Closed-Loop Bioremediation Pilot Demonstration
NWIRP Bethpage, New York

Project Summary 26 February 2005 – 25 March 2005

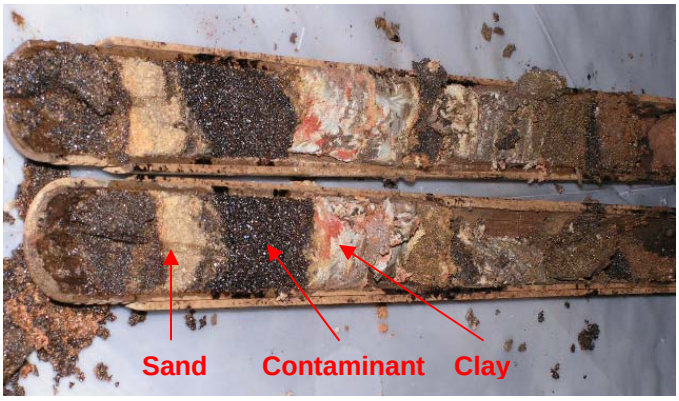
tierra technologies
A DIVISION OF AR UTILITY SPECIALISTS, INC.
Proprietary Information

From 26 February – 4 March, treatment intended to emulsify the contaminants was focused to the north of the concrete pad. Treatment consisted of low concentration iron followed by low concentration hydrogen peroxide carried via a warm surfactant foam media.

Groundwater samples and Soil Confirmation Boring #2, was completed from 7 – 11 March. Physical observations show an increase in subsurface temperature (80-90°F) and corresponding decrease in contaminant viscosity. We conclude that the iron + hydrogen peroxide treatment is having the desired effect of emulsifying the contaminant. Lab results of total petroleum hydrocarbon concentrations show no change since the previous soil confirmation boring event in December. This was anticipated due to the use of hydrogen peroxide inhibiting microorganism activity.

Now that the subsurface is warm and contaminant emulsified, the focus of our efforts will be to establish the subsurface bioreactor. Circulation of bacteria, surfactant, growth promoters, and nutrients will begin by early April, utilizing a higher power 50 hp, 221 cfm compressor. In addition, free product recovery will be restarted after shutdown due to winter weather conditions.

Soil samples are collected using the hollow stem auger drilling method.



Soil samples collection by split spoon method.

Closed Loop Bioremediation Pilot Demonstration

Project Information

Description:	Bioremediation of Diesel and Fuel Oil Impacted Soil
Client:	US Navy (NFESC / EFANE)
Contract Number:	N47408-04-C-7505
Contract Amount:	$1,646,016
Contract Period:	Feb 2004 – May 2006
Prime Contractor:	Tierra Technologies
Subcontractors:	Locus Technologies, Inc. James Woerner, Inc. Gordon L. Seaman, Inc. Popkin Electric Co.
Project Manager:	Dan Lohavanijaya 602-393-3932 (Phone) 602-509-5766 (Mobile) dan.lohavanijaya@arusi.net
Sr. Engineers:	Edmundo Uribe 602-431-2175 (Phone) edmundo.uribe@arusi.net
	David Peskin 602-685-1173 (Phone) peskind@locustec.com

Completed Activities

- Installation of a Second 1,100 gal tank for water storage
- Groundwater Sampling and Soil Boring #2
- CLB Vapor Circulation and Treatment
  - Lines 1 – 4
  - Sparging on all Lines
- Surfactant + H_2O_2 & Iron Foaming in Wells North, West, and South of Concrete Pad

Current/Future Activities

- RAB Meeting 6 April 2005
- CLB Vapor Circulation and Treatment
  - Lines 1 – 4
  - Sparging on all Lines
- Free Product Recovery
- Installation of 50 hp, 221 cfm Compressor for Accelerated Subsurface Circulation
- Surfactant + Nutrients Foaming in Wells Surrounding Concrete Pad

