Hydrologic validation was conducted for all of the monitored sites to properly simulate the wet-weather response from the monitored sewershed. Hydrologic validation of a monitored sewershed was based on the maximum number of successfully monitored wet-weather events.

The number of events used for validation depends on the monitoring period and flow monitoring quality.

Using time series plots, graphical comparisons were made of peak flow and volume for each wet-weather event occurring during the validation period. Statistical comparison plots were developed to illustrate the goodness-of-fit between the modeled response and the monitored data. For a large number of storm events monitored locations, the simulated storm volumes and peak flows vs. the corresponding monitored volumes and peak flows were plotted. Regression plots were also generated to make statistical comparisons of the simulated flows and the monitored flows. The statistics include a regression trendline of model results compared to the metering results, a calculation of the slope and intercept of the trendline. An R-square value calculation is performed to provide a measure of the models accuracy to predict flow monitoring results. Storm events with missing, incomplete and/or errant flow monitoring data, unreasonable responses in either the simulated flows or monitored flows or inaccurate or unreasonable precipitation data were identified and deemed "outliers." These outlier storm events were deleted for the regression analysis, so they did not affect the results of the regression analysis. The iterative process of optimizing the runoff and RDII parameters was continued until the validation objectives were achieved.

While using any monitored flow data to validate a hydraulic model, the variability of the monitored data needs to be considered. This is to say that even under optimal conditions within a monitoring manhole, the accuracy of monitored data is typically +/-10 percent, and the variability can be higher in a hydraulically challenged site such as high velocities, surface turbulence and varying backwater interferences. Depending on the hydraulic conditions present at a monitoring site, there can be ample variation in the performance of a monitoring site in terms of flow monitoring data collected during dry- and wet-weather flow from that site. This variability was accounted for when using the observed flow monitoring data during the hydrologic validation of the sites.

The purpose of the validation process for monitored combined sewersheds is to determine the runoff parameters to achieve the following primary goals of model validation:

- On the statistical regression plots, a regression line with slope close to one (1) indicates that the modeled storm event volumes and peak flow rates are consistent with the monitored volumes and peak flow rates.

- On the statistical regression plots, an intercept of the regression line close to zero (0) indicates that the modeled event volumes and peak flow rates were not biased (i.e., consistently over-simulating or under-simulating) with respect to the monitored volumes and peak flow rates.

- On the statistical regression plots, an R-square value of the regression line close to one (1) indicates that the degree of scatter in the data points in the regression plot is low.

- On the time series plots, matching as closely as possible the ratio of the time to peak, shape and magnitude for the monitored and simulated events.

For small number of storm events monitored locations, the statistical method may not generate stable regression plots. In these cases, model validation was evaluated for individual storms and overall storms. The validation criteria are the percentage of model peak higher than meter peak (P_{per}) and the percentage of model volume higher than meter volume (V_{per}). These criteria where used in conjunction when determining whether or not a particular portion of the system was adequately validated. The iterative process of optimizing the runoff parameters was continued until the validation objectives were achieved. The definition of P_{per} and V_{per} were shown in Equation 2 and Equation 3.

$$P_{per} = \frac{P_o - P_m}{P_o} \times 100\% \qquad \text{Equation 2}$$

$$V_{per} = \frac{V_o - V_m}{V_o} \times 100\% \qquad \text{Equation 3}$$

Where:

P_o = Observed (meter) hydrograph peak;

P_m = Modeled hydrograph peak;

V_o = Observed (meter) hydrograph total volume;

V_m = Modeled hydrograph total volume;

The purpose of the validation process for monitored combined and separate sub-catchments is to determine the runoff parameters to achieve the primary goals of model validation. Generally speaking, peaks and volumes within 15 percent are considered to be well validated.

It is important to emphasize that with the large number of storms used to validate the model, data scatter is expected and acceptable in the regression plots, especially for simulated vs. monitored storm peak flow rates. Because of the large number of storm events considered in the analyses, a higher degree of scatter in the data points (with a corresponding lower R-square value) needs to be allowed, as long as there is no overall bias demonstrated in these plots. With the long-term continuous simulation modeling approach, simulation of individual storms is not significant when compared with the accuracy of the overall model simulation over the course of the total model duration. The criterion is to make sure that there is no overall bias in the simulations, and that over-simulation and under-simulation of individual storms balance out over the course of the long-term simulation.

5.3.2 Model Validation QA/QC Procedures

QA/QC procedures were utilized during both the hydrologic and hydraulic validation processes to verify that the model yields meaningful, accurate, and reliable results consistent with the modeling goals and objectives. The following general QA/QC procedures were performed during the model validation processes:

- Checked for warnings and error messages in the model output file and resolved all major warnings and errors.
- Checked the model's run report for inconsistencies and/or unexpected results.
- Checked the model's overall continuity error and resolved items resulting in an overall continuity error greater than 2%.
- Checked individual continuity errors and resolved items resulting in individual continuity errors greater than 5%.
- Checked model stability using the following methods:
  - Visually checked the dynamic performance of the hydraulic grade line along profile views of sewers.
  - Visually checked the output hydrographs at key hydraulic locations across the simulated area.
  - Checked for dry pipes under both dry weather and wet weather flow conditions and resolved any improperly loaded conditions.
  - Checked the performance of system appurtenances such as pumps, weirs, orifices, and storage elements and verified that they are performing as expected.
  - Checked manholes where flows are lost from the system and verified that these losses are as expected.

5.3.3 Model Validation

For the validation process, all of the wet weather events where data were available were initially utilized at each monitoring location. During the QA/QC process, certain events were noted to have various data problems, including uncharacteristic responses, and these events were generally defined as outliers. Table 5.2 shows the kept events number, outlier events number and the total events number for each site.

Number of Kept, Outlier, and Total Events by Site
Table 5.2

	Kept	Outlier	Total
M-3	6	1	7
M-4A	7	0	7
M-5	7	0	7
M-6A	7	0	7
M-7A	6	1	7

Figure 5.5 and Figure 5.6 present the overall validation results for all the monitoring sites in the Dravosburg system for event volume and event peak flow, respectively. The plots show all of the validation events and a trendline for the validation events. The data used to generate these figures is derived from the individual modeling and monitoring site.

Figure 5.5 shows the regression plot between the simulated event volume and monitored event volume for all the monitored sites in the Dravosburg system. As the plot shows, the slope of the regression line is 1.1563, which suggests that there is good correlation between the simulated and monitored event volumes. The small value of 0.0144 for the intercept suggests that there is no relative bias in the simulation of the event volumes. The R-squared value of the regression plots is 0.9242, suggesting that there is a very small scatter in the data points around the regression. The source of the scatter is attributed to non-uniform hydrologic responses in the collection system and inaccuracies in flow monitoring and rainfall data collection.

Event Volume Regression Plot for All Sites in the Dravosburg System

Figure 5.5

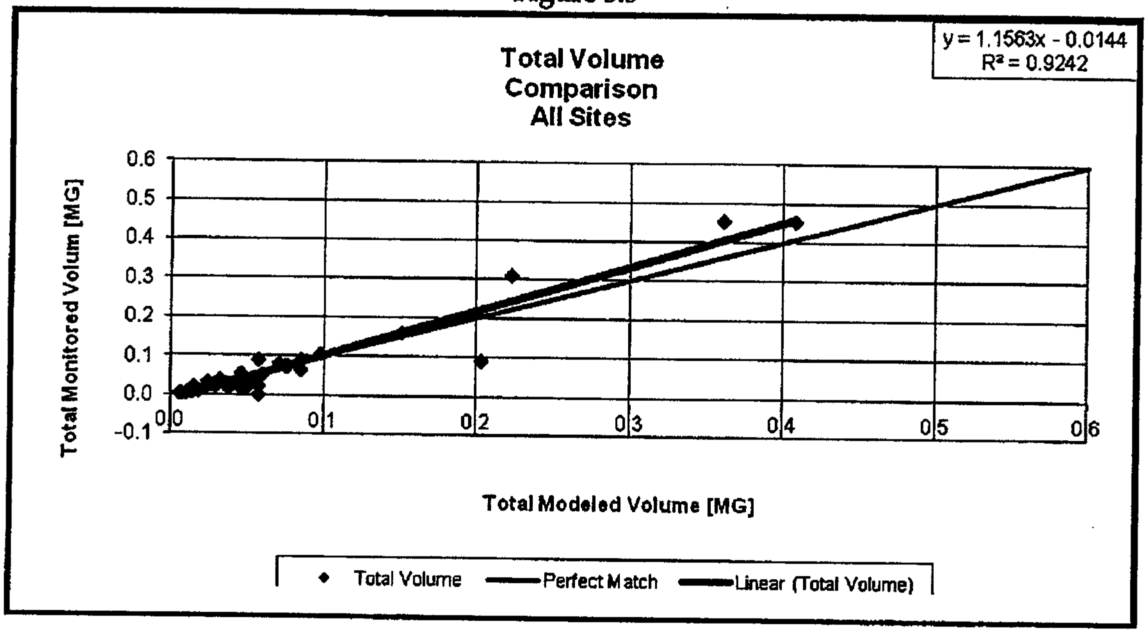
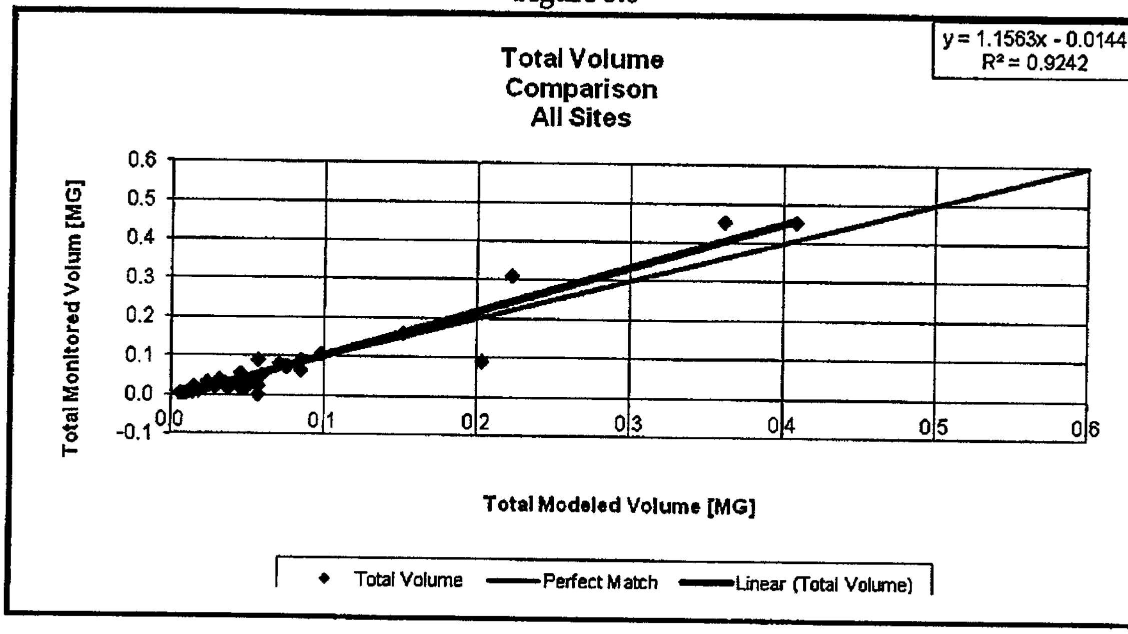


Figure 5.6 shows the regression plot between the simulated event peak flow and monitored peak flow for all the monitored locations in the Dravosburg system. As the plot shows, the slope of the regression lines is 0.8658 which suggests that there is good correlation between the simulated and monitored event peak flows. The small value of 0.0836 for the intercept suggests that there is no relative bias in the simulation of the event peak flows. The R-squared value of the peak flow regression plot is 0.9238 suggesting that there is a small scatter in the data points. The source of the scatter is attributed to non-uniform hydrologic responses in the collection system and inaccuracies in flow monitoring and rainfall data collection.

