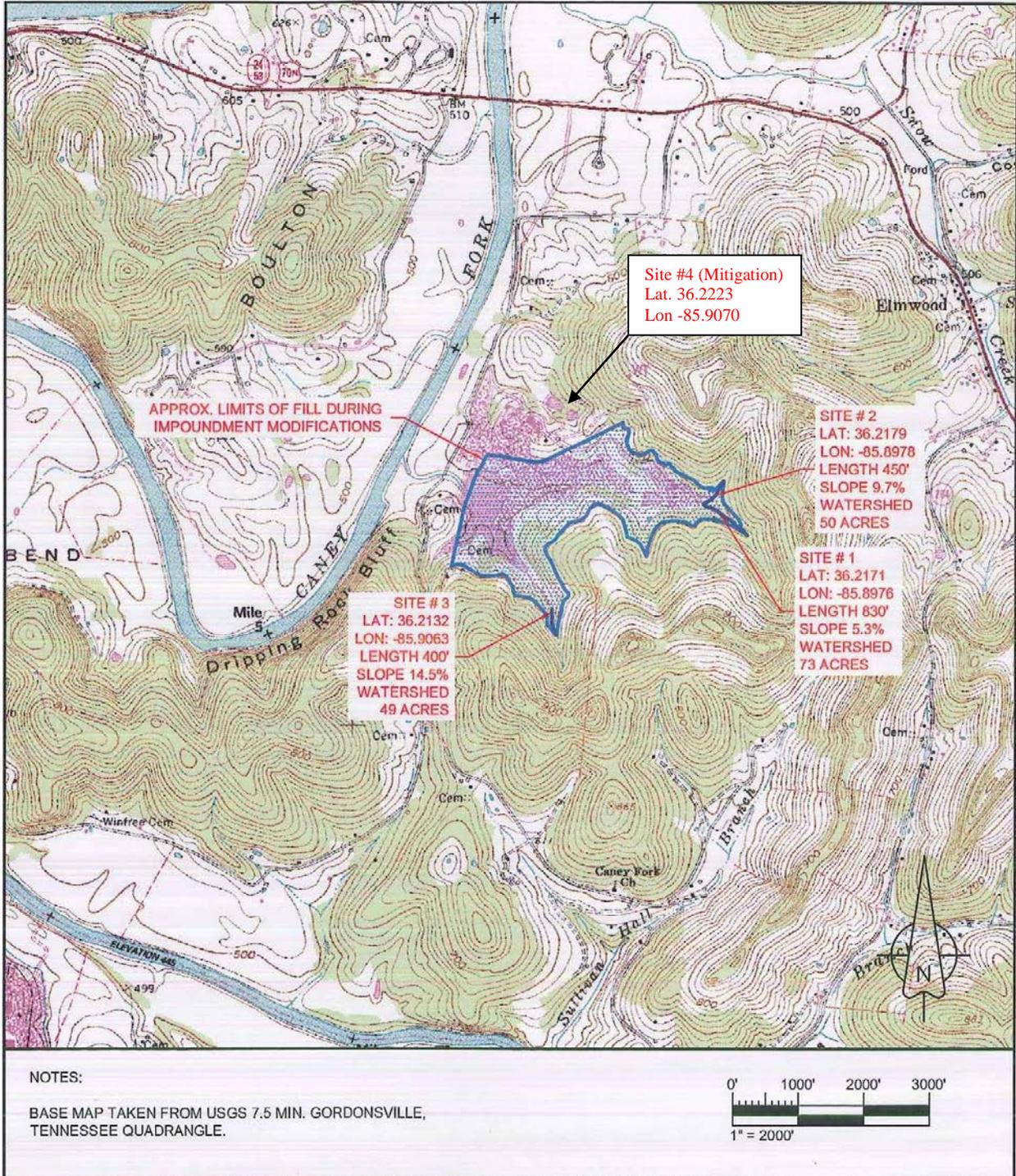
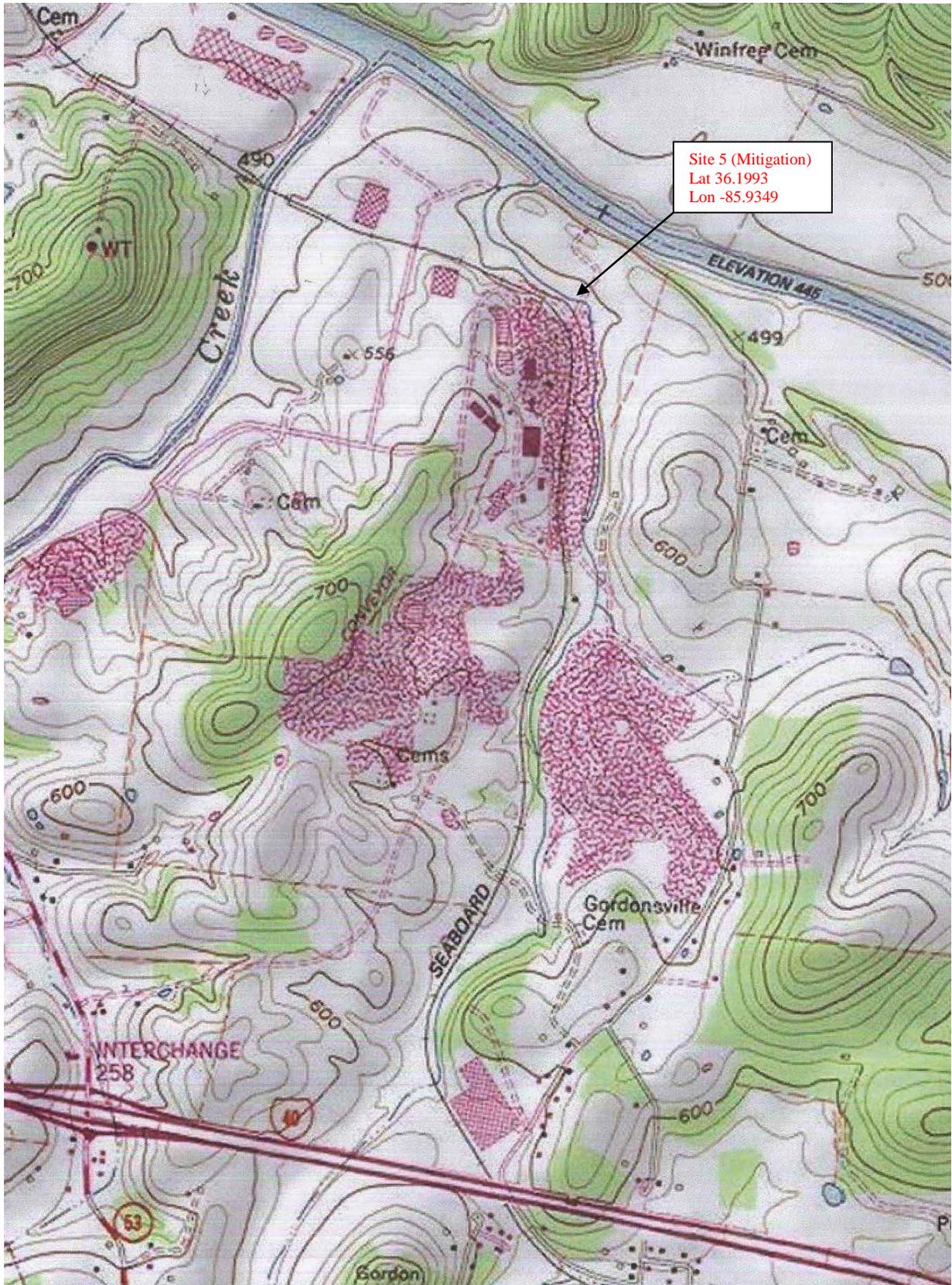


NYRSTAR PROPOSED EXPANSION ELMWOOD IMPOUNDMENT - MAP FOR SITES 1-4



NYRSTAR PROPOSED EXPANSION ELMWOOD IMPOUNDMENT - MAP FOR SITE 5



Appendix B
Stage 4, 5, and 6 Construction Plans

PROPOSED MODIFICATIONS TO ELMWOOD ZINC TAILINGS IMPOUNDMENT (STAGE 4 - 6 EXPANSION)