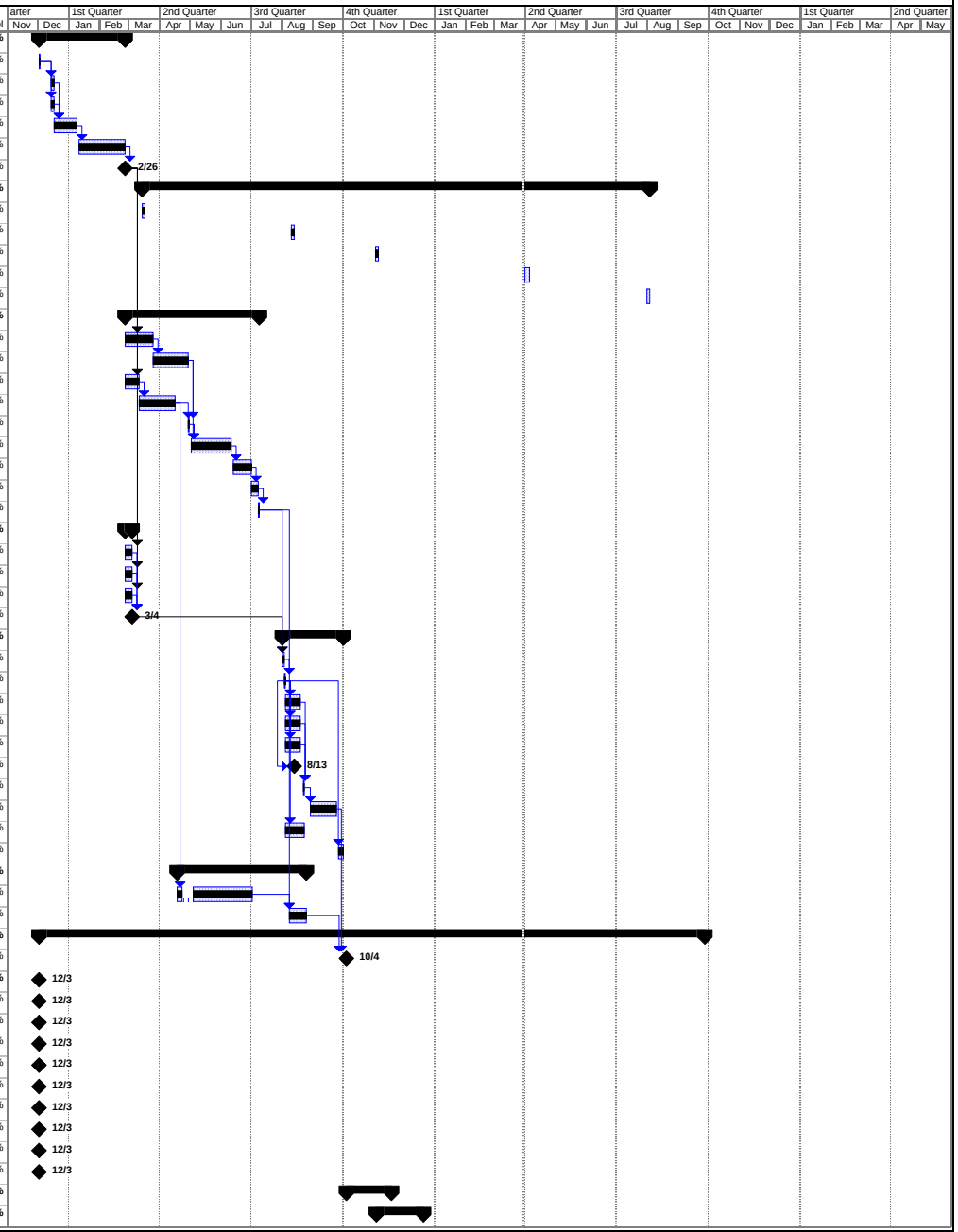
Current Completion Status

Task 1	Pre Design	100%
Task 1.5	RAB Meetings	60%
Task 2	Work Plan	100%
Task 3	Permits	100%
Task 4	Infrastructure Install	100%
Task 4.5	Site Electrical	100%
Task 5	System Operation	42%
Task 6	Soil Borings	31%
Task 7	Final Report	0%
Task 8	Site Restoration	0%