Event Peak Regression Plot for All Sites in the Dravosburg System

Figure 5.6



To illustrate modeling details, Appendix G shows the modeled and monitored volumes and peaks for each site and each event, as well as the monitored and modeled hydrographs. Appendix H shows the regression plots for each site. Because some sites have a small number of monitoring events, the statistical method may not generate stable regression plots. This does not mean the validation is poor, as long as the total volume and peak differences are in reasonable range.

Overall, the model is considered to be well validated and suitable for evaluating the system performance in various rain events.

5.4 HISTORICAL RAINFALL ANALYSIS

As previously stated, the "presumption" approach evaluates overflows on an annual average basis.

> *"The elimination or capture for treatment of no less than 85% by volume of combined sewage collected in the CSS during precipitation events on a system-wide annual average basis."*

The ALCOSAN typical year 15-minute interval rainfall data was used for this analysis. This data was used because it is readily available to KLH and it is representative of the annual average conditions for Dravosburg. This data is included in Appendix I.

5.5 LONG-TERM CONTINUOUS SIMULATION RESULTS

In order to determine whether or not the Dravosburg CSS can capture for treatment at least 85 percent of CSS rainfall dependent flow volume, on an annual average basis, a year-long continuous model simulation was completed using the increased ALCOSAN Pixel Eight typical year rainfall. All flow volume from the separate sewer system areas must be captured for treatment. Therefore, this volume is not part of Equation 4 below.

Equation 4 was utilized for percent capture evaluation.

$$\% \text{ Capture} = [V_{WWTP} / (V_{WWTP} + V_{CSO})] \times 100\% \qquad \text{Equation 4}$$

Where

V_{WWTP} - Total volume of CSS flow conveyed to the WWTP during wet weather,
V_{CSO} = Total volume of overflow from the CSO,

These volumes were determined based on the one year simulation.

V_{WWTP} = 19.87 MG
V_{CSO} = 1.82 MG
%Capture = [19.87 / (19.87 + 1.82)] x 100% = 91.6%

Based on the continuous simulation modeling, the Dravosburg CSS, on a system-wide annual average basis, will meet the "presumption" approach criteria ii, after completion of WWTP improvements described in the following sections. Maintaining a free discharge boundary condition at the WWTP influent pump station will allow for the "presumption" approach to be met. The SWMM model report is included in Appendix J.

6.0 EXISTING FACILITY

6.1 EXISTING NPDES PERMIT REQUIREMENTS

The existing WWTP provides screening, grit removal, conventional aeration, secondary treatment and disinfection prior to discharging treated effluent to Monongahela River. The operation and discharge is regulated under the terms of the current NPDES Permit Number PA0028401. The permit limits are listed in Table 6.1. The WWTP design flow is 0.48 MGD.

Existing Effluent Limits
Table 6.1

PARAMETER	LOADING (lbs)			CONCENTRATION (mg/L)			
	Average Monthly	**Average Weekly**	**Units**	**Average Monthly**	**Average Weekly**	**Instant. Maximum**	**Units**
Flow	-	-	-	Monitor and Report			-
CBOD-5 Day	100	150	lb/day	25	37.5	50	mg/L
Suspended Solids	120	180	lb/day	30	45	60	mg/L
Total Residual Chlorine				1.0		3.3	mg/L
Fecal Coliform							
May 1 to Sept 30				200			/ 100ml
Oct. 1 to April 30				2,000			/ 100ml
pH	Within Limits of 6.0 to 9.0 Standard Units At All Times.						

6.2 EXISTING HYDRAULIC LOADINGS

6.2.1 Average Flows

The facility has an average daily design capacity of 0.48 MGD. Analysis of flow data from the past five (5) years shows that monthly average flow has not exceeded 0.48 MGD for three (3) consecutive months, and therefore the WWTP is technically not hydraulically overloaded. However monthly average flows have exceeded 0.48 MGD five (5) times over the past five (5) years. The maximum monthly average flow observed over the past five (5) years is 0.820 MGD.

Analysis of flow data from the past five (5) years shows that the annual average flow for the WWTP is 0.274 MGD. Table 6.2 summarizes average flows for the five (5) years.

Existing Hydraulic Loadings
Table 6.2

Year	Max. Mo. Ave. Flow (MGD)	Annual Ave. Flow (MGD)
2009	0.237	0.192
2010	0.820*	0.432
2011	0.566	0.312
2012	0.383	0.207
2013	0.399	0.227

**The Year 2010 Chapter 94 Report was provided with a disclaimer from Glenn Engineering & Associates, LTD stating that accuracy of data may have been compromised by the admitted falsifying of records by the former Sewage Plant Operator.*

6.2.2 Peak Flows

The capacity of the raw sewage pump station limits peak flows that can be received by the WWTP. The peak pump capacity with the two (2) small pumps running is equivalent to the flow produced by the single larger pump. This limiting capacity is 0.72 MGD.

6.3 EXISTING MASS LOADINGS

6.3.1 Historical Loadings

WWTP raw sewage organic loading data was evaluated for the past five (5) years. Organic loadings are summarized in Table 6.3 below.

Existing Influent Organic Loadings
Table 6.3

Year	Max. Month (lb. BOD/day)	Annual Ave. (lb. BOD/day)
2009	229	162
2010	1,149*	580
2011	235	126
2012	150	99
2013	115	71

**The Year 2010 Chapter 94 Report was provided with a disclaimer from Glenn Engineering & Associates, LTD stating that accuracy of data may have been compromised by the admitted falsifying of records by the former Sewage Plant Operator.*

The WWTP's current rated organic capacity as reported in the Chapter 94 report is 2,780 lb/day. Given the 5-year annual average BOD loading of 208 lb/day and the 5-year annual average flow of 0.274 MGD, the average BOD concentration is 91 mg/L. The Borough's wastewater would be classified as low strength which is not uncommon for old CSS's.

6.4 EXISTING PROCESS

A process flow diagram for the existing WWTP is included in Appendix K of this report. A site plan for the existing WWTP is included in Appendix L. Calculations associated with the existing processes are included in Appendix M.

6.4.1 Preliminary Treatment

Preliminary treatment consists of a comminutor with a static bypass bar screen. These facilities were constructed in the Year 1965.

The design capacity of the comminutor channel is unknown however the WWTP's peak flows are limited to 0.72 MGD.

Comminutor/Bypass Channel
Photograph 6.1

6.4.2 Raw Sewage Pumping

Flow comes into the existing wet well via the comminutor channel. Prior to entering the wet well, flow passes through a comminutor, with a static screen provided for bypass flow. The flow is then lifted up to the grit chamber by three (3) centrifugal pumps. Two (2) of the pumps operating simultaneously have the same pumping capacity as the third, larger pump. The raw sewage pumps have a peak pumping capacity of approximately 0.72 MGD. This capacity assumes that one pump is a backup and not operational. This pump station was constructed in the late 1950's, and the pumps were recently refurbished.

Raw Sewage Pumps
Photograph 6.2

6.4.3 Grit Removal

Wastewater is pumped from the raw sewage pump station to an open channel flowing to the grit basin. The grit basin's peak capacity is 2.51 MGD based on a 3 minute minimum detention time. It is noted that the square configuration of this basin is not conducive to plug flow. Plug flow is desirable in aerated grit basin in order to reduce potential for basin short-circuiting.

6.4.4 Secondary Treatment

The grit basin effluent flows by gravity to two (2) aeration basins where biological treatment takes place. Each basin measures 90-feet long by 30-feet wide and have an average flow water surface depth of 15-feet.

Aeration basin effluent flows by gravity to two (2) rectangular final settling tanks. The settling tanks have a peak capacity of 0.680 MGD, based on total weir length and surface overflow rate.

Final Clarifiers
Photograph 6.3

6.4.5 Disinfection

Final settling tank effluent flows by gravity into two (2) chlorine contact tanks. Each tank is 23.5 feet long by 5 feet wide. Total calculated peak capacity is 0.396 MGD. These tanks were constructed in 1965.

Chlorine Contact Tank
Photograph 6.4

6.4.6 Solids Handling

Sludge in each final tank settles to the end hopper, where it is then transferred to an intermediate sludge well via a telescoping valve. Scum removed from the surface of the final tanks is also conveyed to the sludge well. Return sludge is pumped from the sludge well back to the aeration basins by a set of two (2) Chicago Dry-Pit Solids Handling Pumps (Model LM4 HBB). The capacity of each of these pumps is 500 GPM at 33-feet of head.

The Authority has a third party company pump out the sludge well as necessary. The WWTP does not have an additional sludge holding facilities.

7.0 TREATMENT PLANT UPGRADES

7.1 DESIGN HYDRAULIC LOADINGS

In order to meet the EPA CSO Control Policy, "presumption" approach as well as DEP design standards, three criteria were evaluated:

1. Percent capture – at least 85% of CSS volume (resulting from rain events), on an annual average basis, must be captured and conveyed to the WWTP for full biological treatment.
2. Peak core flow – Peak core flow = CSS peak dry weather flow x 3.5 + separate sewer system peak (given design rain event).
3. Design rain event – application of a design rain event is critical to ensure that upgrades completed to address percent capture and peak core flow will not result in manhole overflows.

The peak core flow for this system is 3.43 MGD. This peak flow includes 350% of the CSS dry weather flow and 100% of the separate sewer flow peak (given the design 10-year, 24-hour rain event). The peak core flow must receive full treatment; therefore, the design peak flow for the facility upgrades must be equal or greater than 3.43 MGD. KLH evaluated CSO regulator modifications required to ensure that both peak core flow and percent capture criteria are met. These modifications resulted in the 91.6% capture which was described in the Flow Monitoring and System Modeling section of this report. Application of the 10-year, 24-hour rain event, to the sewer system, including the modified CSO regulator, results in a modeled peak flow at the WWTP of 3.812 MGD. Since this peak flow is in excess of the peak core flow, it is an acceptable design peak. Design flows are summarized in Table 7.1 below.

Design Hydraulic Loadings
Table 7.1

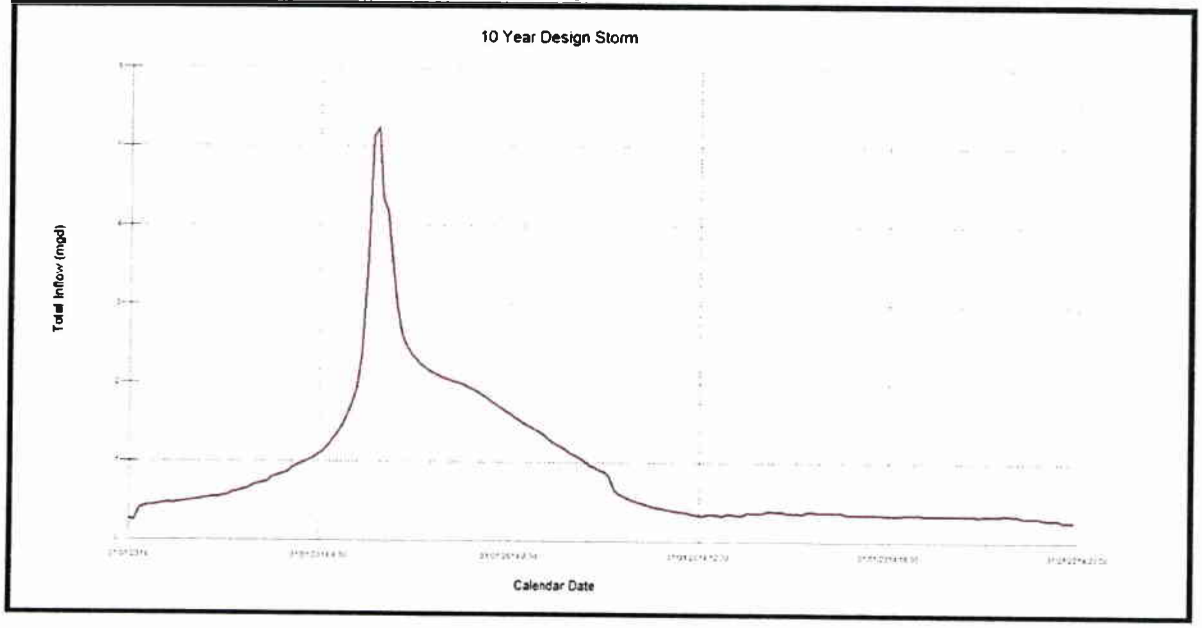
Design Flow	WWTP (MGD)
Peak Instantaneous	3.812
Peak Hourly	2.924
Peak Daily	0.985
Max Monthly Ave	0.60
Annual Average	0.36

All design flows were based on 30-year population projection. No significant growth is anticipated within the Borough over the next 30 years. Consistent with past Chapter 94 reports, 2 EDUs/year over the next 30 years was included. Development of each design flow is further described below.