SMITH COUNTY, TENNESSEE

PREPARED FOR: MID TENNESSEE ZINC COMPANY
GORDONSVILLE, TENNESSEE

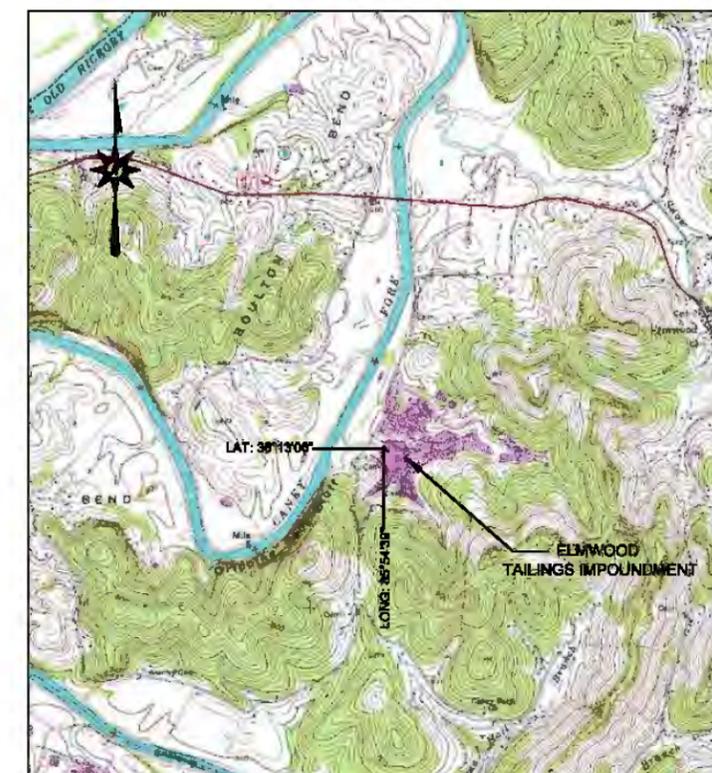
PREPARED BY: AMEC EARTH AND ENVIRONMENTAL



LOCATION MAP
ADAPTED FROM STREET ATLAS 2005 USA 2005
0' 4000' 8000' 12000'

LIST OF DRAWINGS

1. TITLE SHEET
2. WATERSHED MAP
3. EXISTING CONDITIONS/STAGE 4 COMPLETION
4. PLAN VIEW STAGE 5
5. PLAN VIEW STAGE 6
6. SECTIONS 0+00 & 6+00
7. SECTIONS 12+00 & 14+00
8. SECTIONS 16+00 & 20+00
9. SECTIONS 22+00 & 26+00
10. SECTION 32+00 & BASELINE PROFILE
11. BORING LOGS
12. PRINCIPAL SPILLWAY AND STAGE STORAGE CURVE
13. EMERGENCY SPILLWAY DETAILS
14. DETAILS
15. ABANDONMENT PLAN



VICINITY MAP
ADAPTED FROM GORDONSVILLE 7.5 MIN. U.S.G.S. QUADRANGLE 1988 EDITION.
0' 2000' 4000' 8000'

REVISIONS			
NO.	DESCRIPTION	BY	DATE

CLIENT:

nystar

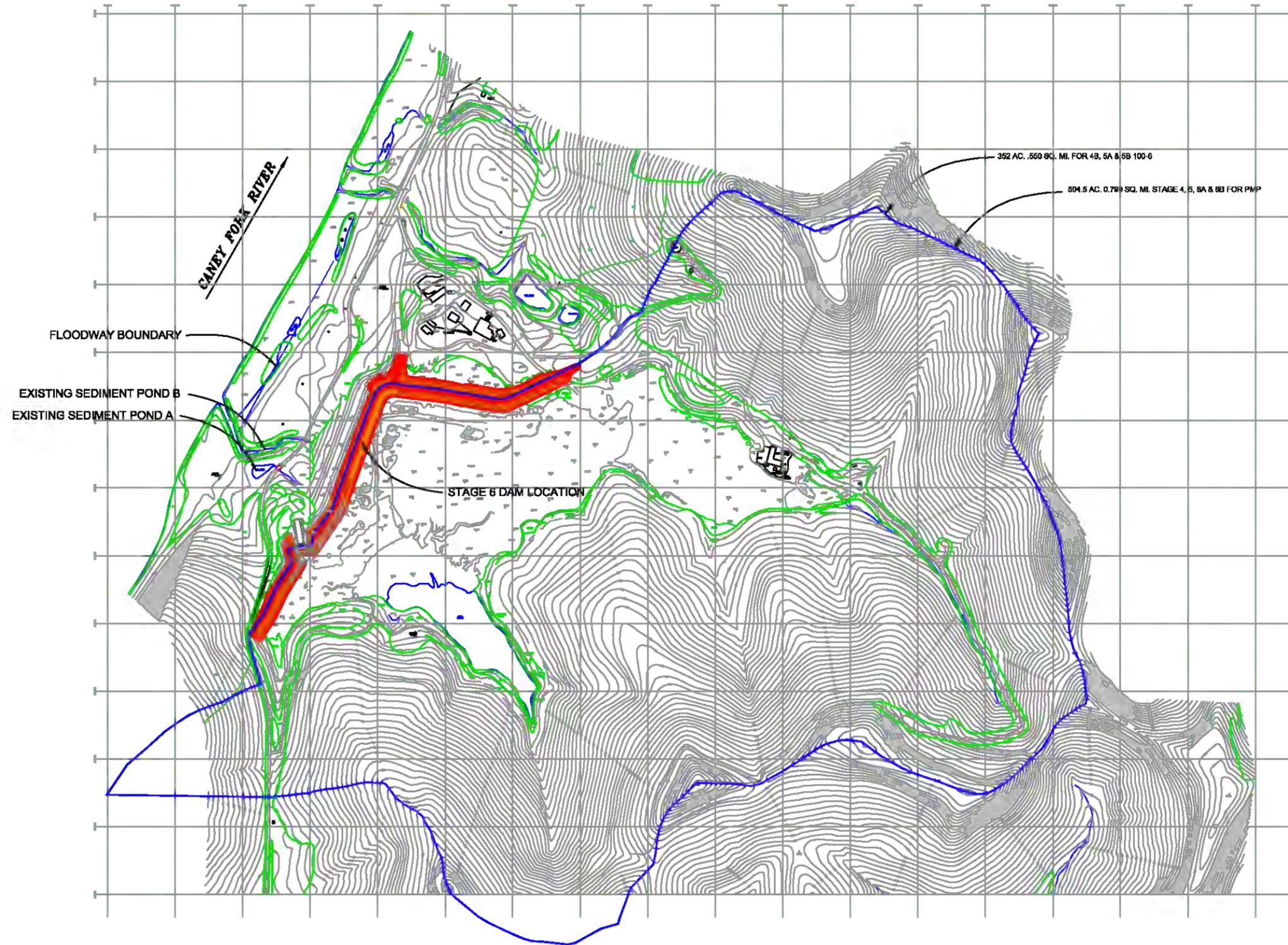
AMEC Environment & Infrastructure
8728 Ogilvie Road
Knoxville, Tennessee 37802
Tel (865) 674-6774
Fax (865) 571-6884

amec

TITLE:

**TITLE SHEET
ELMWOOD TAILINGS IMPOUNDMENT
SMITH COUNTY, TENNESSEE**

DRAWN BY:	APT
CHECKED BY:	LOW
REVIEWED BY:	LOW
SCALE:	AS SHOWN
DATE:	08/07/07
PROJECT NO.:	64936000-0001
REVISION NO.:	NA
SHEET 1 OF 11	



STRUCTURE	DESIGN STORM	ACRES	SQ. MILES
EMERGENCY SPILLWAY	PMP	504.5	0.79
PRINCIPAL SPILLWAY	PMP	504.5	0.79
PRINCIPAL SPILLWAY	100YR-8-H	504.5	0.79

NOTE:
 BASE MAP PROVIDED BY CONTINENTAL AERIAL SURVEYS, PROJECT NO. 05-1288
 MAP DATED 2/28/07, AERIAL PHOTOGRAPHY DATED 9/22/05.

REVISIONS			
NO.	DESCRIPTION	BY	DATE

CLIENT:

nyrstar

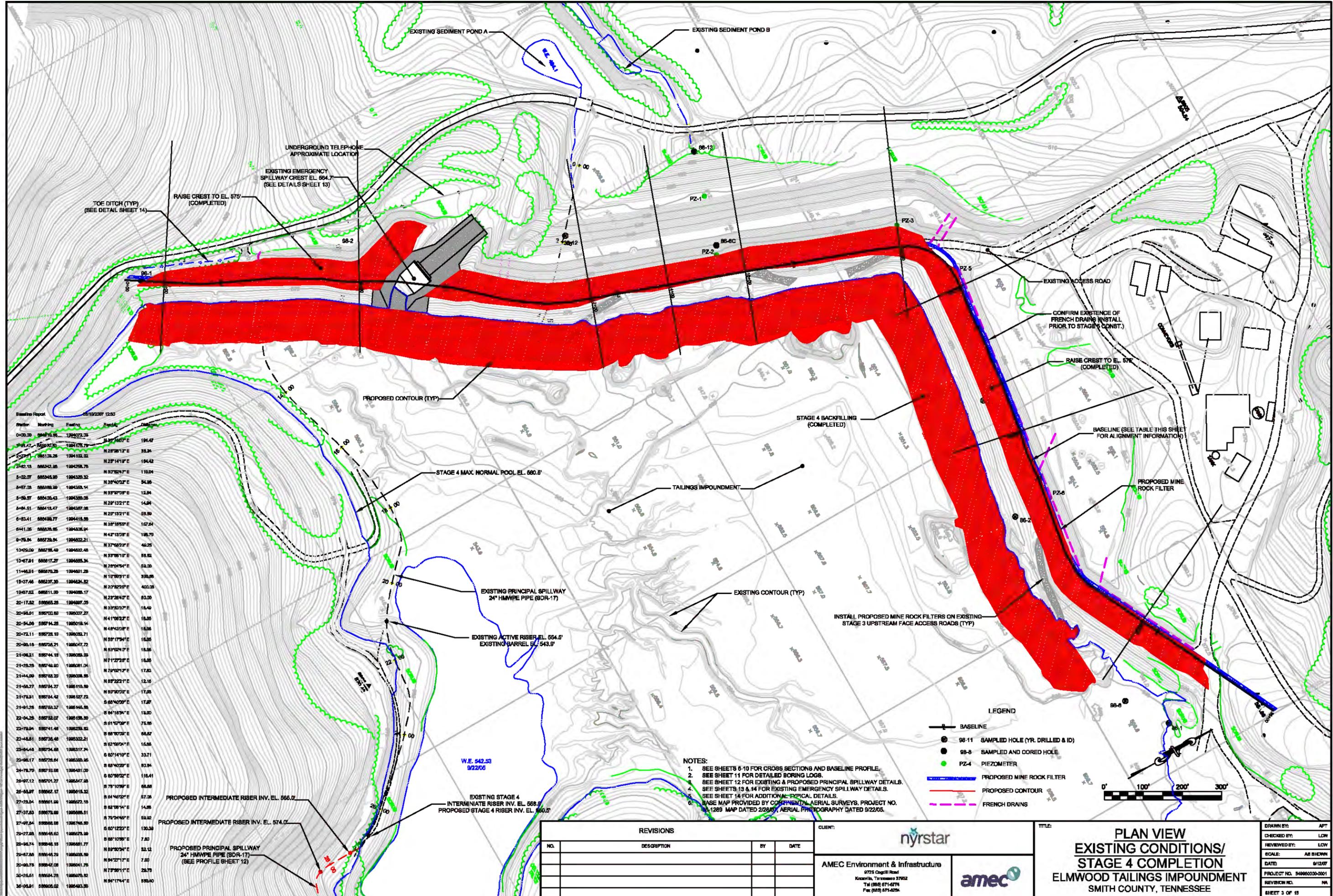
AMEC Environment & Infrastructure
 6725 Coghill Road
 Knoxville, Tennessee 37952
 Tel (855) 671-6276
 Fax (855) 671-6296

amec

TITLE:

WATERSHED MAP
ELMWOOD TAILINGS IMPOUNDMENT
 SMITH COUNTY, TENNESSEE

DRAWN BY:	APT
CHECKED BY:	LOW
REVIEWED BY:	LOW
SCALE:	AS SHOWN
DATE:	9/12/07
PROJECT NO.:	94996030-001
REVISION NO.:	NA
SHEET 2 OF 15	



Baseline Report 05/19/2007 12:30

Station	Marking	Existing	Proposed	Distance	Angle
0+00.00	9847.16	139402.05	N 32°40'7" E	194.47	
0+01.42	9597.95	1394178.79	N 28°28'12" E	38.24	
0+02.84	9651.04	1394131.56	N 23°14'19" E	184.42	
0+04.26	9652.45	1394258.76	N 30°32'14" E	110.04	
0+05.68	9653.86	1394320.32	N 38°40'32" E	94.88	
0+07.10	9655.27	1394358.14	N 33°30'39" E	12.84	
0+08.52	9656.68	1394300.06	N 29°13'21" E	14.84	
0+09.94	9658.09	1394367.26	N 23°13'21" E	38.88	
0+11.36	9659.50	1394415.06	N 38°18'59" E	167.84	
0+12.78	9660.91	1394436.94	N 42°13'09" E	188.76	
0+14.20	9662.32	1394602.21	N 37°49'22" E	40.28	
0+15.62	9663.73	1394632.46	N 33°08'19" E	98.84	
0+17.04	9665.14	1394655.34	N 28°04'54" E	58.00	
0+18.46	9666.55	1394681.28	N 13°09'31" E	308.88	
0+19.88	9667.96	1394634.82	N 20°32'29" E	400.08	
0+21.30	9669.37	1394688.17	N 23°28'04" E	80.00	
0+22.72	9670.78	1394687.05	N 33°30'37" E	18.40	
0+24.14	9672.19	1394607.27	N 41°08'27" E	18.80	
0+25.56	9673.60	1394518.14	N 48°43'08" E	18.80	
0+26.98	9675.01	1394581.71	N 59°17'34" E	18.80	
0+28.40	9676.42	1394628.39	N 63°02'04" E	18.80	
0+29.82	9677.83	1394681.04	N 71°22'39" E	17.80	
0+31.24	9679.24	1394638.85	N 79°12'12" E	12.16	
0+32.66	9680.65	1394610.89	N 89°30'09" E	17.80	
0+34.08	9682.06	1394527.32	S 65°40'09" E	17.80	
0+35.50	9683.47	1394448.86	S 64°18'34" E	18.80	
0+36.92	9684.88	1394380.00	S 61°10'09" E	75.88	
0+38.34	9686.29	1394334.84	S 68°30'33" E	66.82	
0+39.76	9687.70	1394302.21	S 62°39'04" E	16.88	
0+41.18	9689.11	1394317.34	S 60°14'10" E	33.71	
0+42.60	9690.52	1394333.05	S 60°40'29" E	90.84	
0+44.02	9691.93	1394381.00	S 60°30'32" E	116.41	
0+45.44	9693.34	1394447.08	S 79°10'59" E	66.88	
0+46.86	9694.75	1394515.32	S 64°46'02" E	67.28	
0+48.28	9696.16	1394522.16	S 63°08'14" E	14.88	
0+49.70	9697.57	1394588.81	S 70°24'49" E	69.82	
0+51.12	9698.98	1394676.89	S 60°12'23" E	100.32	
0+52.54	9700.39	1394673.89	S 68°10'58" E	7.80	
0+53.96	9701.80	1394651.77	N 68°30'34" E	32.12	
0+55.38	9703.21	1394603.89	N 64°27'17" E	7.80	
0+56.80	9704.62	1394641.76	N 73°36'11" E	28.78	
0+58.22	9706.03	1394609.82	N 64°17'44" E	358.40	
0+59.64	9707.44	1394683.30			

- NOTES:
- SEE SHEETS 6-10 FOR CROSS SECTIONS AND BASELINE PROFILE.
 - SEE SHEET 11 FOR DETAILED BORING LOGS.
 - SEE SHEET 12 FOR EXISTING & PROPOSED PRINCIPAL SPILLWAY DETAILS.
 - SEE SHEETS 13 & 14 FOR EXISTING EMERGENCY SPILLWAY DETAILS.
 - SEE SHEET 14 FOR ADDITIONAL TYPICAL DETAILS.
 - BASE MAP PROVIDED BY CONTINENTAL AERIAL SURVEYS, PROJECT NO. 03-1289 MAP DATED 2/28/07, AERIAL PHOTOGRAPHY DATED 9/22/05.

LEGEND

- BASELINE
- 98-11 SAMPLED HOLE (YR. DRILLED & ID)
- 98-8 SAMPLED AND CORED HOLE
- PZ-4 PIEZOMETER
- PROPOSED MINE ROCK FILTER
- PROPOSED CONTOUR
- FRENCH DRAINS