Closed-Loop Bioremediation Pilot Demonstration
NWIRP Bethpage, NY
Contract No. N47408-04-C-7505

tierra technologies
A Division of AR Utility Specialists, Inc.
Proprietary Information

ID	Phase	ID	Task Name	Duration	Start	Finish	% Compl
1	**1000**	**1**	**Task 1 - Pre Design Meeting / Site Walk**	**56 days**	**Wed 12/3/03**	**Thu 2/26/04**	**100%**
2	1010	2	Fact Finding Conference Call	1 day	Wed 12/3/03	Wed 12/3/03	100%
3	1020	3	Pre Design Meeting	3 days	Mon 12/15/03	Wed 12/17/03	100%
4	1030	4	Site Walk	3 days	Mon 12/15/03	Wed 12/17/03	100%
5	1040	5	Project Proposal	11 days	Thu 12/18/03	Fri 1/9/04	100%
6	1050	6	Customer Review and Negotiations	34 days	Mon 1/12/04	Thu 2/26/04	100%
7	1060	7	Project Award	0 days	Thu 2/26/04	Thu 2/26/04	100%
8	**1500**	**8**	**Task 1.5 CLB Technology Introductions and Presentation**	**354 days**	**Mon 3/15/04**	**Wed 8/3/05**	**60%**
9	1510	9	Technology Introduction to NYSDEC	3 days	Mon 3/15/04	Wed 3/17/04	100%
10	1520	10	RAB Meeting 1 (4 August 2004)	3 days	Wed 8/11/04	Fri 8/13/04	100%
11	1530	11	RAB Meeting 2 (3 November 2004)	3 days	Wed 11/3/04	Fri 11/5/04	100%
12	1540	12	RAB Meeting 3 (May 2005)	3 days	Fri 4/1/05	Tue 4/5/05	0%
13	1550	13	RAB Meeting 4 (August 2005)	3 days	Mon 8/1/05	Wed 8/3/05	0%
14	**2000**	**14**	**Task 2 - Develop RAP, HASP, System Design Drawings**	**94 days**	**Fri 2/27/04**	**Fri 7/9/04**	**100%**
15	2010	15	Develop Remedial Action Plan, Health & Safety Plan 50% Drafts	20 days	Fri 2/27/04	Thu 3/25/04	100%
16	2020	16	Complete Remedial Action Plan, Health & Safety Plan Draft	25 days	Fri 3/26/04	Thu 4/29/04	100%
17	2030	17	Develop System Design	10 days	Fri 2/27/04	Thu 3/11/04	100%
18	2040	18	Develop System Design & Drawings	26 days	Fri 3/12/04	Fri 4/16/04	100%
19	2050	19	RAP, HASP, Design Presentation	1 day	Fri 4/30/04	Fri 4/30/04	100%
20	2060	20	NAVFAC, NYSDEC Review of Drafts	29 days	Mon 5/3/04	Fri 6/11/04	100%
21	2070	21	Response to NAVFAC, NYSDEC	14 days	Mon 6/14/04	Thu 7/1/04	100%
22	2080	22	Final Draft Submission	4 days	Fri 7/2/04	Thu 7/8/04	100%
23	2090	23	Final Draft - Client Approval (not to exceed 45 days)	1 day	Fri 7/9/04	Fri 7/9/04	100%
24	**3000**	**24**	**Task 3 - Site Construction, Environmental, and Drilling Permits**	**5 days**	**Fri 2/27/04**	**Thu 3/4/04**	**100%**
25	3010	25	Site Construction Permits (if Necessary)	5 days	Fri 2/27/04	Thu 3/4/04	100%
26	3020	26	Environmental Permits (if Necessary)	5 days	Fri 2/27/04	Thu 3/4/04	100%
27	3030	27	Drilling Permits (if Necessary)	5 days	Fri 2/27/04	Thu 3/4/04	100%