7.1.1 Peak Instantaneous Flow (PIF)

As discussed above, PIF is governed by the design rain event. The design hydrograph resulting from the SWMM modeling is shown in Figure 7.1 below.

Design Hydrograph
Figure 7.1



7.1.2 Peak Hourly Flow (PHF)

PHF was also estimated based on SWMM modeling.

7.1.3 Peak Daily Flow (PDF)

Application of design rain event to the SWMM model resulted in a PDF of 0.985 MGD. Recent Borough flow records indicate that PDFs of nearly 0.722 MGD have been observed, which is consistent with the maximum influent pumping capacity.

7.1.4 Maximum Monthly Average Flow (MMAF)

MMAF is a critical design parameter for evaluating WWTP treatment capacity. As discussed under Section 6.2.1 monthly average flows have exceeded the WWTP design average (0.48 MGD) 5 times over the past 10 years. Also the maximum monthly average flow observed over the past 10 years was 0.820 MGD, but the accuracy of this data is in question. Since the MACM took over the WWTP in the Year 2011, the reported maximum monthly average flow has been 0.566 MGD. The Monitoring and Modeling Sections established MMF as 0.60 MGD, which is based on the maximum 3-month average flow in the past three (3) years, plus an additional factor of safety of 1.2, to account for reduction in CSO volumes.

Projected growth was also included in the design MMAF flow. No significant growth is projected for the Borough for the next 30 years.

Design average flow which corresponds to MMAF was established at 0.60 MGD for the purposes of this study in order to accommodate increase conveyance of CSS flow to the WWTP.

The increase in design average flow from 0.48 MGD to 0.60 MGD will require a hydraulic re-rate.

7.1.5 Annual Average Flow (AAF)

AAF of 0.36 MGD was estimated based on the typical year rainfall distribution applied to the SWMM model.

7.2 DESIGN MASS LOADINGS

Design mass loadings were developed based on review of existing WWTP loading data with respect to industry standard typical values. It must be noted that by significantly increasing percent capture, there may be a significant increase in mass loadings. However, given the fact that the Borough's current loads are far below the WWTP's design capacity, it is reasonable to conclude that no organic re-rate will be necessary. Industry standard loadings for low to medium strength sewage and combined sewage were evaluated with respect to WWTP influent data available from the recent NPDES Permit Renewal.

Design Mass Loadings
Table 7.2

Parameter	Design Concentration (mg/L)	Design Loading (lb/day)
BOD	190	951
TSS	210	1,051
NH_3-N	25	125
TKN	40	200
TP	7	35

7.3 DESIGN EFFLUENT LIMITS

Tables 7.3 lists the design effluent limits. These limits apply only to construction of new treatment processes. These arte preliminary effluent limits provided by DEP.

Design Effluent Limits
Table 7.3

PARAMETER	LOADING (lbs)			CONCENTRATION (mg/L)			
	Average Monthly	Average Weekly	Units	Average Monthly	Average Weekly	Instant. Maximum	Units
Flow	-	-	-	Monitor and Report			-
CBOD-5 Day	125	250	lb/day	25		50	mg/L
Suspended Solids	150	300	lb/day	30		60	mg/L
Total Residual Chlorine				0.5		1.6	mg/L
Ammonia Nitrogen							
May 1 to Sept 30				25			mg/L
Oct. 1 to April 30				M&R			mg/L
Fecal Coliform							
May 1 to Sept 30				200			/ 100ml
Oct. 1 to April 30				2,000			/ 100ml
pH	Within Limits of 6.0 to 9.0 Standard Units At All Times.						

Note: Mass loadings are based on 0.60 MGD design flow.

7.4 ALTERNATIVES EVALUATION

7.4.1 Development of Alternatives

Alternatives were developed for evaluation with the primary focus of providing treatment to 85 percent of CSS flow captured during rain events on an annual average basis. In order to meet the 85 percent criteria, a hydraulic re-rate will be required. During the development of each alternative, it was high priority to maintain as much of the existing processes as possible. Three (3) alternatives were initially considered, but only two (2) were developed for detailed evaluation. The third alternative, to pump Dravosburg flow to the Duquesne WWTP, was discounted due to limited capacity at the Duquesne WWTP.

1. Alternative 1 – Convert existing process to a Sequencing Batch Reactor (SBR) process. Modification of existing process to handle all average and peak flow. This alternative includes construction of a new headworks and influent pump station, as well as modifications to the existing process using existing tanks. Additionally, this alternative includes upgrading the existing process to meet re-rate requirements. The following items are included in Alternative 1.

- New automatic bar screen and by-pass channel with static screen.
- New headworks building.
- New raw sewage pump station and controls.
- New raw sewage pump station piping and valve vault.
- New pump flow meter.
- Site gravity and force main piping.
- New grit removal system.
- Retrofit existing aeration basins to serve as SBRs.
- All SBR equipment and piping.
- Retrofit existing final clarifiers to serve as sludge holding tanks.
- Retrofit existing chlorine contact tanks to serve as UV disinfection.

2. Alternative 2 – Pump to McKeesport WWTP and convert existing WWTP to peak flow storage. This alternative includes construction of a new raw sewage pump station to convey all flow up to 1.0 MGD to the Municipal Authority of the City of McKeesport (MACM) WWTP. All flow above 1.0 MGD will be pumped by separate storm pumps and stored in the existing Dravosburg WWTP aeration basins. The following items are included in Alternative 2.

   - New automatic bar screen and by-pass channel with static screen.
   - New headworks building.
   - New raw sewage pump station and controls.
   - Average flow pumps and storm pumps.
   - New raw sewage pump station piping and valve vault.
   - New pump flow meter.
   - Site gravity and force main piping.
   - Force main piping to the MACM WWTP.
   - Retrofit existing aeration basins to serve as peak flow storage.
   - New diffusers in the peak flow storage basins.

7.4.2 Evaluation of Alternatives

The following sections summarize design considerations associated with each alternative. Both Alternatives 1 and 2 will meet the current permit requirements and will allow for treatment of design flows. Table 7.4 lists the advantages and disadvantages associated with each alternative.

Alternatives Comparison
Table 7.4

Alternative No.	Alternative	Advantages	Disadvantages
1	SBR	1. Process is very flexible and easy to operate. 2. Low manpower requirement. 3. Large biomass volume provides process protection against shock mass loadings. 4. Produces a well stabilized sludge. 5. Lower sludge production. 6. Proven technology. 7. DEP is comfortable with SBR process.	1. Effluent quality depends on decanter reliability. 2. Process control is dependent on PLC operation.
2	Pump Station To MACM WWTP	1. Operation and maintenance of WWTP eliminated. 2. Lower manpower requirement.	1. Large pump station will require various sized pumps

7.4.2.1 Alternative 1 – Upgrade Existing Process

Alternative 1 includes three (3) main components:

1. Construction of a new raw sewage pump station.
2. Modification of the existing WWTP to a SBR plant capable of handling higher peak flows.
3. Modification of the existing chlorine contact tanks to serve as a UV disinfection facility.

A process flow diagram associated with Alternative 1 is included in Appendix N. A site plan associated with Alternative 1 is included in Appendix O. Calculations associated with Alternative 1 are included in Appendix P.

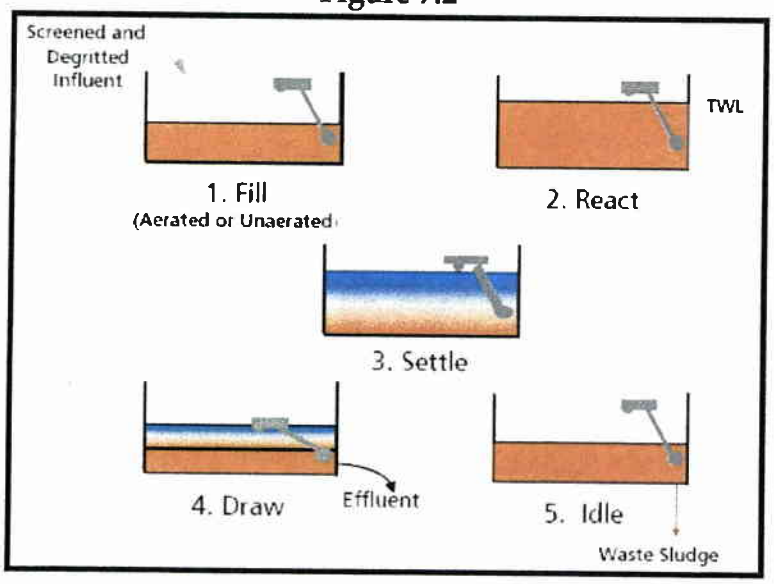
A mechanical bar screen, sized for 3.812 MGD, is recommended prior to the new raw sewage pump station. This screen will protect the grit basin, eliminate static screen cleaning requirement, and remove more fibrous materials from the flow stream than the existing static screens are capable of. While the existing comminutor provides pump protection by shredding fibrous solids, it does not remove these materials from the flow stream. The fibrous solids and other large inert solids that can be passed or shredded by the comminutor may still cause operation and maintenance issues in the downstream processes. Automatic bar screen clear openings of 1/4 inch are recommended. A by-pass channel with a static bar screen is recommended so that the automatic bar screen can be taken out of service for maintenance. This screen will be sized for at least 3.812 MGD.

The existing raw sewage pump station does not have adequate volume to handle the projected peak flows. As such, a new pump station is proposed. This station will be located adjacent to the existing final clarifiers and will require new gravity sewers to reroute influent flow. In addition to the structure and pumps, new pump controls and associated electrical equipment will be included. Also a new pump discharge flow meter is recommended, located in an adjacent underground valve vault. This flow meter is used for DEP reporting, therefore accuracy is critical.

A new grit removal system is proposed at the head of the SBR tanks. This basin will be sized for a 0.6 MGD average and 3.812 MGD peak. Flow will be pumped from the new raw sewage pump station directly to the grit basin influent channel. The basin will consist of an above grade concrete tank. Grit pumps and grit dewatering equipment will be housed in a new building. Effluent from the grit basin will be conveyed by gravity to the proposed 2-basin SBR.

The conventional SBR treatment process typically involves a five-stage cycle that occurs in the reactor tank. The first stage is the fill stage when the wastewater influent fills the tank and mixes with mixed liquor settled during the fifth stage. Aeration characterizing the second or react stage can also occur during the initial stage. The react stage results in organic and nitrogenous oxidation. Aeration and mixing are terminated and the third or settle stage allows the settling of solids. The fourth or draw stage involves the decanting of effluent after settling. During the last stage the tank remains idle and solids are withdrawn from the bottom. Parallel reactor cycle times overlap such that the system is continuously accepting forward flow. Figure 7.2 shows conventional SBR operation.