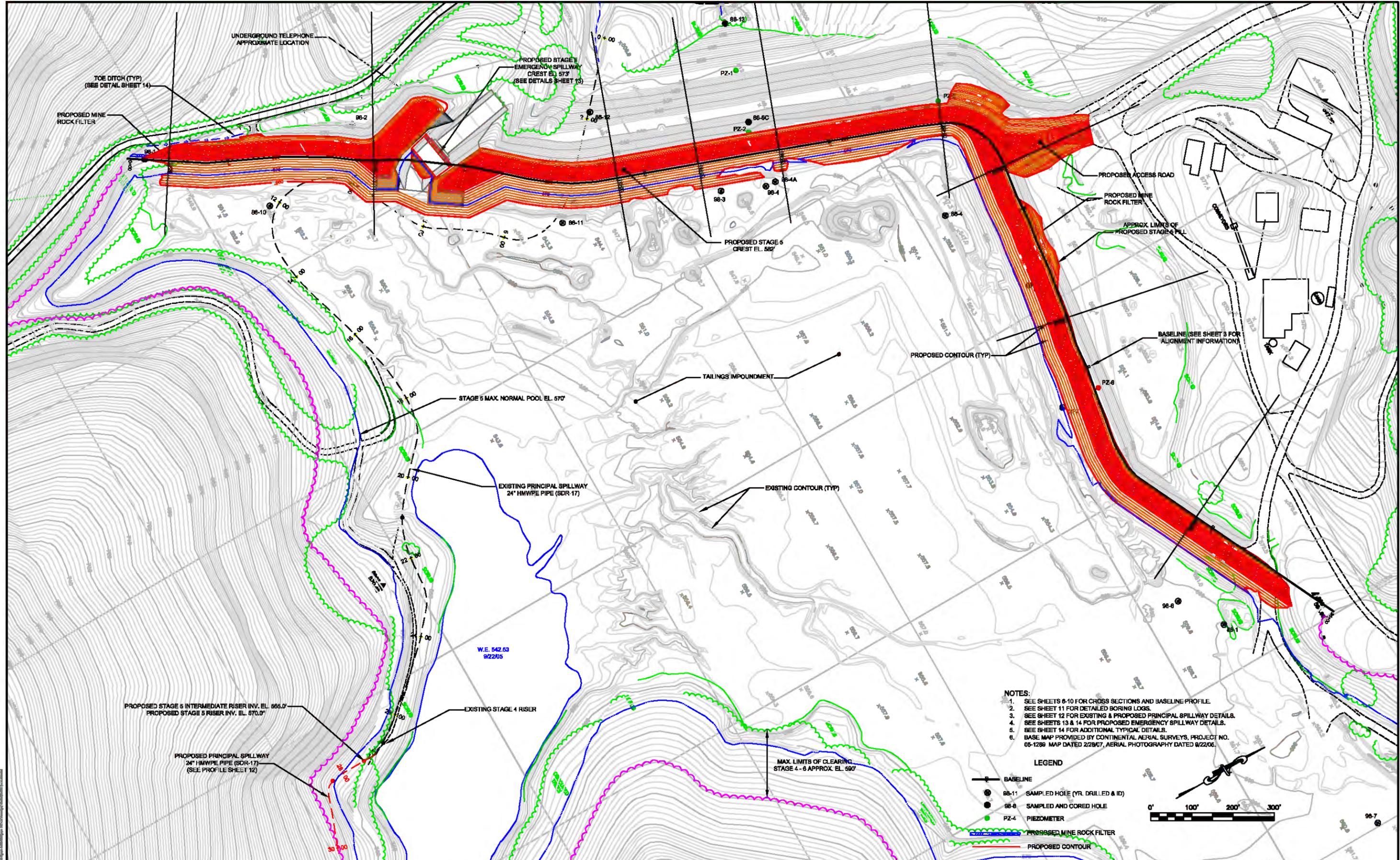
REVISIONS			
NO.	DESCRIPTION	BY	DATE

CLIENT: nyrstar

AMEC Environment & Infrastructure
 6725 Cogbill Road
 Knoxville, Tennessee 37952
 Tel (865) 671-6276
 Fax (865) 671-6296

TITLE: PLAN VIEW EXISTING CONDITIONS/ STAGE 4 COMPLETION ELMWOOD TAILINGS IMPOUNDMENT SMITH COUNTY, TENNESSEE

DRAWN BY:	APT
CHECKED BY:	LOW
REVIEWED BY:	LOW
SCALE:	AS SHOWN
DATE:	9/12/07
PROJECT NO.:	04986030-001
REVISION NO.:	NA
SHEET 3 OF 15	



- NOTES:**
- SEE SHEETS 6-10 FOR CROSS SECTIONS AND BASELINE PROFILE.
 - SEE SHEET 11 FOR DETAILED BORING LOGS.
 - SEE SHEET 12 FOR EXISTING & PROPOSED PRINCIPAL SPILLWAY DETAILS.
 - SEE SHEETS 13 & 14 FOR PROPOSED EMERGENCY SPILLWAY DETAILS.
 - SEE SHEET 14 FOR ADDITIONAL TYPICAL DETAILS.
 - BASE MAP PROVIDED BY CONTINENTAL AERIAL SURVEYS, PROJECT NO. 05-1289 MAP DATED 2/28/07, AERIAL PHOTOGRAPHY DATED 6/22/06.

LEGEND

- BASELINE
- 98-11 SAMPLED HOLE (YR. DRILLED & ID)
- 98-8 SAMPLED AND CORED HOLE
- PZ-4 PIEZOMETER
- PROPOSED MINE ROCK FILTER
- PROPOSED CONTOUR



REVISIONS			
NO.	DESCRIPTION	BY	DATE

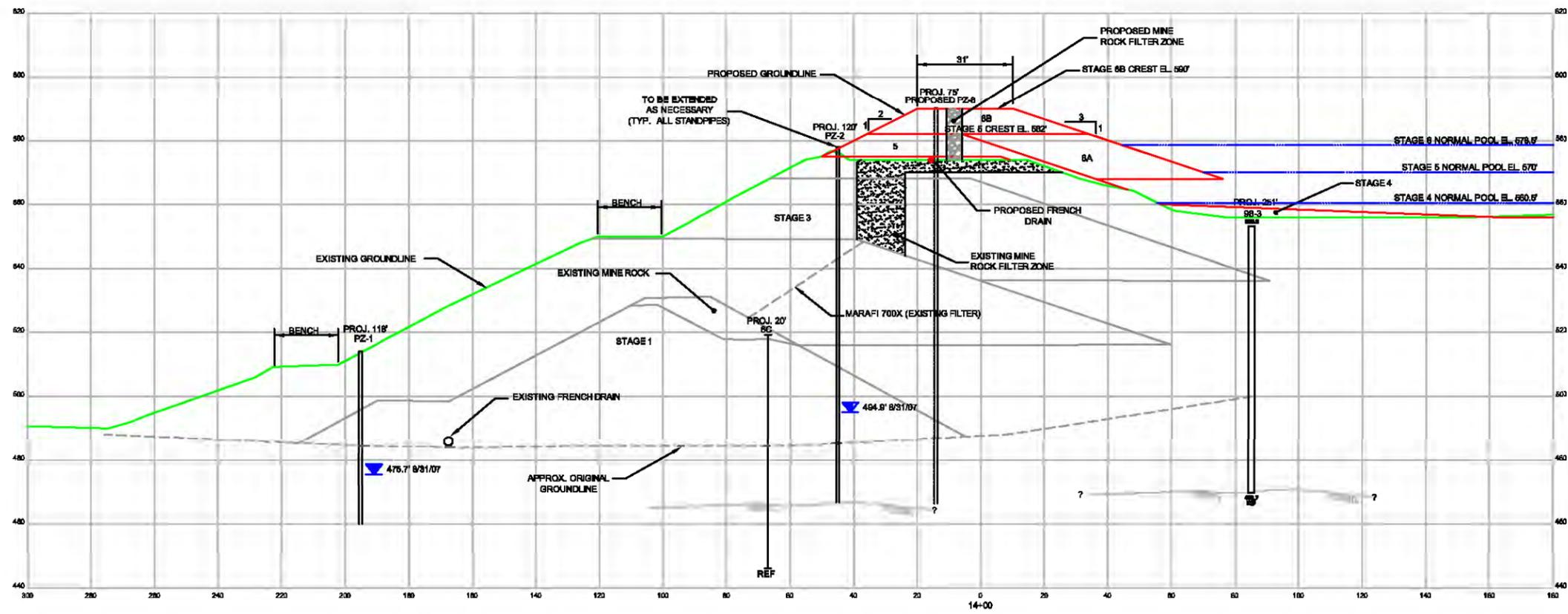
CLIENT: **nyrstar**

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 Knoxville, Tennessee 37952
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 Fax (615) 671-6296

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TITLE: **PLAN VIEW STAGE 5
ELMWOOD TAILINGS IMPOUNDMENT
SMITH COUNTY, TENNESSEE**

