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30 June 2000

Mr. Arthur A. Coccoli  
Remedial Project Manager  
Northern Division, Naval Facilities Engineering Command  
10 Industrial Highway, Mail Stop 82  
Lester, Pennsylvania 19113-2090

RE: Summary of Monitoring Well Redevelopment Conducted 15-16 March, 23 March 2000,  
and 5 and 7 April 2000 at Three Sites, Naval Air Station, Brunswick, Maine  
Contract N62472-92-D-1296, Contract Task Order No. 0047  
EA Project No. 29600.47

Dear Mr. Coccoli:

EA Engineering, Science, and Technology is pleased to provide the enclosed summary of monitoring well redevelopment activities conducted at Sites 1 and 3, Site 9, and the Eastern Plume at Naval Air Station, Brunswick, Maine. The monitoring well redevelopment activities included the redevelopment of 1 monitoring well each at Sites 1 and 3 and Site 9, and 5 monitoring wells at the Eastern Plume. All 7 monitoring wells are included in the long-term monitoring program and currently cannot be sampled using a submersible pump, and/or these wells will require extended purge time due to high turbidity within the wells.

Included in the letter report are the Field Record of Well Development forms which were used to record field measurements collected during redevelopment activities (Attachment A).

### WELL REDEVELOPMENT

A total of 7 ground-water monitoring wells included in the long-term monitoring program could not be sampled using a submersible pump and/or require extended purge time due to high turbidity. Well redevelopment was completed at the following well locations and sites: well MW-202A at Sites 1 and 3; well MW-NASB-079 at Site 9; and Eastern Plume wells MW-309B, MW-313, MW-330, MW-334, and MW-305.

Well redevelopment was completed by EA onsite personnel prior to Monitoring Event 16 (April 2000). Prior to beginning redevelopment, the static ground-water elevation was recorded at each well. To monitor the effectiveness of the redevelopment process, the following parameters were assessed prior to, during, and after redevelopment: pH, conductivity, temperature, dissolved oxygen, and turbidity. These values are presented in the Field Record of Well Development forms in Attachment A.

### **Sites 1 and 3**

Monitoring well MW-202A was redeveloped at Sites 1 and 3 as part of this task. Redevelopment of this well lasted a total of 50 minutes at a purge rate of 2 L/minute. A total of 90 L of ground water was removed from MW-202A. The turbidity after redevelopment was 9 nephelometric turbidity units (NTUs).

### **Site 9**

Monitoring MW-NASB-079 was redeveloped at Site 9. Redevelopment of MW-NASB-079 lasted a total of 55 minutes at a purge rate of 3 L/minute. A total of 165 L was removed from the well. The turbidity of the well after redevelopment was 2 NTUs.

### **Eastern Plume**

Monitoring wells MW-305, MW-309B, MW-313, MW-330, and MW-334 were redeveloped as part of this task. All redeveloped monitoring wells at the Eastern Plume did not stabilize during redevelopment activities.

On 15 March 2000, monitoring well MW-305 was purged for 75 minutes at a rate of 2 L/minute. A total of 150 L was removed, however, turbidity remained at greater than 1,000 NTUs.

On 23 March 2000, MW-305 was purged for an additional 3 hours at a rate of 2 L/minute.

An additional 360 L were removed with turbidity remaining at greater than 1,000 NTUs. It should be noted that the screened interval of this well is within a silt and clay layer with some sand lenses.

On 16 March 2000, monitoring well MW-313 was purged for 3.5 hours at a rate of 3 L/minute.

A total of 630 L was removed, however, turbidity remained greater than 1,000 NTUs. Fine sands were observed in the purge water throughout the redevelopment process. It should be noted that the screened interval of this well is within clay with some silt and sand lenses.