28	3040	28	Site Cleared for Work	0 days	Thu 3/4/04	Thu 3/4/04	100%
29	**4000**	**29**	**Task 4 - CLB Well and Piping Infrastructure Installation**	**44 days**	**Mon 8/2/04**	**Fri 10/1/04**	**100%**
30	4010	30	Utility Location (Potholing)	2 days	Mon 8/2/04	Tue 8/3/04	100%
31	4020	31	Drilling Mobilization	1 day	Wed 8/4/04	Wed 8/4/04	100%
32	4030	32	Drilling and Installation of 28 Deep Treatment Wells	11 days	Thu 8/5/04	Thu 8/19/04	100%
33	4040	33	Drilling and Installation of 6 Shallow Treatment Wells	11 days	Thu 8/5/04	Thu 8/19/04	100%
34	4060	34	Decontamination, Collection and Disposal of IDW	11 days	Thu 8/5/04	Thu 8/19/04	100%
35	4070	35	Drilling and Installation, Decon, IDW 50% Complete Milestone	0 days	Fri 8/13/04	Fri 8/13/04	100%
36	4080	36	Demobilization	1 day	Mon 8/23/04	Mon 8/23/04	100%
37	4090	37	Trenching and Infrastructure Installation	19 days	Mon 8/30/04	Fri 9/24/04	100%
38	4100	38	Soil Analytical	13 days	Thu 8/5/04	Mon 8/23/04	100%
39	4110	39	Groundwater Analytical	5 days	Mon 9/27/04	Fri 10/1/04	100%
40	**4500**	**40**	**Task 4.5 - Power Distribution System**	**91 days**	**Mon 4/19/04**	**Wed 8/25/04**	**100%**
41	4510	41	Design Coordination and Approval	47 days	Mon 4/19/04	Fri 7/2/04	100%
42	4520	42	Installation	13 days	Mon 8/9/04	Wed 8/25/04	100%
43	**5000**	**43**	**Task 5 - Start Up and Operation of the CLB System**	**459 days**	**Wed 12/3/03**	**Tue 9/27/05**	**42%**
44	5005	44	Mobilization and System Start Up	0 days	Mon 10/4/04	Mon 10/4/04	100%
45	**5010**	**45**	**System Performance (Sliding Scale)**	**0 days**	**Wed 12/3/03**	**Wed 12/3/03**	**0%**
46	5015	46	First Milestone 10% Reduction	0 days	Wed 12/3/03	Wed 12/3/03	0%
47	5020	47	Second Milestone 20% Reduction	0 days	Wed 12/3/03	Wed 12/3/03	0%
48	5025	48	Third Milestone 30% Reduction	0 days	Wed 12/3/03	Wed 12/3/03	0%
49	5030	49	Fourth Milestone 40% Reduction	0 days	Wed 12/3/03	Wed 12/3/03	0%
50	5035	50	Fifth Milestone 50% Reduction	0 days	Wed 12/3/03	Wed 12/3/03	0%
51	5040	51	Sixth Milestone 60% Reduction	0 days	Wed 12/3/03	Wed 12/3/03	0%
52	5045	52	Seventh Milestone 70% Reduction	0 days	Wed 12/3/03	Wed 12/3/03	0%
53	5050	53	Eighth Milestone 80% Reduction	0 days	Wed 12/3/03	Wed 12/3/03	0%
54	5055	54	Ninth Milestone 90% Reduction	0 days	Wed 12/3/03	Wed 12/3/03	0%
55	**5060**	**55**	**1st Treatment Cycle**	**33 days**	**Mon 10/4/04**	**Thu 11/18/04**	**100%**
74	**5155**	**74**	**2nd Treatment Cycle**	**31 days**	**Wed 11/3/04**	**Mon 12/20/04**	**100%**