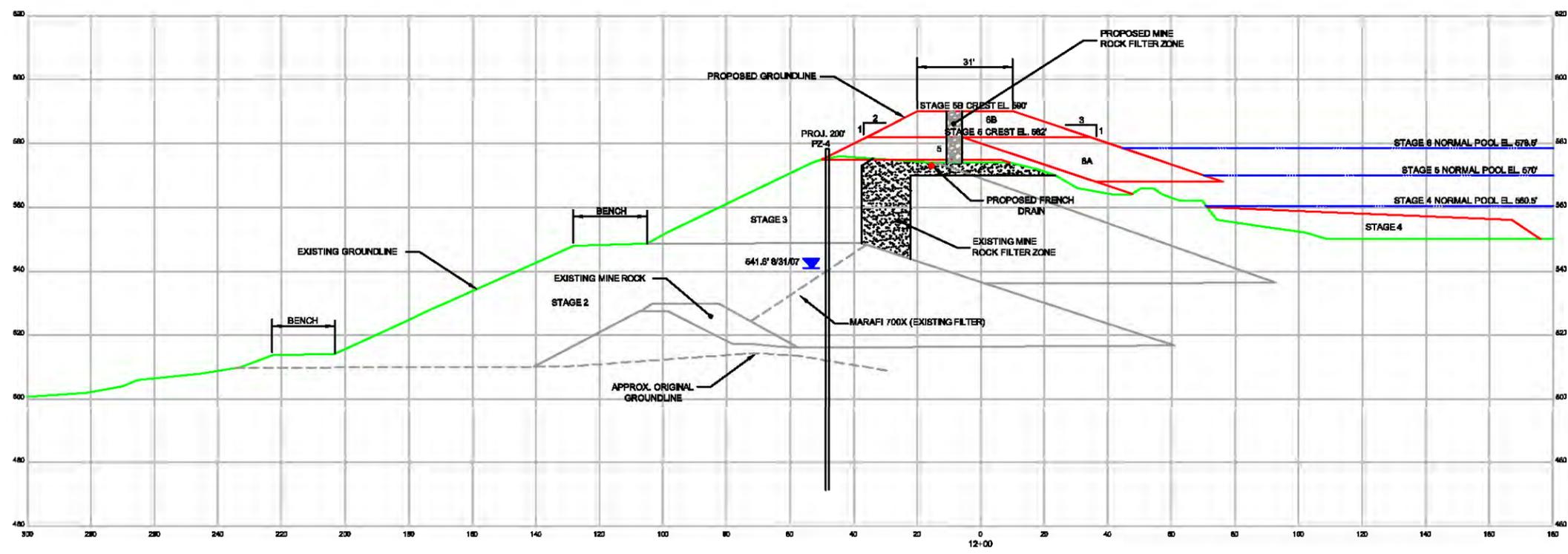
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 CHECKED BY: LCM
 REVIEWED BY: LCM
 SCALE: AS SHOWN
 DATE: 9/12/07
 PROJECT NO. 04966030-001
 REVISION NO. NA
 SHEET 4 OF 15



LEGEND

EXISTING GROUNDLINE	
PROPOSED GROUNDLINE	
APPROX. ORIGINAL GROUNDLINE	
APPROX. LIMITS OF PREVIOUS STAGES	

NOTES:
 1. SEE SHEET 11 FOR DETAILED BORING LOGS.
 2. SEE SHEET 8 FOR TYPICAL PIEZOMETER DETAIL.



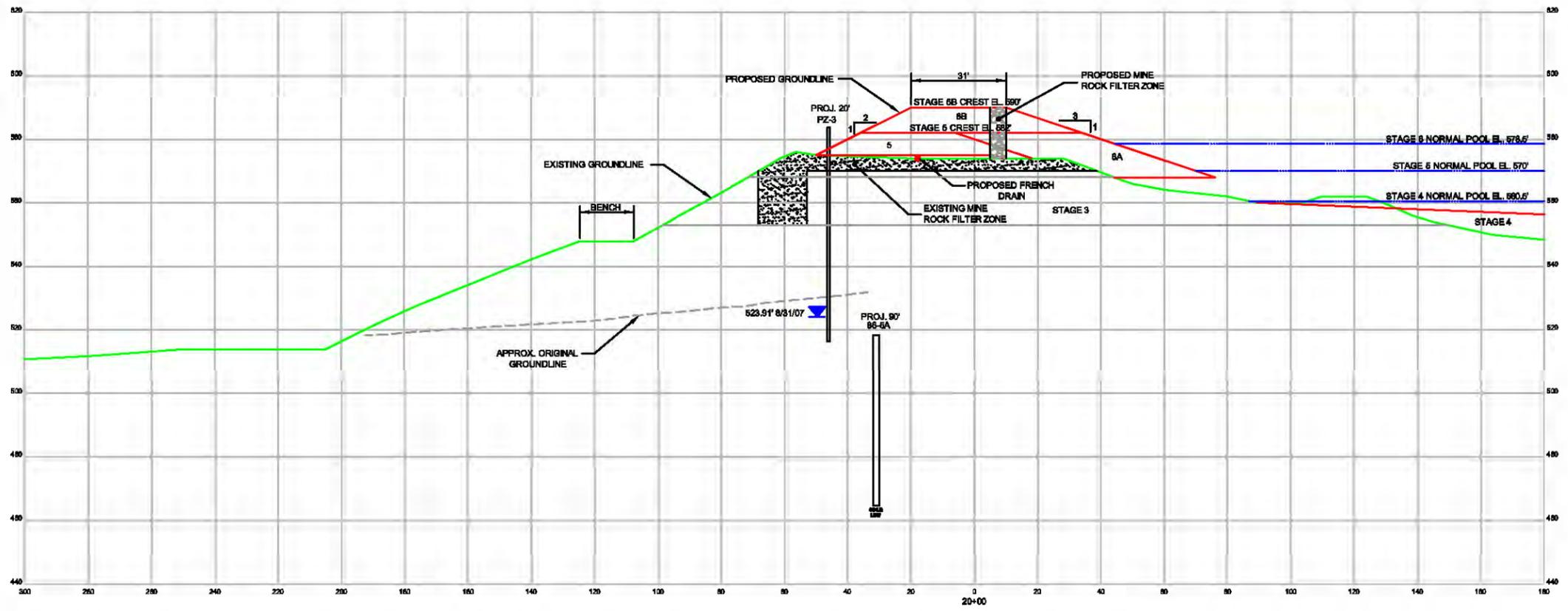
REVISIONS			
NO.	DESCRIPTION	BY	DATE

CLIENT:

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 Fax (865) 671-6296

TITLE: **CROSS SECTIONS
 ELMWOOD TAILINGS IMPOUNDMENT
 SMITH COUNTY, TENNESSEE**

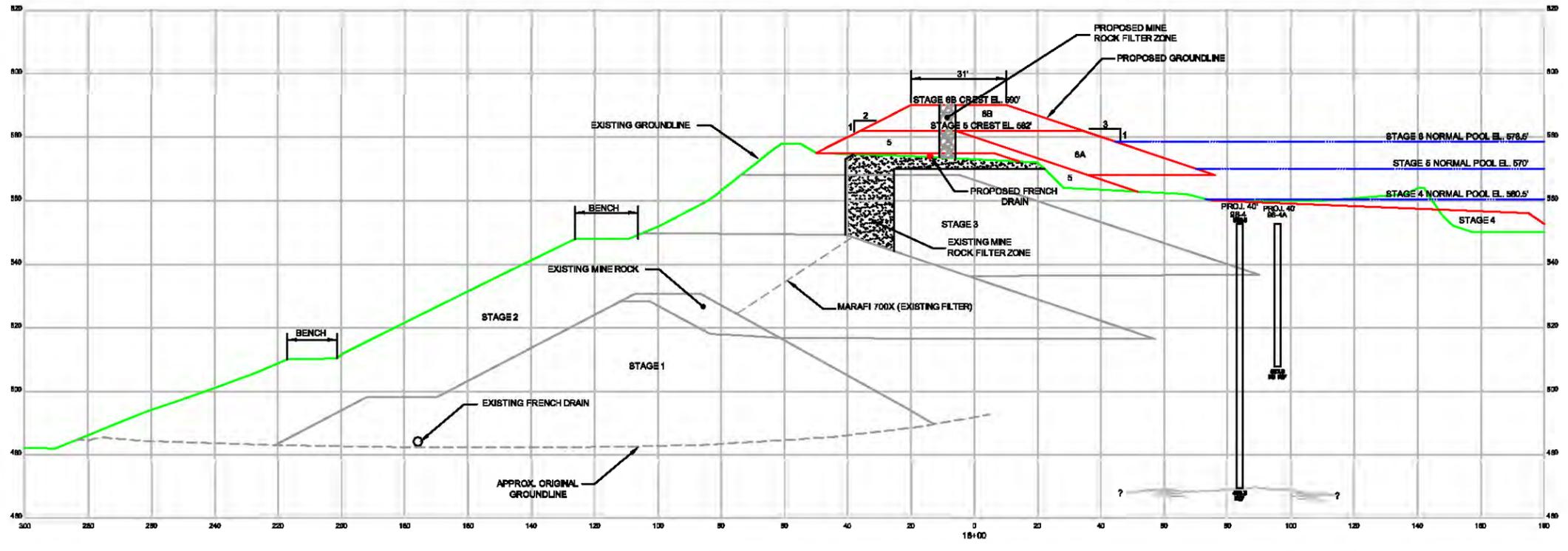
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REVIEWED BY:	LOW
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DATE:	9/12/07
PROJECT NO.:	34986020-3001
REVISION NO.:	NR
SHEET 7 OF 15	



LEGEND

EXISTING GROUNDLINE	—
PROPOSED GROUNDLINE	—
APPROX. ORIGINAL GROUNDLINE	- - -
APPROX. LIMITS OF PREVIOUS STAGES	—

- NOTES:**
- SEE SHEET 11 FOR DETAILED BORING LOGS.
 - SEE SHEET 5 FOR TYPICAL PIEZOMETER DETAIL.