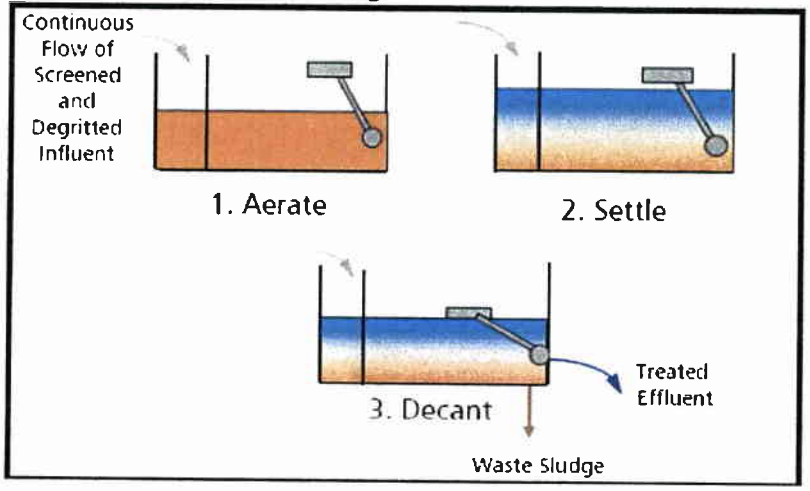
Conventional SBR
Figure 7.2



Some SBR systems involve a semi-batch process where all stages occur in one tank as influent is continually accepted and baffled in an effort to reduce short-circuiting equalized flow and prevent disturbance of quiescent settling conditions. The five cycle stages of the true SBR cycle are combined into three in the semi-batch mode of operation. The first two stages of the true batch process comprise the first stage of the semi-batch version. Sedimentation is considered the second stage of the semi-batch cycle, while the last is a combination of the decanting and idle stages of the true batch method. Figure 7.3 shows continuous flow SBR operation.

Continuous Flow SBR

Figure 7.3



For either process system the cycle times can be adjusted to accommodate incorporating alternating phases of aerobic-anoxic/anaerobic (air on-air off) conditions in the cycles for BNR capabilities. Both systems provide a high degree of treatment by eliminating the negative impacts caused by extreme flow fluctuations and are considered viable options at the preliminary design stage.

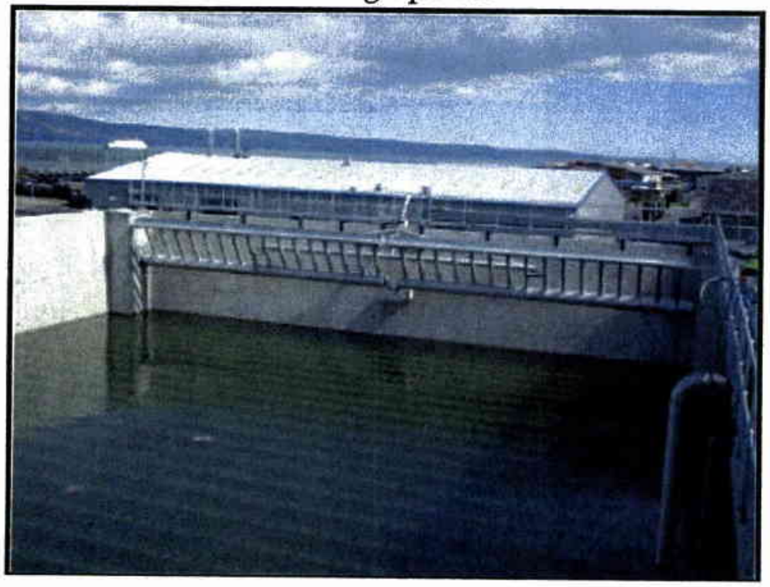
Preference has been given to the continuous flow semi-batch style process. The manufacturer associated with the continuous flow style is ITT-ABJ. The reasons for the partiality include:

- Continuous flow type provides a more flexible adjustment to the sudden changes in flow. True batch characteristics are maintained for flows up to 3.5 times the design flow whereas continuous flow units allowing for "fill decant" mode during peak flow conditions over 3.5 times the design flow without disturbing the sludge blanket.
- As a result of the continuous acceptance of influent, the overall volume of the system is typically reduced by 20 to 30 percent of the true batch counterpart which needs the additional volume to equalize peak flows.
- The continuous flow system can be converted to a true batch system with the appropriate valving at low flows.

For these reasons the continuous flow system as manufactured by ITT-ABJ was the basis for the calculation of basin sizes and developing the cost estimates for Alternative 2. Photograph 7.1 is an example of an ITT-ABJ SBR basin. The photograph shows the floor mounted aeration diffusers and the decanter mechanisms.

SBR

Photograph 7.1



Flow from the SBR will be discharge directly to the UV disinfection facility. The UV system must be sized for the peak decant rate, which is 4.4 MGD. The existing chlorine contact tank structures can be utilized for the UV channels. Use of these tanks will reduce required excavation and concrete costs, however maintenance of existing treatment processes will be challenging during construction. Further evaluation of this option should be completed during design.

The UV disinfection facility must be constructed at an elevation high enough to protect it from the 100-year flood. According to Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map, the 100-year flood elevation for the WWTP site is 746. Water level in the UV channels will be controlled by appropriately sized weirs. The weir crest elevation should be at least 1.5 feet above the water surface elevation based on a 4.4 MGD peak decant flow through the outfall sewer given 100-year flood elevation tail water. A new outfall sewer will be required in order to accommodate the increased peak discharge.

Sludge from the SBRs will be wasted directly to the sludge holding tanks. The existing final will be converted into sludge holding tanks. The clarifier equipment will be removed. The existing tanks will provide approximately 58,000 gallons of capacity. Construction of digester tank(s) is not recommended. The Authority can continue to haul sludge to the MACM WWTP as required.

7.4.2.2 Alternative 2 – Pump Station to MACM WWTP

Alternative 2 includes the following main components:

1. Construction of a new raw sewage pump station, including normal flow and peak flow pump capacity.
2. Construction of new force main.
3. Modification of existing aeration basins to serve as peak flow storage basins.

A process flow diagram associated with Alternative 2 is included in Appendix Q. A site plan associated with Alternative 2 is included in Appendix R.

A mechanical bar screen, sized for 3.812 MGD, is recommended prior to the new raw sewage pump station. Automatic bar screen clear openings of 1/4 inch are recommended. A by-pass channel with a static bar screen is recommended so that the automatic bar screen can be taken out of service for maintenance. This screen will be sized for at least 3.812 MGD.

A submersible pump station is proposed for the new raw sewage pump station. This type of pump intake structure minimizes required footprint, as well as capital and operating cost. The pump station will be required to pump a total flow of at least 3.812 MGD. This will consist of normal flow pumps with a total pumping capacity of 1.0 MGD to the MACM WWTP, as well as peak flow pumps capable of conveying at least 4.24 MGD to the proposed peak flow storage basins. Four (4) to six (6) pumps will be required, two (2) to three (3) of each normal flow and peak flow pumps. Flow in excess of 1.0 MGD will cause rising water levels in the wet well and, in turn, activate the peak flow pumps.

In conjunction with the new pump station, a force main to the MACM WWTP will be required. The force main is estimated to be 8-inch diameter and will span 4,600 lineal feet. The force main will require a bore under the river to reach the MACM WWTP, estimated to be 800-feet in length. A copy of the proposed force main alignment can be found in Appendix S.

7.4.2.3 Cost Evaluation

Study level total project cost estimates were completed for the evaluated alternatives. The costs are as summarized in Table 7.5 below. Detailed cost estimates are included in Appendix T.

WWTP Upgrade Costs
Table 7.5

Alternative	Year 2014 Construction Cost	Year 2014 Total Project Cost
Alt 1 - WWTP Upgrades	$7,099,000	$8,874,000
Alt 2 – Pump Station	$4,401,000	$5,503,000

7.4.2.4 Recommended Alternative

Detailed evaluation of the proposed alternatives led to the recommendation of Alternative 2 for Borough's LTCP upgrades. The total estimated project cost is $5,503,000. This alternative is recommended for the following reasons:

- Alternative 1 project cost is $3,371,000 more than the recommended Alternative 2.
- Alternative 2 eliminates operation and maintenance requirements of a WWTP.

Alternative 2 is recommended however given the "High Burden" classification associated with this work, completion of the proposed upgrades on a typical project timeline may not be feasible. Project financing will drive the schedule for implementing Alternative 2 upgrades.

8.0 PROJECT PLANNING

The following LTCP schedule is proposed.

LTCP Schedule
Table 8.1

Milestone	Date
Submit draft LTCP	September 1, 2014
Submit final LTCP with MACM ACT 537	November 1, 2015
DEP approval of LTCP and ACT 537	January 1, 2016
Obtain funding for design related services	January 1, 2017
Begin design of upgrades	January 1, 2017
Apply for MACM WWTP re-rate	July 1, 2017
Apply for Part II Permit for pump station	July 1, 2018
Receive Part II Permit for pump station	January 1, 2019
Obtain funding for construction	January 1, 2021
Begin construction for CSS upgrades	March 1, 2021
Complete construction	March 1, 2023
Submit post construction compliance monitoring plan	September 1, 2023

*DEP LTCP approval and Part II Permit dates are beyond the control of the Borough and KLH, therefore schedule dates will be adjusted based on actual DEP milestone completion dates.

9.0 SUMMARY AND CONCLUSIONS

In order to address the "presumption" approach percent capture criteria the following upgrades are recommended:

- Construct Alternative 2 – A new pump station and force main to the City of McKeesport Municipal Authority WWTP.

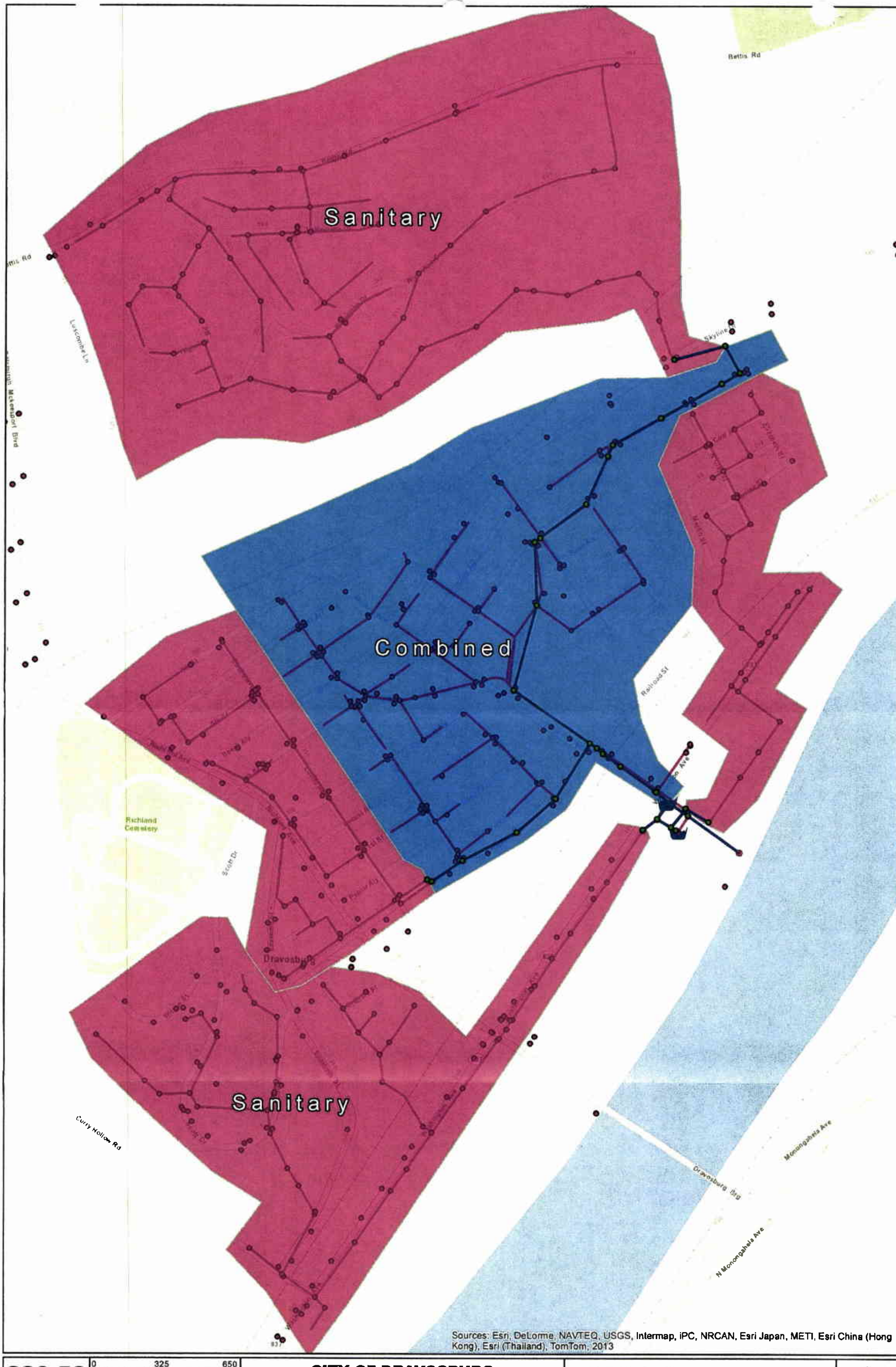
No CSS upgrades are required to convey the 10-year, 24-hour design storm flow while maintaining greater than 85% capture during a typical year.