On 5 April 2000, monitoring well MW-309B was redeveloped. After purging the well at a rate of 1 L/minute for 20 minutes, the well went dry. The well was allowed to recharge for 15 minutes and only recovered 5 ft. Turbidity was recorded at 180 NTUs. The well was purged dry and allowed to recharge for 1 hour and recovered at a rate of 0.5 ft/minute. An attempt was made to purge the well again, however, the well was purged dry after only 2 minutes. It should be noted that the well screen is completed in bedrock.

On 7 April 2000, monitoring well MW-330 was redeveloped. After purging the well at a rate of 1.5 L/minute for 15 minutes, the well went dry. The well was allowed to recharge for 15 minutes. Monitoring well MW-330 was then purged at a rate of 0.7 L/minute. A total of 140 L was removed from this well, however, turbidity was measured at 387 NTUs at the completion of redevelopment. This well is screened within a clay layer with a 16-in. layer of sand.

On 16 March 2000, monitoring well MW-334 was purged at a rate of 2 L/minute for 2.5 hours. A total of 300 L was removed, however, turbidity remained greater than 1,000 NTUs. The screened interval of this well is completed within clay with approximately 23 in. of sand in the screened interval.

## RESULTS

All 7 monitoring wells were sampled following redevelopment activities as part of Monitoring Event 16 in April 2000. The ending turbidities from Monitoring Event 15 (September 1999) and Monitoring Event 16 (April 2000) were compared to determine if the redevelopment had been effective.

Five of 7 redeveloped monitoring wells (MW-202A at Sites 1 and 3; MW-NASB-79 at Site 9; and MW-305, MW-309B, and MW-334 at Eastern Plume) showed a decrease in turbidity following the completion of low flow purging from Monitoring Event 15 to Monitoring Event 16. Three of these 5 wells (MW-202A at Sites 1 and 3, MW-NASB-79 at Site 9, and MW-305 at Eastern Plume) had stabilization with turbidity at less than 10 NTUs.

The 2 monitoring wells (MW-313 and MW-334 at the Eastern Plume) had an increase in turbidity. However, these well screens were completed in clay with minor amounts of sand and sand lenses. During the redevelopment process, turbidity never decreased below 1,000 NTUs in wells MW-313 and MW-334.

Ground-water sampling results are presented in the Monitoring Event 16 reports for Sites 1 and 3 and Eastern Plume, and Site 9.

It has been our pleasure providing Northern Division these data. If there are any questions, please do not hesitate to call.

Respectfully,



Alexander C. Easterday, P.G.  
Project Manager



Suzanne Chase, P.G.  
Project Geologist

ACE/mkp  
Attachment

cc: A. Williams, NASB (1 copy)  
C. Sait, MEDEP (1 copy)  
M. Barry, EPA (1 copy)  
C. Lepage, Lepage Environmental (1 copy)  
Administrative Record (2 copies)  
Project File (1 copy)

**Attachment A**

**Field Record of  
Well Development Forms**



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## FIELD RECORD OF WELL DEVELOPMENT - Sites 1+3

Project Name: <u>Well Redevelopment</u>	Project No: <u>2960047.7404</u>	Date: <u>3/15/00</u>
EA Personnel: <u>SC, BA</u>	Development Method: <u>Surge/purge</u>	
Weather/Temperature/Barometric Pressure: <u>overcast 40°</u>		Time: <u>1345</u>

Well No.: <u>MW-202A</u>	Well Condition: <u>Good</u>
Well Diameter: <u>2</u>	Measurement Reference: <u>TOC</u>
Well Volume Calculations	
A. Depth To Water (ft): <u>20.12</u>	D. Well Volume/ft: <u>0.605</u>
B. Total Well Depth (ft): <u>26.00</u>	E. Total Well Volume (L)[C*D]: <u>3.6</u>
C. Water Column Height (ft): <u>5.88</u>	F. Five Well Volumes (L): <u>18</u>