REVISIONS			
NO.	DESCRIPTION	BY	DATE

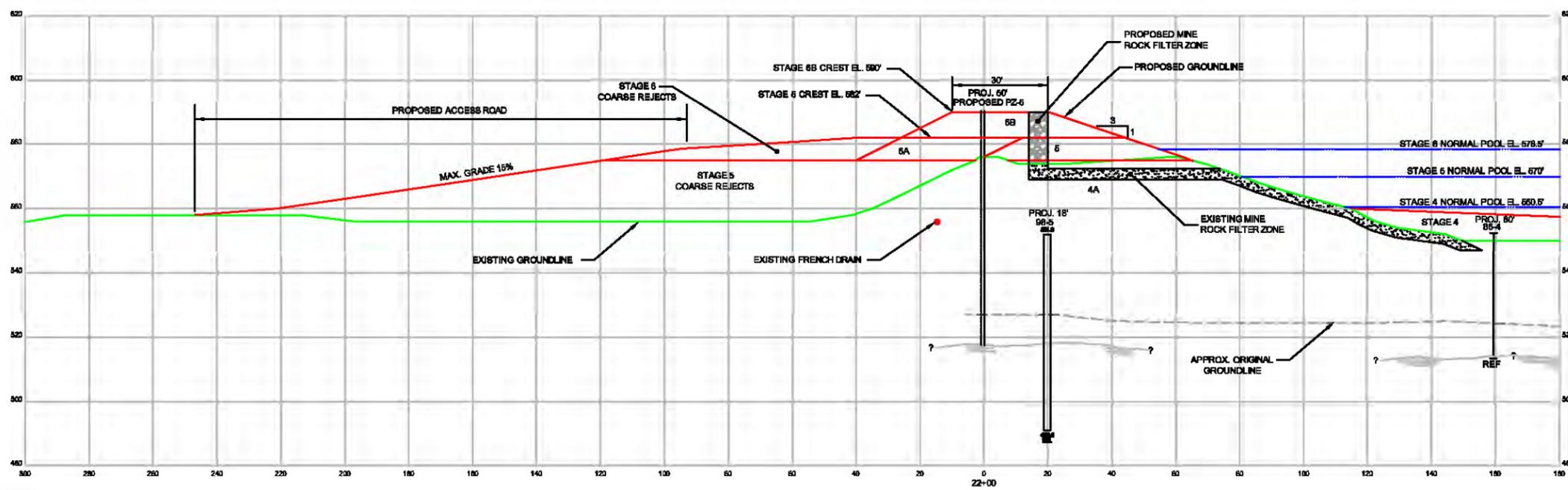
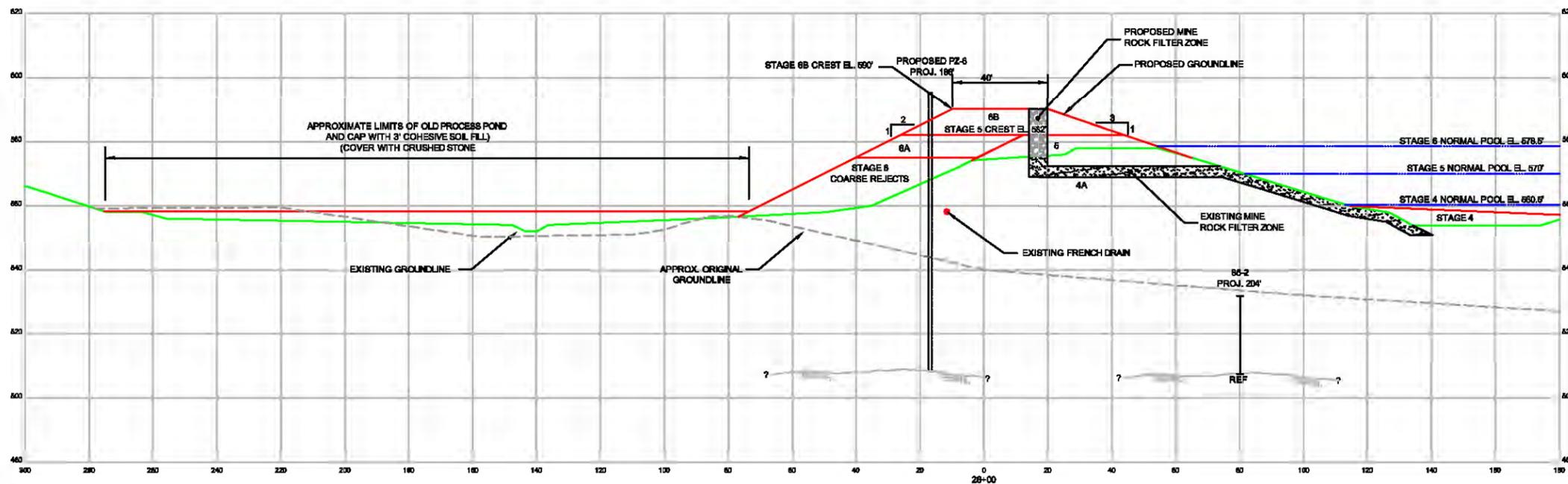
CLIENT: **nyrstar**

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Knoxville, Tennessee 37952
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Fax (865) 671-6296

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TITLE: **CROSS SECTIONS
ELMWOOD TAILINGS IMPOUNDMENT
SMITH COUNTY, TENNESSEE**

DRAWN BY:	AFT
CHECKED BY:	LOW
REVIEWED BY:	LOW
SCALE:	AS SHOWN
DATE:	9/12/07
PROJECT NO.:	34986020-3001
REVISION NO.:	NR
SHEET 6 OF 15	



LEGEND

- EXISTING GROUNDLINE —
- PROPOSED GROUNDLINE —
- APPROX. ORIGINAL GROUNDLINE - - -
- APPROX. LIMITS OF PREVIOUS STAGES —

NOTES:

1. SEE SHEET 11 FOR DETAILED BORING LOGS.
2. SEE SHEET 6 FOR TYPICAL PIEZOMETER DETAIL.

REVISIONS			
NO.	DESCRIPTION	BY	DATE

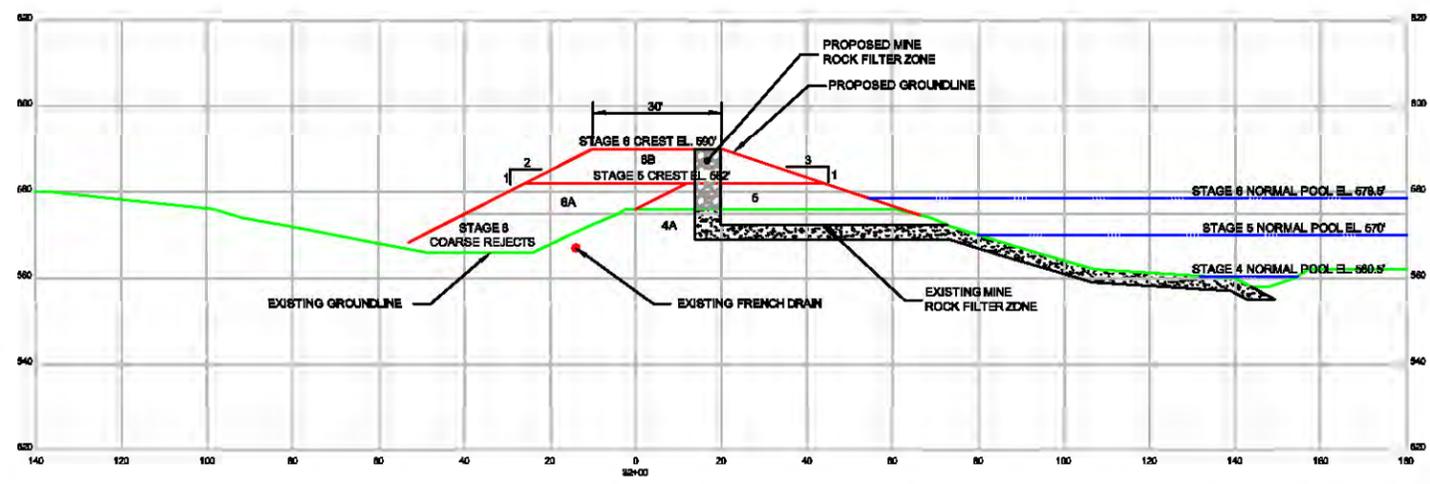
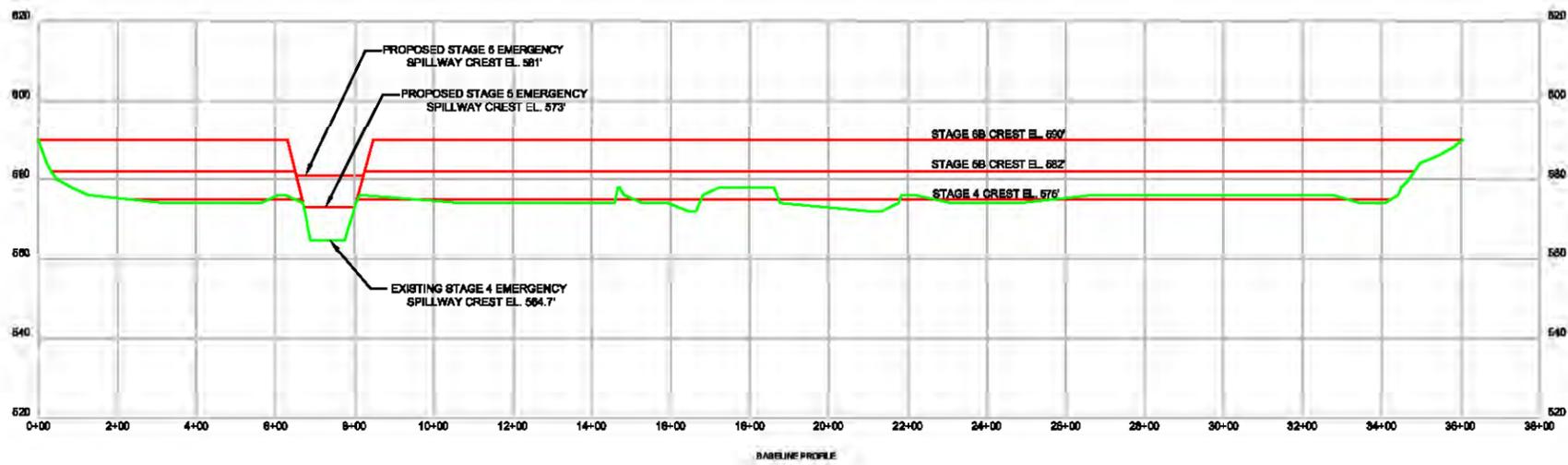
CLIENT: **nyrstar**