The work associated with Alternative 2 has an estimated total project cost of $5,503,000.

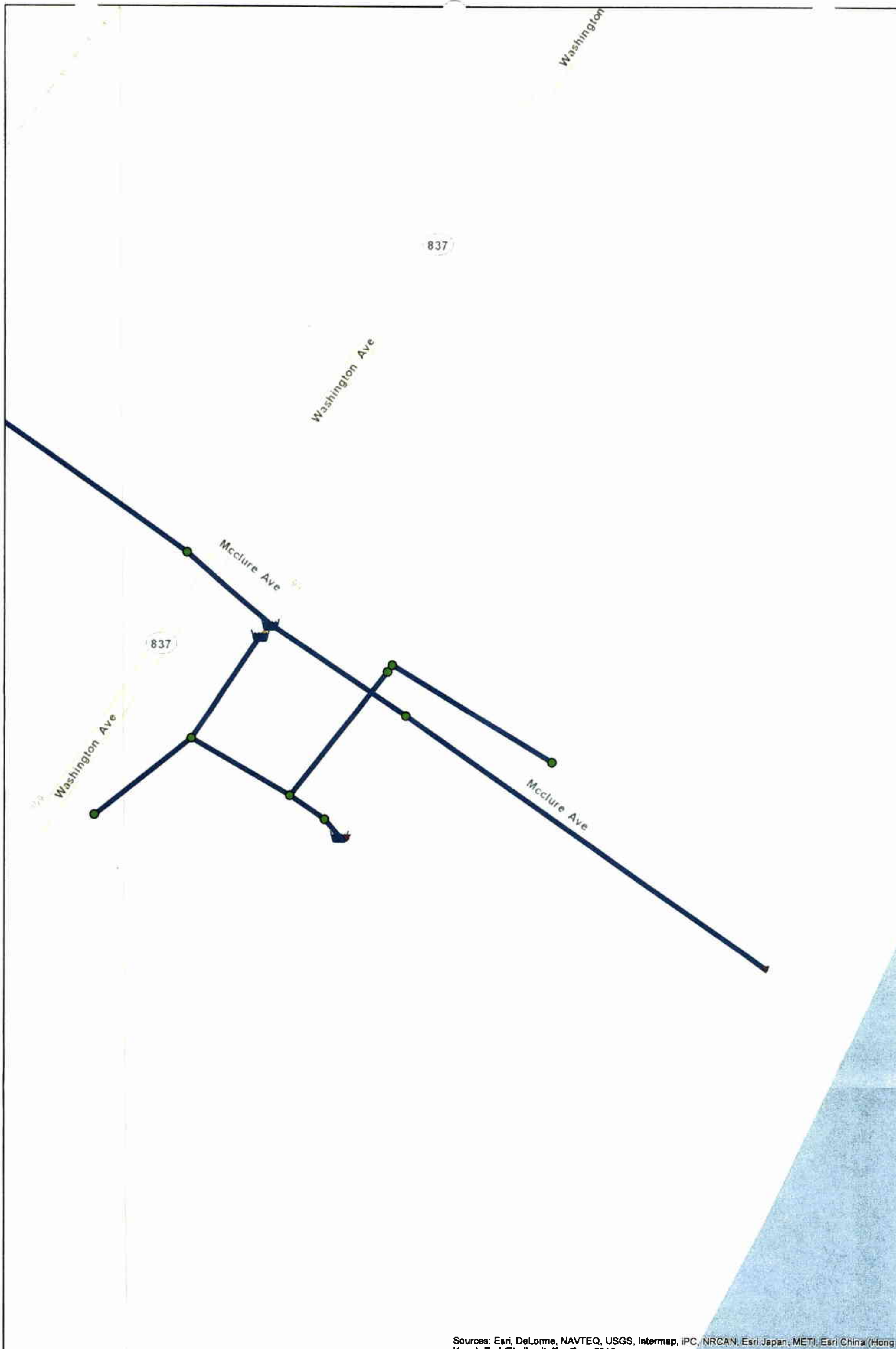
APPENDIX A

System Map
CSO Location Map
Tributary Area Map

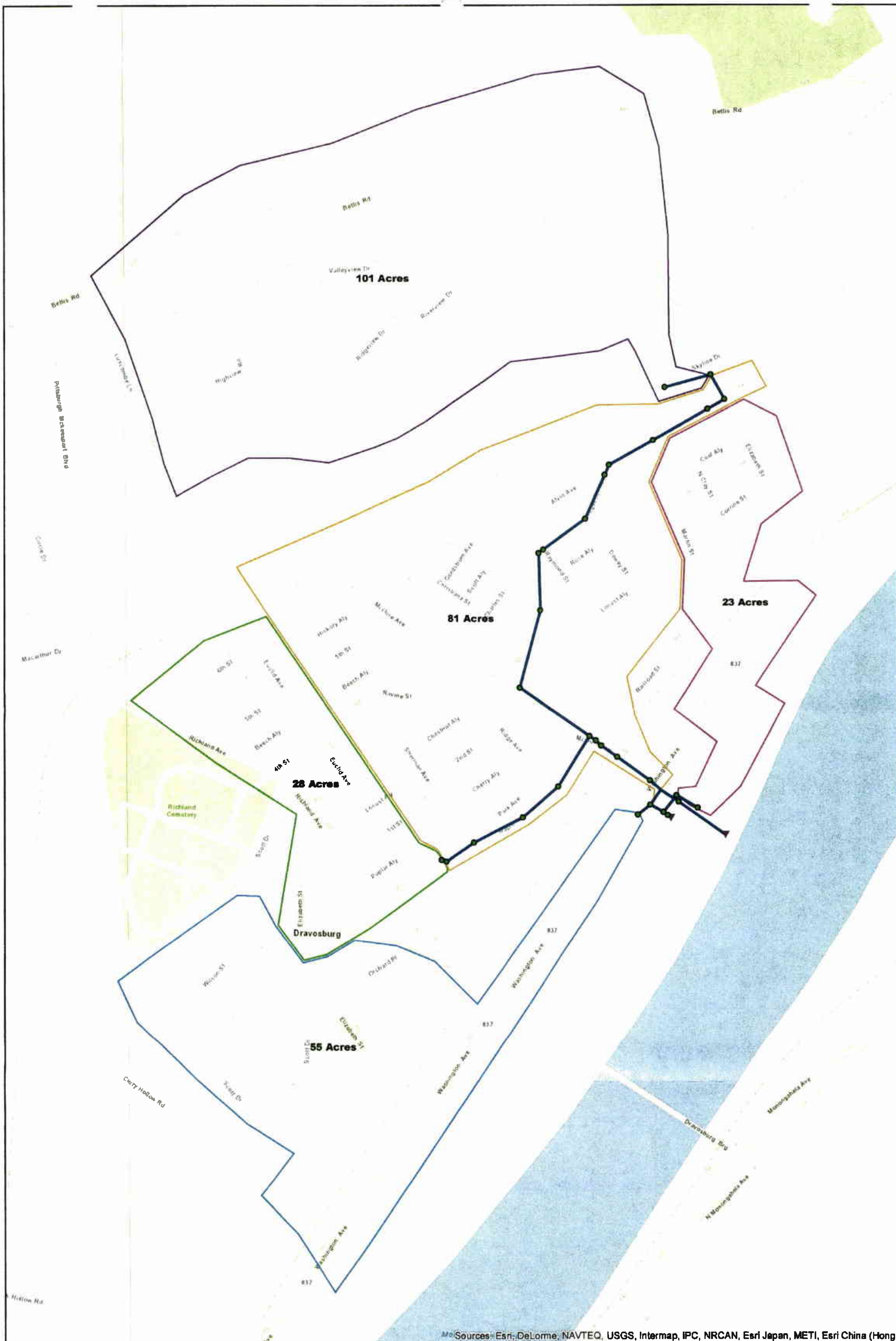

WEST MIFFLIN BOROUGH
G.I.S.
MAPPING
BOROUGH OF DRAVOSBURG
ALLEGHENY COUNTY, PA
COMBINED SEWER
SYSTEM
G.I.S. MAPPING
1 - 1



220-53 Exhibit	0 325 650 Feet Author: Ross Valkovein Date: 8/21/2014 NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet Projection: Lambert Conformal Conic	**CITY OF DRAVOSBURG ALLEGHENY COUNTY, PENNSYLVANIA SEWER TYPES**	KLH ENGINEERS, INC	N



220-53	0 40 80 Feet	**CITY OF DRAVOSBURG**	KLH ENGINEERS, INC
Exhibit	Author: Ross Vollwein Date: 7/28/2014 NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet Projection: Lambert Conformal Conic	**ALLEGHENY COUNTY, PENNSYLVANIA** **CSO LOCATION**	



220-53 Exhibit

0 360 720 Feet

Author: Ross Volkwein
Date: 7/25/2014
NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
Projection: Lambert Conformal Conic