Parameter	Beginning	1	2	3	4	5
Time (min)		1410	1415	1420	1425	1430
Turbidity (nTu)		16	10	7	9	8
Purge Rate (lpm)		2	2	2	2	2
Volume Purged (L)		50	60	70	80	90
PH		5.63	5.66	5.75	5.75	5.79
Temperature (EF)		10.25	10.89	12.27	12.64	12.89
Conductivity (µmhos/cm)		952	964	981	994	1001
Dissolved Oxygen (mg/L)		16.26	12.81	11.27	10.54	10.00
Parameter	6	7	8	9	10	End
Time (min)						1435
Turbidity (nTu)						9
Purge Rate (lpm)						2
Volume Purged (L)						100
PH						5.81
Temperature (EF)						12.78
Conductivity (µmhos/cm)						989
Dissolved Oxygen (mg/L)						9.56

COMMENTS AND OBSERVATIONS: Well purged at 2 l/min for a total of 100 gal liters

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## FIELD RECORD OF WELL DEVELOPMENT - Site 9

Project Name: <u>Well Redevelopment</u>	Project No: <u>29600477404</u>	Date: <u>3-15-00</u>
EA Personnel: <u>SC, BA</u>	Development Method: <u>Surge / Purge</u>	
Weather/Temperature/Barometric Pressure: <u>Sunny, 40°</u>		Time: <u>1010</u>

Well No.: <u>MW-NASB-079</u>	Well Condition: <u>good</u>
Well Diameter: <u>2</u>	Measurement Reference: <u>TOC</u>

### Well Volume Calculations

A. Depth To Water (L): <sup>Ft</sup> <u>11.17</u>	D. Well Volume (L): <sup>Ft</sup> <u>0.605</u>
B. Total Well Depth (L): <sup>Ft</sup> <u>18.22</u>	E. Total Well Volume (L)[C*D]: <u>4.3</u>
C. Water Column Height (L): <sup>Ft</sup> <u>7.05</u>	F. Five Well Volumes (L): <u>22</u>

Parameter	Beginning	1	2	3	End 4	5
Time (min)		1050	1055	1100	1105	
Turbidity (nTu)		9	9	10	2	
Purge Rate (lpm)		3	3	3	3	
Volume Purged (L)		120	135	150	165	
PH		6.79	6.75	6.76	6.82	
Temperature (EF)		13.06	12.65	12.40	12.36	
Conductivity (µmhos/cm)		270	274	273	275	
Dissolved Oxygen (mg/L)		9.34	9.47	9.43	9.43	
Parameter	6	7	8	9	10	End
Time (min)						
Turbidity (nTu)						
Purge Rate (lpm)						
Volume Purged (L)						
PH						
Temperature (EF)						
Conductivity (µmhos/cm)						
Dissolved Oxygen (mg/L)						

COMMENTS AND OBSERVATIONS: Total of 165 liters removed

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## FIELD RECORD OF WELL DEVELOPMENT - EP

Project Name: <i>Well Redevelopment</i>	Project No: <i>29600477404</i>	Date: <i>3/15/00</i>
EA Personnel: <i>SC, BA</i>	Development Method: <i>Surge purge</i>	
Weather/Temperature/Barometric Pressure: <i>overcast 40°</i>		Time: <i>1500</i>

Well No.: <i>MW-305</i>	Well Condition: <i>good</i>
Well Diameter: <i>2</i>	Measurement Reference: <i>TOC</i>

### Well Volume Calculations

A. Depth To Water <sup>ft</sup> : <i>12.55</i>	D. Well Volume/L: <sup>ft</sup> <i>0.605</i>
B. Total Well Depth <sup>ft</sup> : <i>18.10</i>	E. Total Well Volume (L)(C*D): <i>3.4</i>
C. Water Column Height <sup>ft</sup> : <i>5.55</i>	F. Five Well Volumes (L): <i>17</i>

Parameter	Beginning	1	2	3	4	5
Time (min)						
Turbidity (nTu)						
Purge Rate (lpm)						
Volume Purged (L)						
PH						
Temperature (EF)						
Conductivity (µmhos/cm)						
Dissolved Oxygen (mg/L)						
Parameter	6	7	8	9	10	End
Time (min)						
Turbidity (nTu)						
Purge Rate (lpm)						
Volume Purged (L)						
PH						
Temperature (EF)						
Conductivity (µmhos/cm)						
Dissolved Oxygen (mg/L)						