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 Fax (855) 671-6296

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TITLE: **CROSS SECTIONS
ELMWOOD TAILINGS IMPOUNDMENT
SMITH COUNTY, TENNESSEE**

DRAWN BY:	AFT
CHECKED BY:	LOW
REVIEWED BY:	LOW
SCALE:	AS SHOWN
DATE:	9/12/07
PROJECT NO.:	34986030-3001
REVISION NO.:	NA
SHEET	9 OF 13



LEGEND

EXISTING GROUNDLINE —

PROPOSED GROUNDLINE —

APPROX. ORIGINAL GROUNDLINE ---

APPROX. LIMITS OF PREVIOUS STAGES ---

NOTES:
 1. SEE SHEET 11 FOR DETAILED BORING LOGS.
 2. SEE SHEET 6 FOR TYPICAL PIEZOMETER DETAIL.

REVISIONS			
NO.	DESCRIPTION	BY	DATE

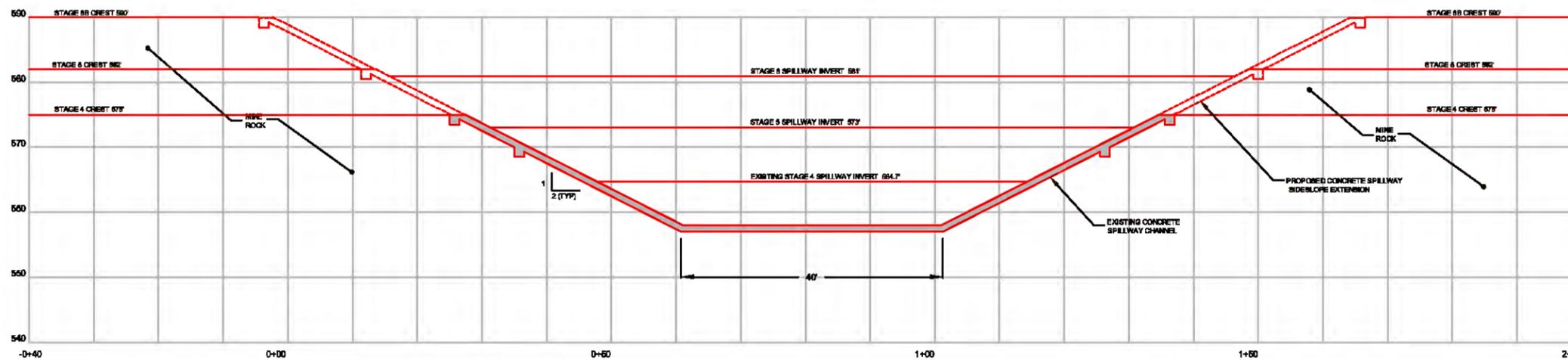
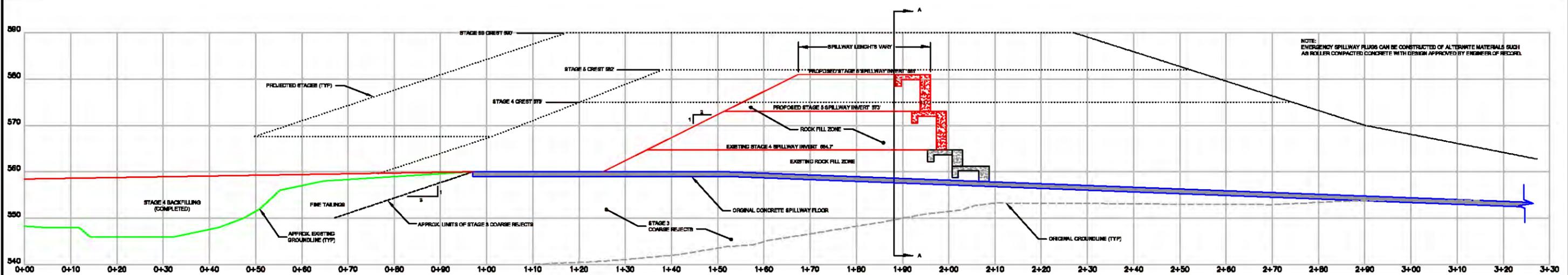
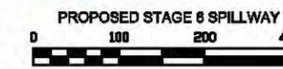
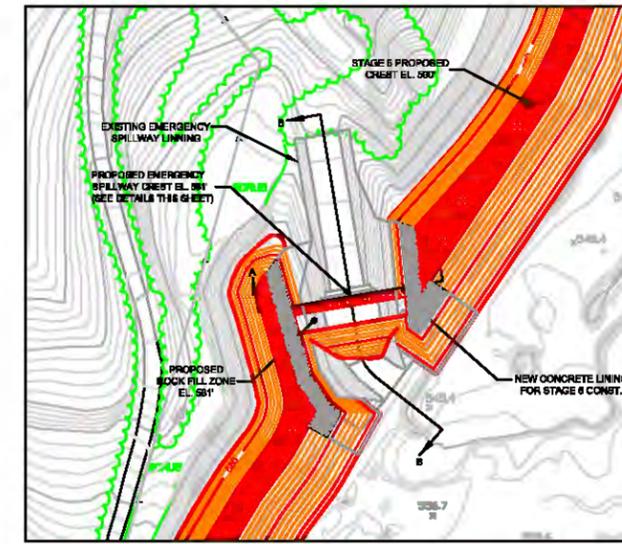
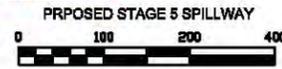
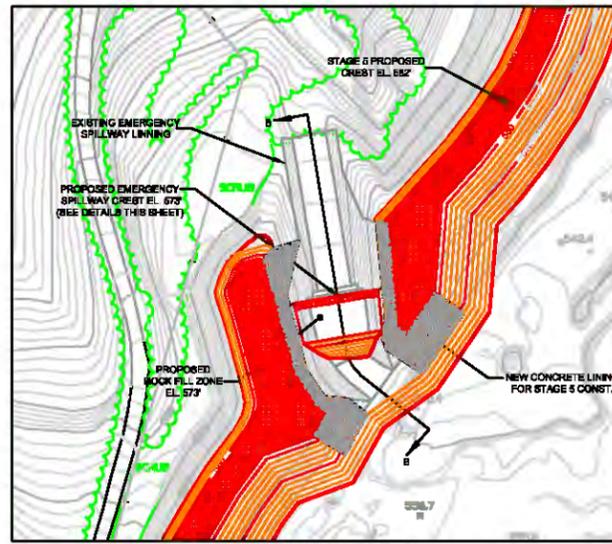
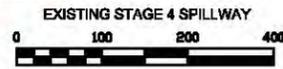
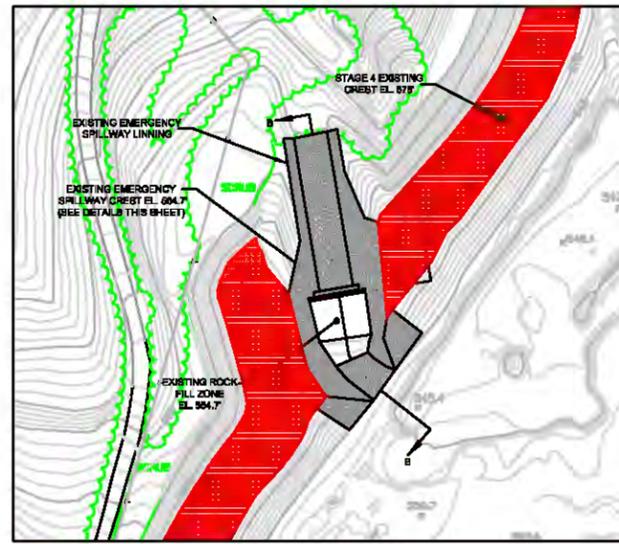
CLIENT: **nyrstar**

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 Knoxville, Tennessee 37952
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 Fax (865) 671-6296

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TITLE: **CROSS SECTIONS
 ELMWOOD TAILINGS IMPOUNDMENT
 SMITH COUNTY, TENNESSEE**

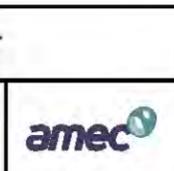
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DATE:	8/12/07
PROJECT NO.:	34986020-3001
REVISION NO.:	NA
SHEET	10 OF 19



NOTE:
1. SEE SHEET 14 FOR ADDITIONAL CONCRETE CONSTRUCTION DETAILS.