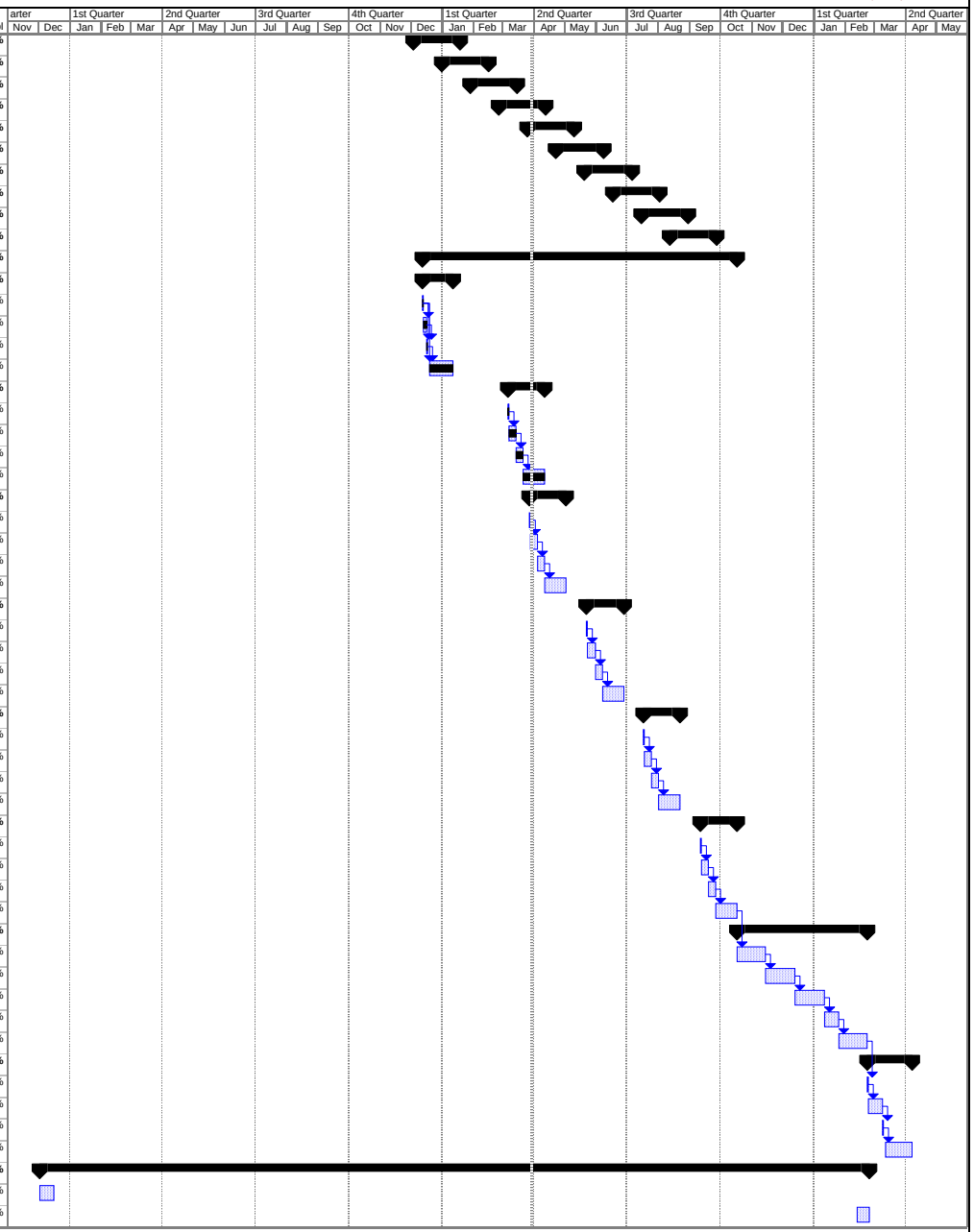
Project: Bethpage CLB Pilot Demo
Date: Tue 3/29/05