CITY OF DRAVOSBURG
ALLEGHENY COUNTY, PENNSYLVANIA
FLOW TRIBUTARY AREAS

KLH ENGINEERS, INC

Appendix B

Dravosburg Survey Field Book

SOKKIA

220-53
AS OF
11/11/13

MADE IN CHINA

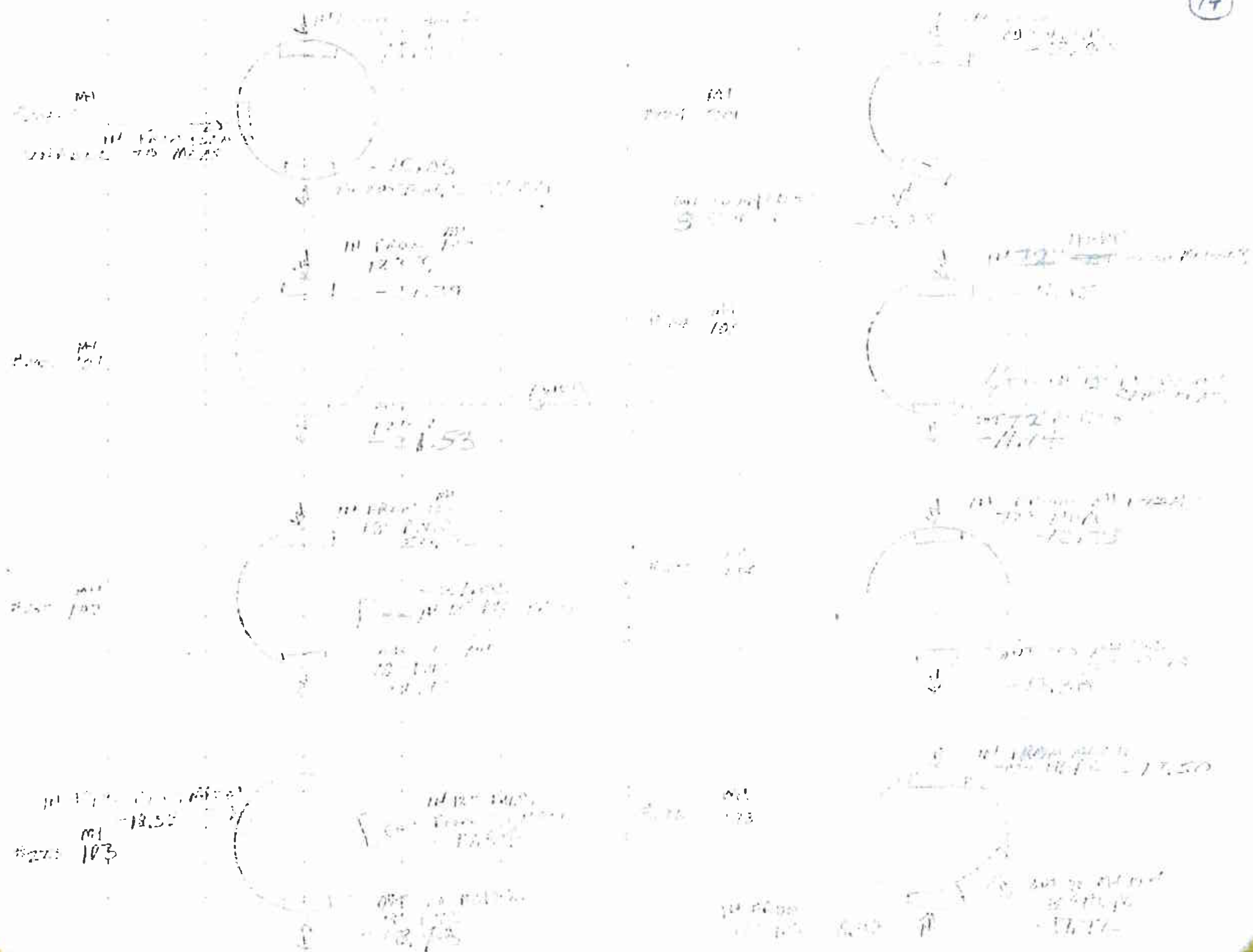
220 MACM

SOKKIA

TRANSIT
FIELD BOOK

220
MACM

No. 8152-00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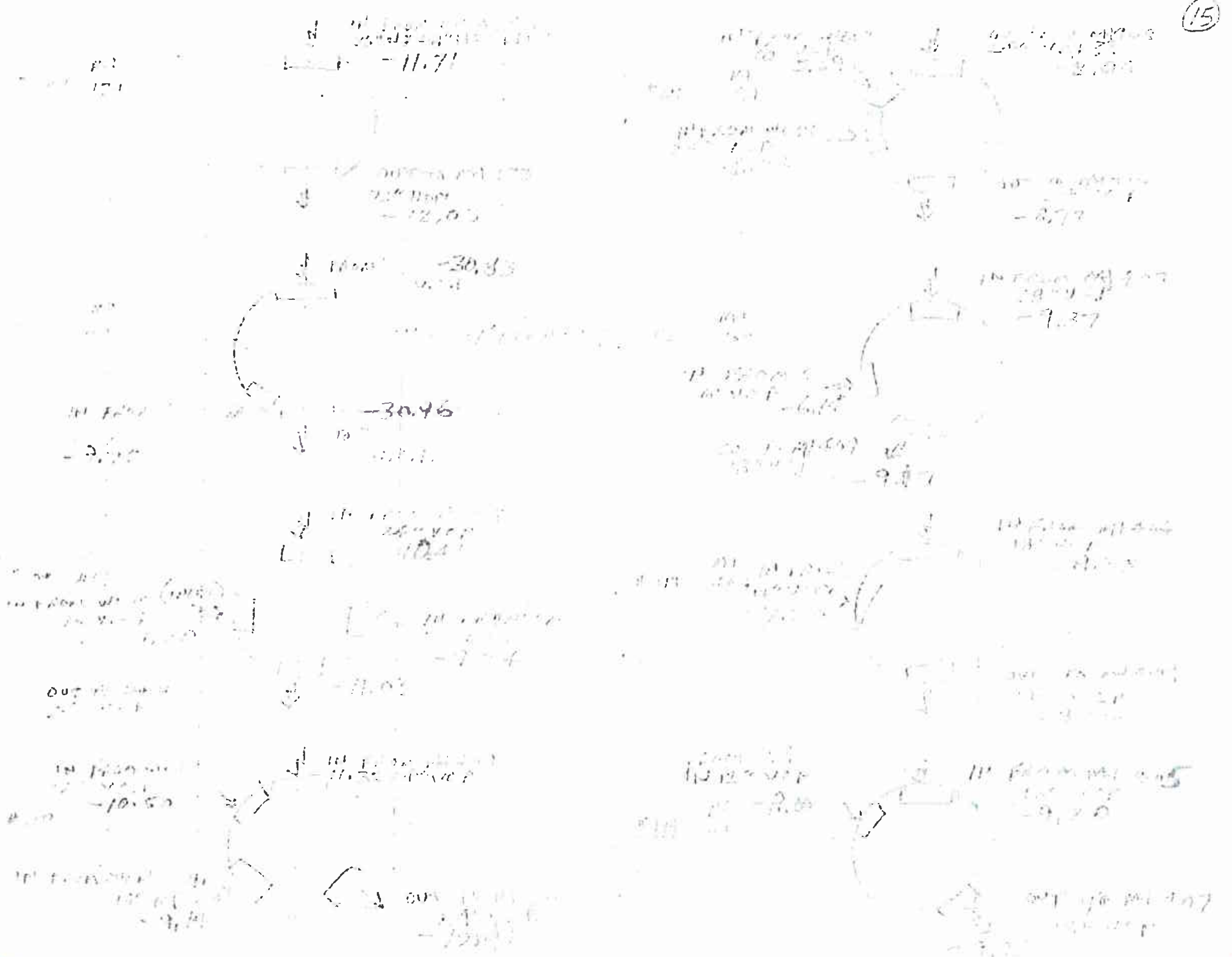
1.53
-13.52
103
-17.50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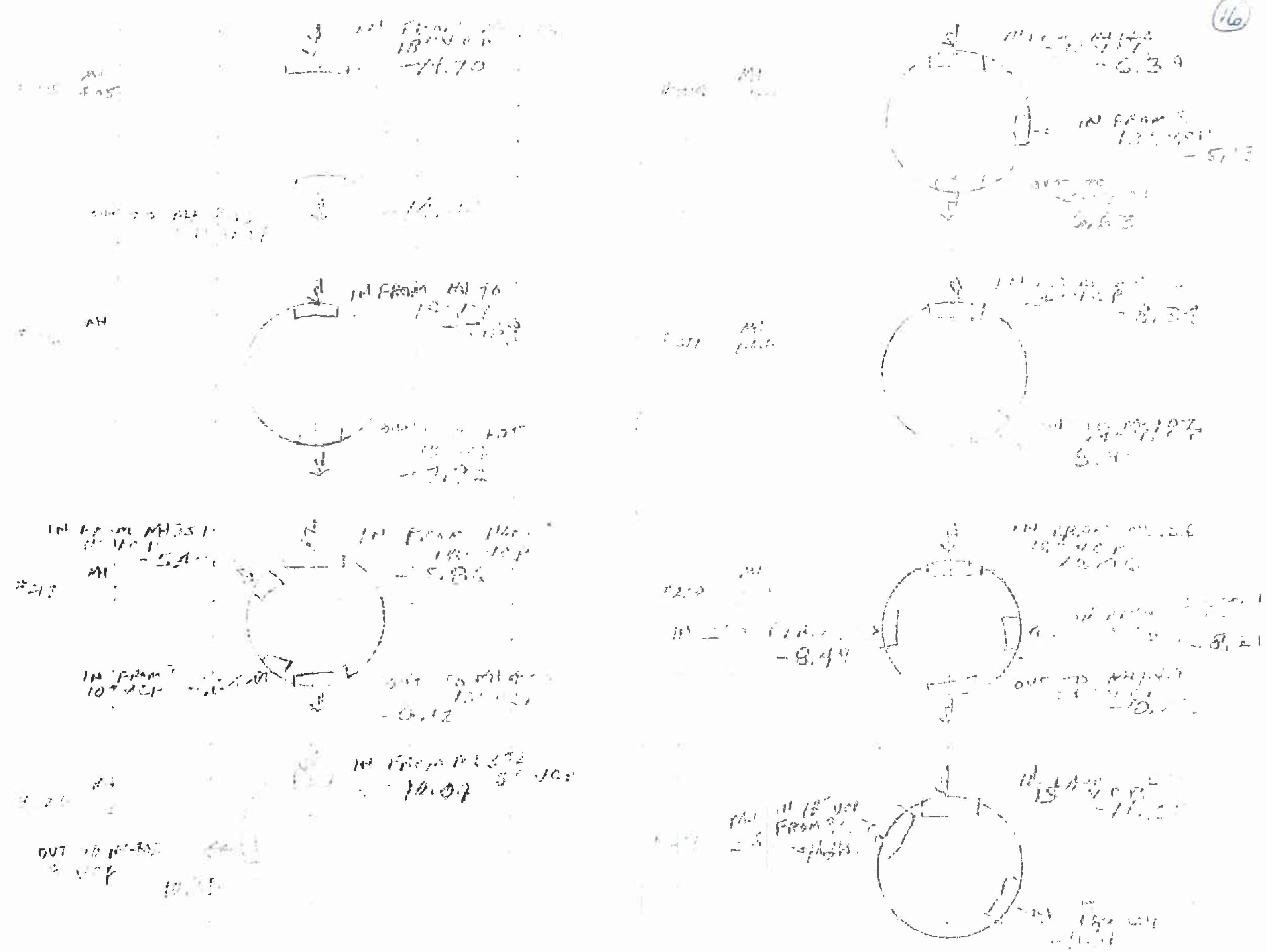
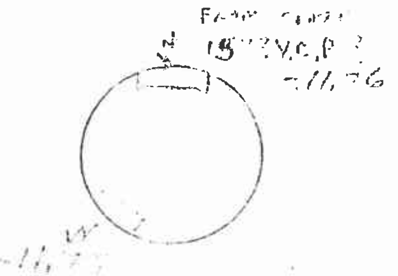
-30.46


-11.70
IN FROM MH 76
-5.86
-6.12
10.07
-6.39
-8.49
-8.21

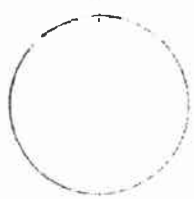
#228 MH 157

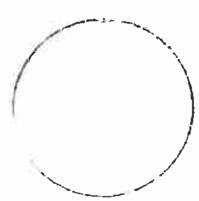


NOT CONNECTED TO MH 156

(11-07-13)