COMMENTS AND OBSERVATIONS: *Well was purged for 75 minutes at 2 L a minute. A total of 150 liters were removed. Turbidity > 1000. Well was purged on 3/23/00 for 3 hrs @ 2 g liters/min. A total of 360 L was removed with turbidity > 1000. Screen includes a silt and clay layer with some sand lenses.*



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## FIELD RECORD OF WELL DEVELOPMENT - EP

Project Name: <u>Well Redevelopment</u>	Project No: <u>2960047.744</u>	Date: <u>3-16-00</u>
EA Personnel: <u>SC, BA</u>	Development Method: <u>Surge / purge</u>	
Weather/Temperature/Barometric Pressure: <u>Sunny 45°</u>		Time: <u>9:18</u>

Well No.: <u>MW-313</u>	Well Condition: <u>good</u>
Well Diameter: <u>2</u>	Measurement Reference: <u>TOC</u>
Well Volume Calculations	
A. Depth To Water (L): <sup>ft</sup> <u>8.16</u>	D. Well Volume (L): <sup>ft</sup> <u>0.605</u>
B. Total Well Depth (L): <sup>ft</sup> <u>28</u>	E. Total Well Volume (L)[C*D]: <u>12</u>
C. Water Column Height (L): <sup>ft</sup> <u>19.84</u>	F. Five Well Volumes (L): <u>60</u>

Parameter	Beginning	1	2	3	4	5
Time (min)						
Turbidity (nTu)						
Purge Rate (lpm)	<u>3</u>					
Volume Purged (L)						
PH						
Temperature (EF)						
Conductivity (µmhos/cm)						
Dissolved Oxygen (mg/L)						
Parameter	6	7	8	9	10	End
Time (min)						
Turbidity (nTu)						
Purge Rate (lpm)						
Volume Purged (L)						
PH						
Temperature (EF)						
Conductivity (µmhos/cm)						
Dissolved Oxygen (mg/L)						

COMMENTS AND OBSERVATIONS: Well <sup>liters</sup> was purged for 3.5 hrs @ a rate of 3 lpm. A total of 630 gallons were removed. Fine sands remain in the water. Turbidity was 21000 NTU.

It should be noted that the screen <sup>covers</sup> has mostly a clay layer with some silt and sand lenses.



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### FIELD RECORD OF WELL DEVELOPMENT

Project Name: <i>Well Redevelopment</i>	Project No: <i>29600477404</i>	Date: <i>4/5/00</i>
EA Personnel: <i>SC</i>	Development Method: <i>surge / purge</i>	
Weather/Temperature/Barometric Pressure: <i>overcast 50°</i>		Time: <i>1255</i>

Well No.: <i>MW-309B</i>	Well Condition: <i>good</i>
Well Diameter: <i>2</i>	Measurement Reference: <i>TOC</i>
Well Volume Calculations	
A. Depth To Water (ft): <i>0.38</i>	D. Well Volume (ft <sup>3</sup> ): <i>0.605</i>
B. Total Well Depth (ft): <i>59.43</i>	E. Total Well Volume (L) [C*D]: <i>36</i>
C. Water Column Height (ft): <i>59.05</i>	F. Five Well Volumes (L): <i>180</i>

Parameter	Beginning	1	2	3	4	5
Time (min)						
Turbidity (nTu)						
Purge Rate (lpm)						
Volume Purged (L)						
PH						
Temperature (EF)						
Conductivity (µmhos/cm)						
Dissolved Oxygen (mg/L)						
Parameter	6	7	8	9	10	End
Time (min)						
Turbidity (nTu)						
Purge Rate (lpm)						
Volume Purged (L)						
PH						
Temperature (EF)						
Conductivity (µmhos/cm)						
Dissolved Oxygen (mg/L)						