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Closed-Loop Bioremediation Pilot Demonstration
NWIRP Bethpage, NY
Contract No. N47408-04-C-7505

tierra technologies
A Division of AR Utility Specialists, Inc.
Proprietary Information

ID	Phase	ID	Task Name	Duration	Start	Finish	% Compl
93	5250	93	**3rd Treatment Cycle**	**30 days**	**Fri 12/3/04**	**Tue 1/18/05**	**100%**
106	5315	106	**4th Treatment Cycle**	**32 days**	**Fri 12/31/04**	**Tue 2/15/05**	**100%**
119	5380	119	**5th Treatment Cycle**	**32 days**	**Fri 1/28/05**	**Tue 3/15/05**	**100%**
132	5445	132	**6th Treatment Cycle**	**32 days**	**Fri 2/25/05**	**Tue 4/12/05**	**0%**
145	5510	145	**7th Treatment Cycle**	**32 days**	**Fri 3/25/05**	**Tue 5/10/05**	**0%**
158	5575	158	**8th Treatment Cycle**	**32 days**	**Fri 4/22/05**	**Wed 6/8/05**	**0%**
171	5640	171	**9th Treatment Cycle**	**31 days**	**Fri 5/20/05**	**Wed 7/6/05**	**0%**
184	5705	184	**10th Treatment Cycle**	**31 days**	**Fri 6/17/05**	**Tue 8/2/05**	**0%**
197	5770	197	**11th Treatment Cycle**	**32 days**	**Fri 7/15/05**	**Tue 8/30/05**	**0%**
210	5835	210	**12th Treatment Cycle**	**31 days**	**Fri 8/12/05**	**Tue 9/27/05**	**0%**
223	6000	223	**Task 6 - Confirmation Borings**	**216 days**	**Mon 12/13/04**	**Mon 10/17/05**	**31%**
224	6010	224	**Soil Confirmation Boring 1**	**20 days**	**Mon 12/13/04**	**Tue 1/11/05**	**100%**
225	6020	225	Drilling Mobilization	1 day	Mon 12/13/04	Mon 12/13/04	100%
226	6030	226	Drilling and Sample Collection	3 days	Tue 12/14/04	Thu 12/16/04	100%
227	6040	227	IDW Collection, Transportation, and Disposal	1 day	Fri 12/17/04	Fri 12/17/04	100%
228	6050	228	Soil Analytical	15 days	Mon 12/20/04	Tue 1/11/05	100%
229	6060	229	**Soil Confirmation Boring 2**	**26 days**	**Mon 3/7/05**	**Mon 4/11/05**	**100%**
230	6070	230	Drilling Mobilization	1 day	Mon 3/7/05	Mon 3/7/05	100%
231	6080	231	Drilling and Sample Collection	5 days	Tue 3/8/05	Mon 3/14/05	100%
232	6090	232	IDW Collection, Transportation, and Disposal	5 days	Tue 3/15/05	Mon 3/21/05	100%
233	6100	233	Soil Analytical	15 days	Tue 3/22/05	Mon 4/11/05	100%
234	6110	234	**Soil Confirmation Boring 3**	**26 days**	**Mon 3/28/05**	**Mon 5/2/05**	**0%**
235	6120	235	Drilling Mobilization	1 day	Mon 3/28/05	Mon 3/28/05	0%
236	6130	236	Drilling and Sample Collection	5 days	Tue 3/29/05	Mon 4/4/05	0%
237	6140	237	IDW Collection, Transportation, and Disposal	5 days	Tue 4/5/05	Mon 4/11/05	0%
238	6150	238	Soil Analytical	15 days	Tue 4/12/05	Mon 5/2/05	0%
239	6160	239	**Soil Confirmation Boring 4**	**26 days**	**Mon 5/23/05**	**Tue 6/28/05**	**0%**