#235





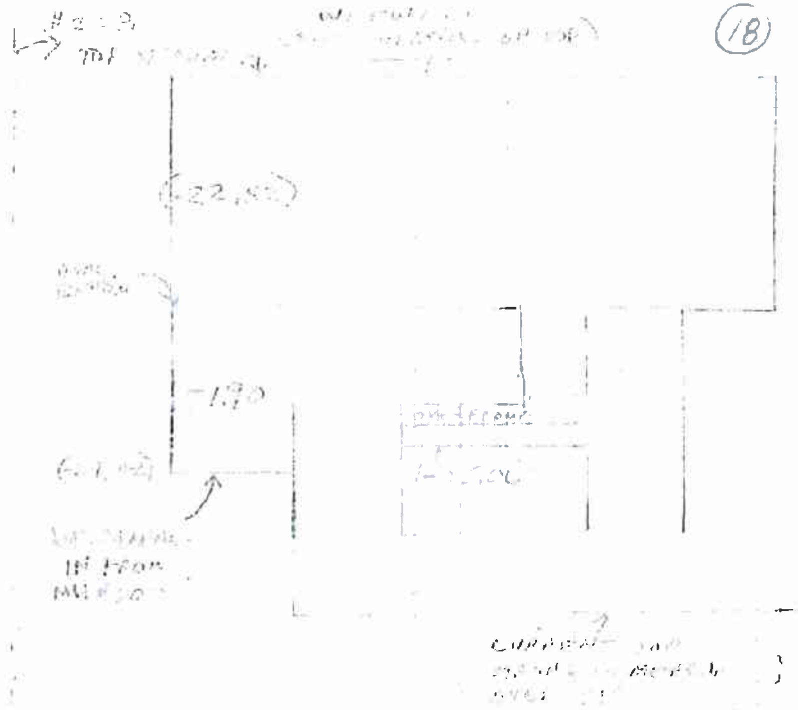
(11-2 - 13)

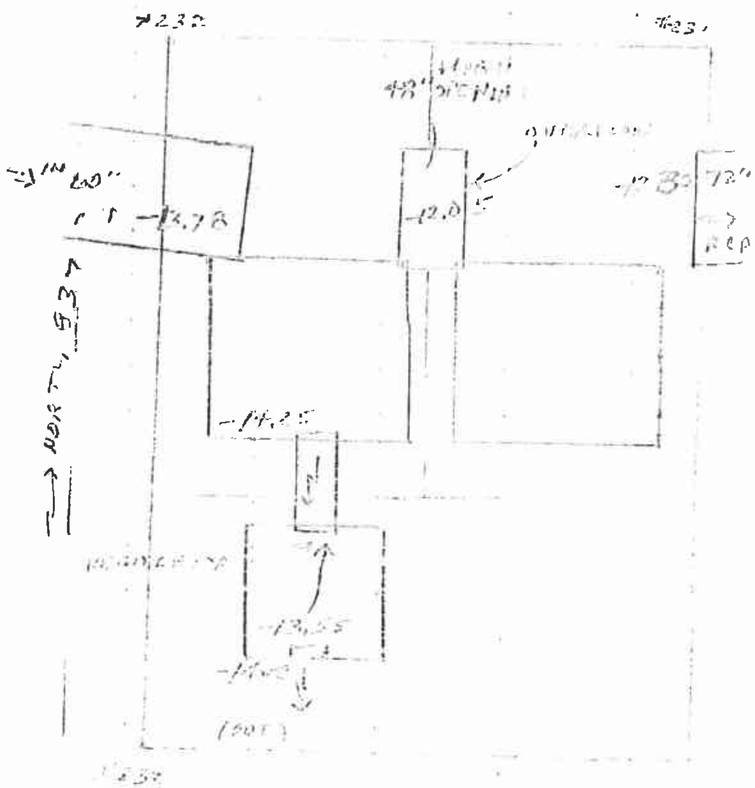
228	TWC	— ⑥ WET [illegible]
22 [illegible]	SANMH.	
2 [illegible]	SANMH.	
231	SANMH.	
232-[illegible]	TWC.	⓪ FLOW PIT (SEE [illegible] / DET [illegible] PG.)

SAN MH [illegible]

↳ [illegible] IN[illegible] OF #227

PG 4 [illegible]

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#231
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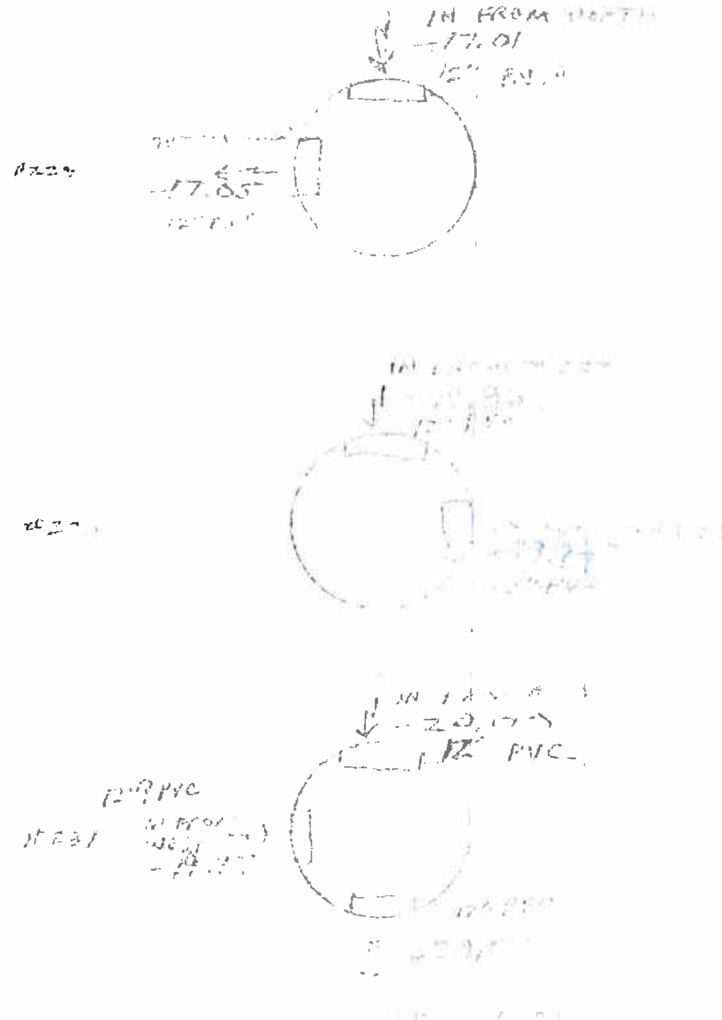
NORTH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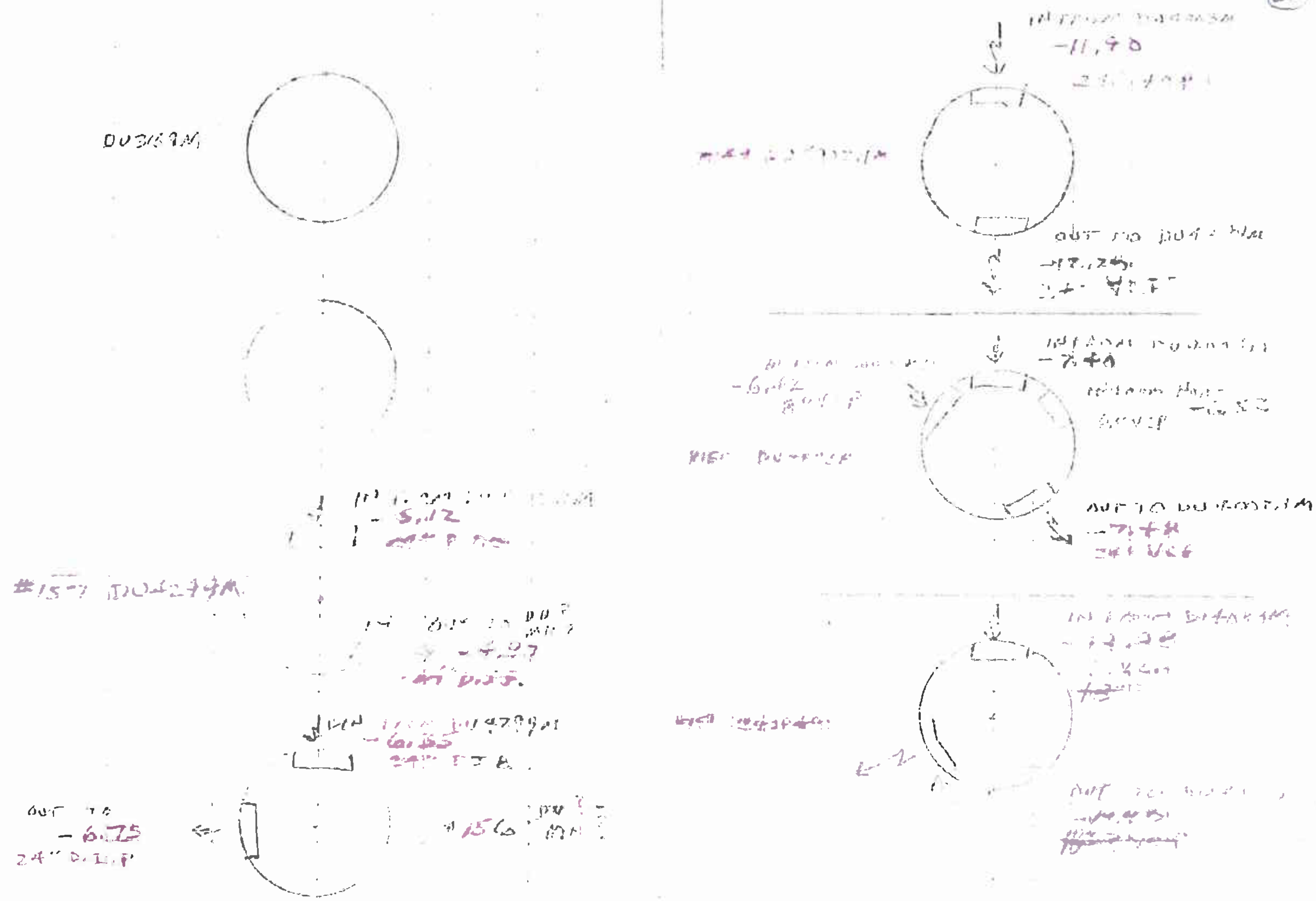
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#157
-6.85
-6.75
#156

Appendix C

DRNACH Meter Site Inspection Forms

DRNACH ENVIRONMENTAL, INC.

MANHOLE INSPECTION FORM

Project Name	Dravosburg Flow
Manhole Identification	M-6A
Surveyor's Name	Alexander Matscherz

Site Description

Next to road in front of Dravosburg Plant.

Street

378 Clairton Dravosburg Road

Date

August 29, 2013

Site Photo

Frame And Cover

Cover:	Solid	Pick holes:	No
At Grade: X	Below:	Above:	

Diameter (In.):	29.5
DS Rim to Invert (In):	168
Ladder Present: Yes	Safe: Yes

Interior

Brick:	Precast: X	Other:

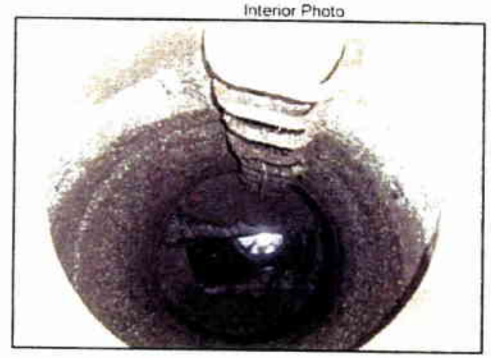
Infiltration Observed

Describe:

Inlets

Size:	Pipe Material:	Notes:
12 inch	VCP	Metering point
inch		
inch		
inch		
inch		

Interior Photo



Outlets

Size:	Pipe Material:	Notes:
12 inch	VCP	
inch		

GPS Information

Accuracy: 20 feet	Elevation: 737 feet	Latitude: 40.349284	Longitude: 79.886014

Notes

DRNACH ENVIRONMENTAL, INC.

MANHOLE INSPECTION FORM

Project Name	Dravosburg Flow
Manhole Identification	M-7A
Surveyor's Name	Alexander Matscherz
Date	August 29, 2013

Site Description

In gravel road next to Dravosburg Plant.