COMMENTS AND OBSERVATIONS: *Well purged at 1g/L/min for 20 minutes. Went Dry. Allowed to recharge 15 min - recharged 5 Ft. turb @ 180. Recharged 30 mins, up 4 Ft, another 30 min additional 1.5 Ft. approx 0.5 Ft/min. Water is removed from well after small time of purging.*



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## FIELD RECORD OF WELL DEVELOPMENT

EP

Project Name: <u>Well Redevelopment</u>	Project No: <u>29600477404</u>	Date: <u>4/17/00</u>
EA Personnel: <u>SYE</u>	Development Method: <u>Surge / purge</u>	
Weather/Temperature/Barometric Pressure:		Time: <u>1000</u>

Well No.: <u>MW-330</u>	Well Condition: <u>good</u>
Well Diameter: <u>2</u>	Measurement Reference: <u>TOC</u>
Well Volume Calculations	
A. Depth To Water (ft): <u>5.27</u>	D. Well Volume (ft <sup>3</sup> ): <u>0.605</u>
B. Total Well Depth (ft): <u>36.60</u>	E. Total Well Volume (L)[C*D]: <u>19</u>
C. Water Column Height (ft): <u>31.33</u>	F. Five Well Volumes (L): <u>95</u>

Parameter	Beginning	1	2	3	4	5
Time (min)						
Turbidity (nTu)						
Purge Rate (lpm)						
Volume Purged (L)						
PH						
Temperature (EF)						
Conductivity (µmhos/cm)						
Dissolved Oxygen (mg/L)						
Parameter	6	7	8	9	10	End
Time (min)						
Turbidity (nTu)						
Purge Rate (lpm)						
Volume Purged (L)						
PH						
Temperature (EF)						
Conductivity (µmhos/cm)						
Dissolved Oxygen (mg/L)						

COMMENTS AND OBSERVATIONS: Well was purged dry @ 1013. Recharged ~19ft below top pvc. Started purging at 1030 at 0.74ppm  
purged an additional 140 gallons. Turb @ 387 at end.  
Screen set in gray clay with a 6in layer of sand.



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## FIELD RECORD OF WELL DEVELOPMENT

EP

Project Name: <u>Well Redevelopment</u>	Project No: <u>2160047.7404</u>	Date: <u>3/16</u>
EA Personnel: <u>SC, BA</u>	Development Method: <u>surge/purge</u>	
Weather/Temperature/Barometric Pressure: <u>overcast 45°</u>		Time: <u>1405</u>

Well No.: <u>MW-334</u>	Well Condition: <u>good</u>
Well Diameter: <u>2</u>	Measurement Reference: <u>TOC</u>
Well Volume Calculations	
A. Depth To Water (L): <sup>ft</sup> <u>11.90</u>	D. Well Volume (L): <sup>ft</sup> <u>3.605</u>
B. Total Well Depth (L): <sup>ft</sup> <u>47.80</u>	E. Total Well Volume (L)[C*D]: <u>22</u>
C. Water Column Height (L): <sup>ft</sup> <u>35.90</u>	F. Five Well Volumes (L): <u>110</u>

Parameter	Beginning	1	2	3	4	5
Time (min)						
Turbidity (nTu)						
Purge Rate (lpm)						
Volume Purged (L)						
PH						
Temperature (EF)						
Conductivity (µmhos/cm)						
Dissolved Oxygen (mg/L)						
Parameter	6	7	8	9	10	End
Time (min)						
Turbidity (nTu)						
Purge Rate (lpm)						
Volume Purged (L)						
PH						
Temperature (EF)						
Conductivity (µmhos/cm)						
Dissolved Oxygen (mg/L)						

COMMENTS AND OBSERVATIONS: Well was purged at a rate of 2 gallons a minute for 2.5 hours. Total of 300 gallons removed. Turbidity 1000

Screen set in gray clay with approx. 23 inches sand lenses