240	6170	240	Drilling Mobilization	1 day	Mon 5/23/05	Mon 5/23/05	0%
241	6180	241	Drilling and Sample Collection	5 days	Tue 5/24/05	Tue 5/31/05	0%
242	6190	242	IDW Collection, Transportation, and Disposal	5 days	Wed 6/1/05	Tue 6/7/05	0%
243	6200	243	Soil Analytical	15 days	Wed 6/8/05	Tue 6/28/05	0%
244	6210	244	**Soil Confirmation Boring 5**	**26 days**	**Mon 7/18/05**	**Mon 8/22/05**	**0%**
245	6220	245	Drilling Mobilization	1 day	Mon 7/18/05	Mon 7/18/05	0%
246	6230	246	Drilling and Sample Collection	5 days	Tue 7/19/05	Mon 7/25/05	0%
247	6240	247	IDW Collection, Transportation, and Disposal	5 days	Tue 7/26/05	Mon 8/1/05	0%
248	6250	248	Soil Analytical	15 days	Tue 8/2/05	Mon 8/22/05	0%
249	6260	249	**Soil Confirmation Boring 6**	**26 days**	**Mon 9/12/05**	**Mon 10/17/05**	**0%**
250	6270	250	Drilling Mobilization	1 day	Mon 9/12/05	Mon 9/12/05	0%
251	6280	251	Drilling and Sample Collection	5 days	Tue 9/13/05	Mon 9/19/05	0%
252	6290	252	IDW Collection, Transportation, and Disposal	5 days	Tue 9/20/05	Mon 9/26/05	0%
253	6300	253	Soil Analytical	15 days	Tue 9/27/05	Mon 10/17/05	0%
254	7000	254	**Task 7 - Final Report and Petition for Site Closure**	**90 days**	**Tue 10/18/05**	**Wed 2/22/06**	**0%**
255	7010	255	Final Report - 50% Draft	20 days	Tue 10/18/05	Mon 11/14/05	0%
256	7020	256	Final Report - Draft	20 days	Tue 11/15/05	Tue 12/13/05	0%
257	7030	257	NAVFAC, NYSDEC Review of Drafts	20 days	Wed 12/14/05	Wed 1/11/06	0%
258	7040	258	Final Draft Submission	10 days	Thu 1/12/06	Wed 1/25/06	0%
259	7050	259	Final Draft - Client Approval (not to exceed 45 days)	20 days	Thu 1/26/06	Wed 2/22/06	0%
260	8000	260	**Task 8 - Site Restoration**	**32 days**	**Thu 2/23/06**	**Fri 4/7/06**	**0%**
261	8010	261	Drill Rig Mobilization	1 day	Thu 2/23/06	Thu 2/23/06	0%
262	8020	262	Well Abandonment	10 days	Fri 2/24/06	Thu 3/9/06	0%
263	8030	263	Drill Rig Demobilization	1 day	Fri 3/10/06	Fri 3/10/06	0%
264	8040	264	Site Restoration	20 days	Mon 3/13/06	Fri 4/7/06	0%
265	8050	265	**Optional**	**565 days**	**Wed 12/3/03**	**Fri 2/24/06**	**0%**
266	4050	266	Two Shallow Treatment Well Installation	10 days	Wed 12/3/03	Tue 12/16/03	0%
267	8060	267	Two Shallow Treatment Well Abandonment	10 days	Mon 2/13/06	Fri 2/24/06	0%



Project: Bethpage CLB Pilot Demo
Date: Tue 3/29/05

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Mean Soil Analytical Results
CLB Pilot Demonstration, NWIRP Bethpage AOC 22

tierra technologies
A DIVISION OF AR UTILITY SPECIALISTS, INC.

Proprietary Information