Street

McClure Street

Site Photo

Frame And Cover

Cover:	Solid	Pick holes:	No

At Grade:	X	Below:		Above:	

Diameter (in.):	28.75
DS Rim to Invert (in):	246

Interior

Brick:		Precast:	X	Other:	

Ladder Present:	Yes	Safe:	Yes

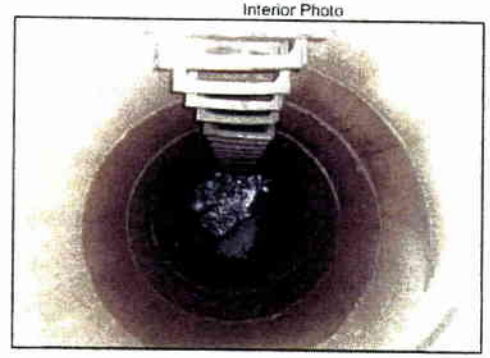
Infiltration Observed

Describe:

Inlets

Size:		Pipe Material:	Notes:
12	inch	PVC	
12	inch	PVC	
	inch		
	inch		
	inch		

Interior Photo



Outlets

Size:		Pipe Material:	Notes:
12	inch	PVC	Metering point
	inch		

GPS Information

Accuracy:	20 feet	Elevation:	744 feet	Latitude:	40.349557	Longitude:	79.885361

Notes

DRNACH ENVIRONMENTAL, INC.

MANHOLE INSPECTION FORM

Project Name: Dravosburg Flow

Site Description: In grass in front of Dravosburg Plant.

Manhole Identification: M-3

Street: 378 Clairton Dravosburg Road

Surveyor's Name: Alexander Matscherz

Date: August 29, 2013

Site Photo

Frame And Cover

Cover:	Solid	Pick holes:	No

At Grade:	X	Below:		Above:	

Diameter (In.): 28.75

DS Rim to Invert (in): 220

Interior

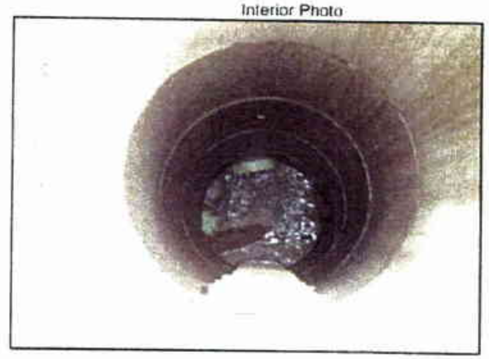
Brick:		Precast:	X	Other:	

Ladder Present:	Yes	Safe:	Yes

Infiltration Observed

Describe:

Interior Photo



Inlets

Size:		Pipe Material:	Notes:
12	inch	PVC	Metering point
12	inch	PVC	
	inch		
	inch		
	inch		

Outlets

Size:		Pipe Material:	Notes:
18	inch	PVC	
	inch		

GPS Information

Accuracy:	20 feet	Elevation:	741 feet	Latitude:	40.349416	Longitude:	79.885779

Notes

DRNACH ENVIRONMENTAL, INC.

MANHOLE INSPECTION FORM

Project Name	Dravosburg Flow
Manhole Identification	M-4A
Surveyor's Name	Alexander Matscherz
Site Description	In back yard of 181 Duquesne Avenue
Street	181 Duquesne Avenue
Date	August 29, 2013

Site Photo

Frame And Cover

Cover:	Solid	Pick holes:	No
At Grade:	Below:	Above:	X

Diameter (in.):	30
DS Rim to Invert (in):	120

Interior

Brick:	Precast:	X	Other:	

Ladder Present:	Yes	Safe:	Yes

Infiltration Observed

Describe:

Inlets

Size:		Pipe Material:	Notes:
8	inch	VCP	Metering point
	inch		
	inch		
	inch		
	inch		

Interior Photo

Outlets

Size:		Pipe Material:	Notes:
8	inch	VCP	
	inch		

GPS Information

Accuracy:	Elevation:	Latitude:	Longitude:
20 feet	990 feet	40.35562	79.884906

Notes

DRNACH ENVIRONMENTAL, INC.

MANHOLE INSPECTION FORM

Project Name	Dravosburg Flow
Manhole Identification	M-5
Surveyor's Name	Alexander Matscherz
Site Description	Middle of road in front of Dravosburg United Methodist.
Street	110 Maple Avenue
Date	August 29, 2013

Site Photo

Frame And Cover

Cover:	Solid	Pick holes:	No

At Grade:	X	Below:		Above:	

Diameter (in.):	26.5
DS Rim to Invert (in):	136

Interior

Brick:	X	Precast:		Other:	

Ladder Present:	Yes	Safe:	Yes

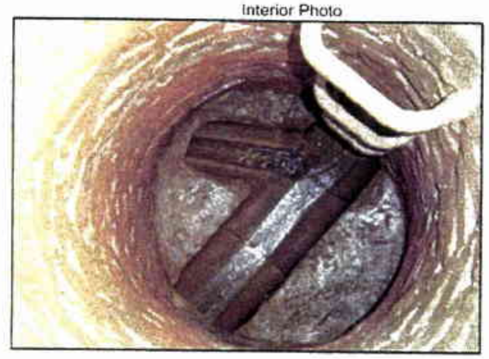
Infiltration Observed

Describe:

Inlets

Size:		Pipe Material:	Notes:
21	inch	VCP	
15	inch	VCP	Metering point
	inch		
	inch		
	inch		

Interior Photo



Outlets

Size:		Pipe Material:	Notes:
21	inch	VCP	
	inch		

GPS Information

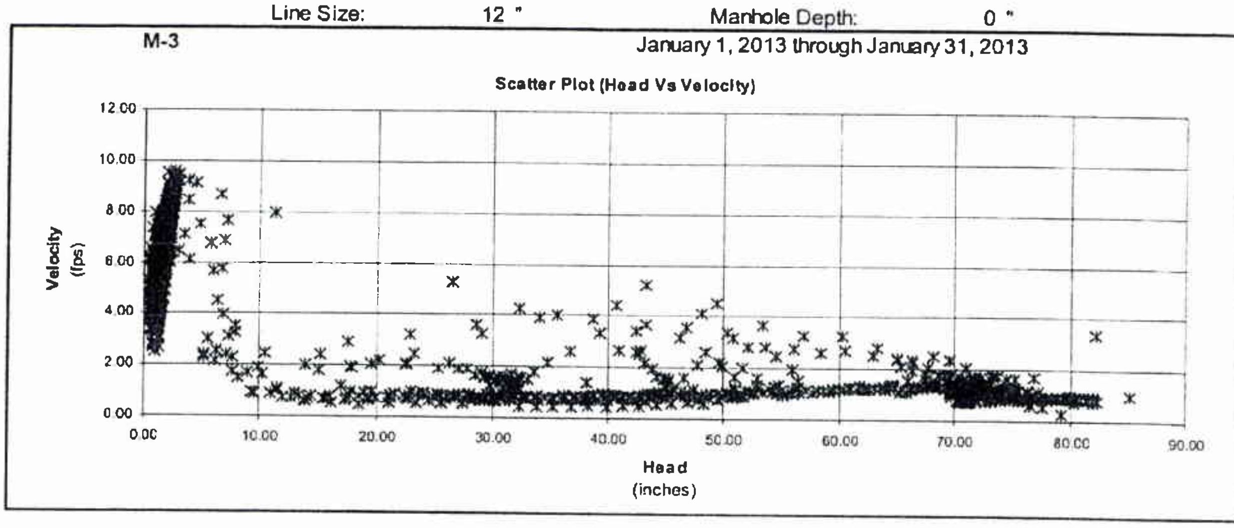
Accuracy:	20 feet	Elevation:	844 feet	Latitude:	40.348521	Longitude:	79.889621

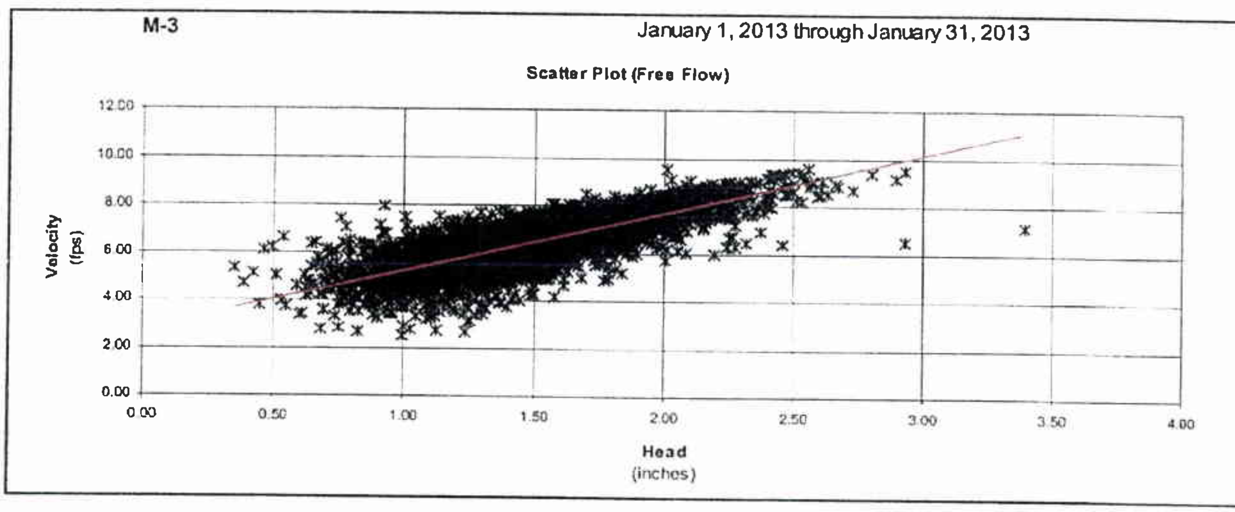
Notes

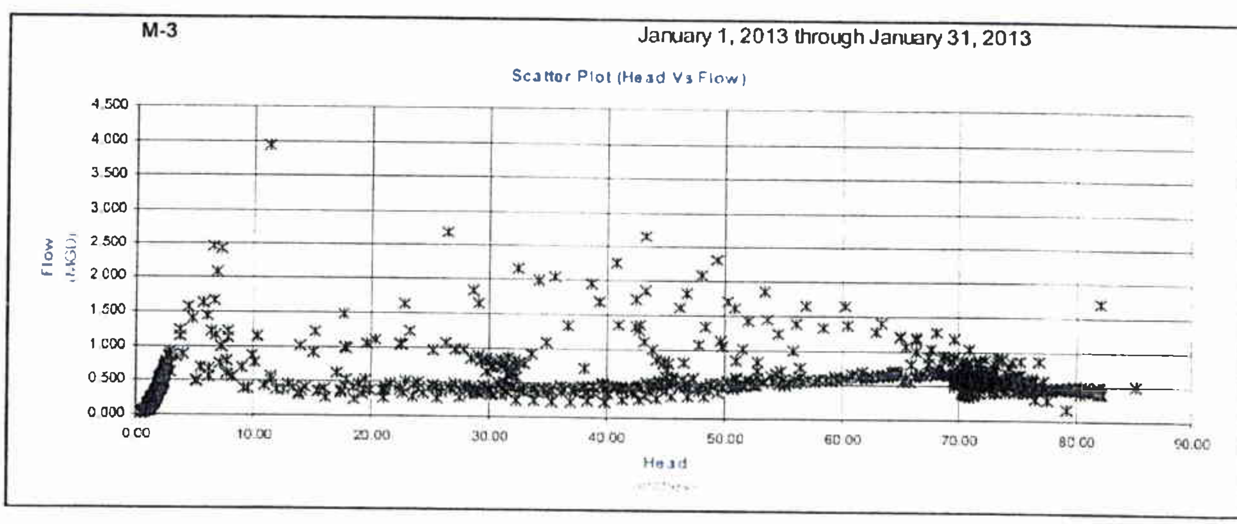
APPENDIX D

DRNACH SCATTERGRAPHS

Line Size: 12 " Manhole Depth: 0 "







Line Size: 12 " Manhole Depth: 0 "