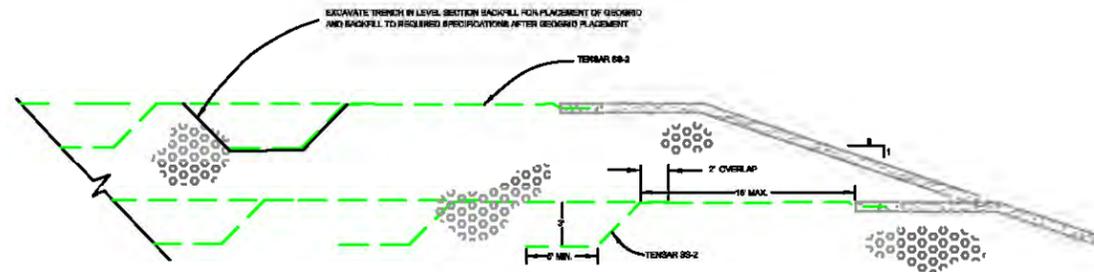
REVISIONS			
NO.	DESCRIPTION	BY	DATE

CLIENT:
nyrstar
AMEC Environment & Infrastructure
6725 Coghill Road
Knoxville, Tennessee 37952
Tel (865) 671-6276
Fax (865) 671-6296

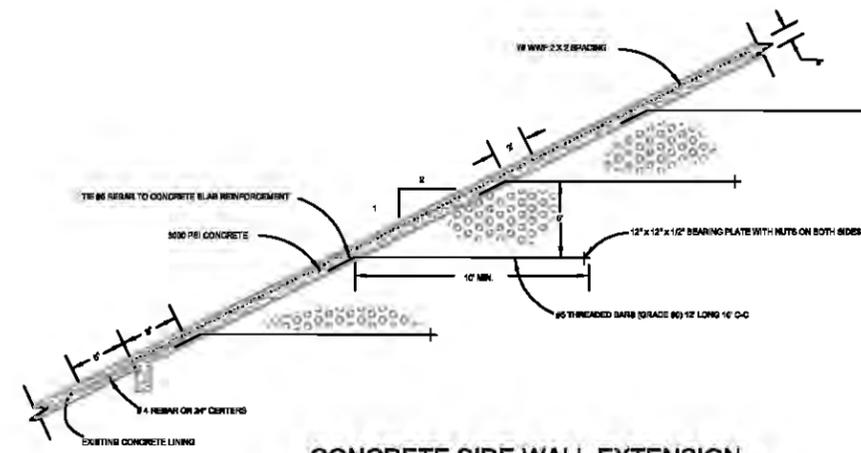


TITLE:
EMERGENCY SPILLWAY DETAILS
ELMWOOD TAILINGS IMPOUNDMENT
SMITH COUNTY, TENNESSEE

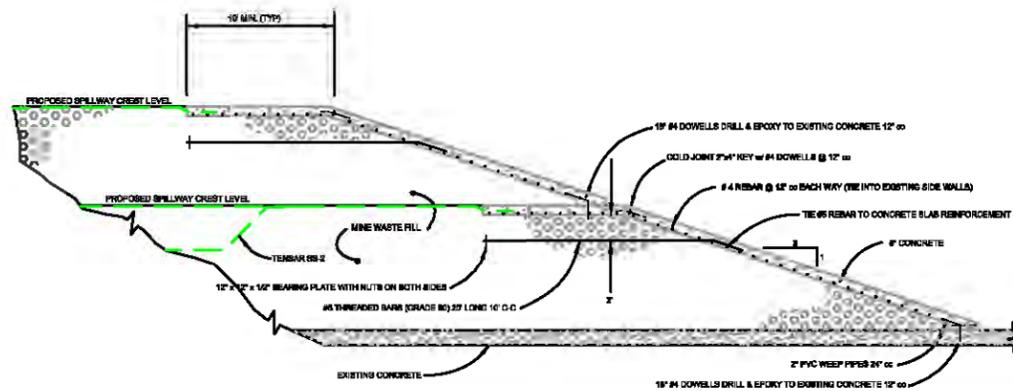
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PROJECT NO.:	94986030-0001
REVISION NO.:	NA
SHEET 13 OF 19	



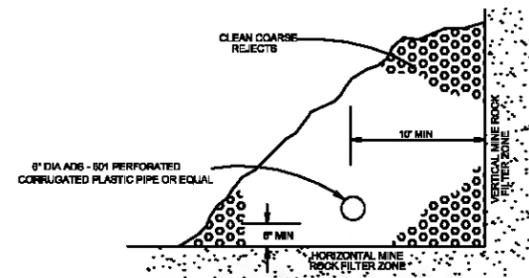
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NOT TO SCALE



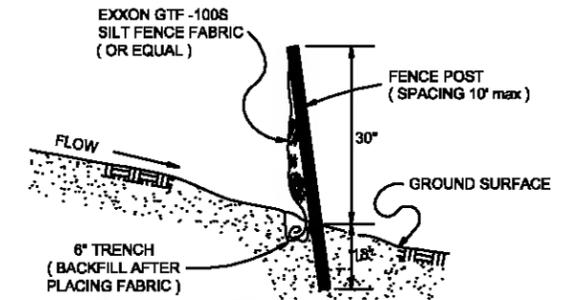
CONCRETE SIDE WALL EXTENSION
NOT TO SCALE



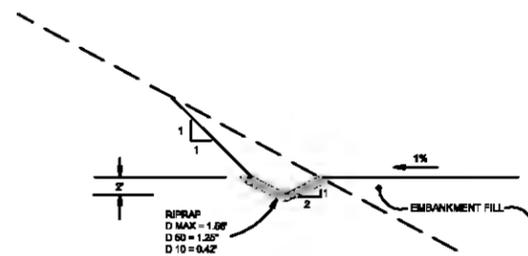
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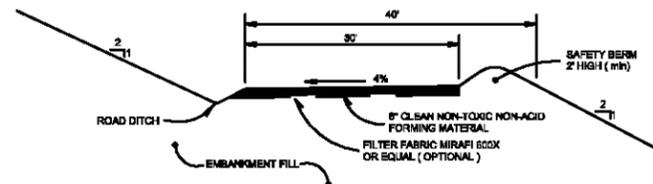
PROPOSED FRENCH DRAIN INSTALLATION DETAILS
NOT TO SCALE



SILT FENCE DETAIL
NOT TO SCALE



TYPICAL TOE DITCH DETAIL
NOT TO SCALE



TYPICAL ACCESSROAD ON EMBANKMENT
NOT TO SCALE

REVISIONS			
NO.	DESCRIPTION	BY	DATE

CLIENT:

nyrstar

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6725 Cogbill Road
Knoxville, Tennessee 37952
Tel (865) 671-6276
Fax (865) 671-6296

amec

TITLE:

DETAILS
ELMWOOD TAILINGS IMPOUNDMENT
SMITH COUNTY, TENNESSEE

DRAWN BY:	AFT
CHECKED BY:	LOW
REVIEWED BY:	LOW
SCALE:	AS SHOWN
DATE:	9/12/07
PROJECT NO.:	34986030-3001
REVISION NO.:	NR
SHEET	14 OF 19

Attachment 4- Mitigation Plan

The details of the stream mitigation projects are included in the Appendix D to our initial submittal (a copy of the TDEC/ ARAP permit application). Relevant portions are excerpted below, with additional commentary as needed, to correspond to the components list you provided.

A. Objectives

The primary goal of the mitigation project is to offset impacts to “waters of the US” associated with the placement of mill tailings. There are 2 project areas for mitigation, summarized in the following table:

	Elmwood project area (Site 4)	Gordonsville Project area (Site 5)
Resource Type	Stream	Stream
Resource Amount (LF)	791	824
Compensation Methods	Replacement and restoration. Remove existing ponds and pipes and replace with constructed stream (680 LF); enhance existing downstream reach (111 LF)	Restoration and Enhancement. Bank stabilization with habitat improvements and riparian zone planting.
Watershed needs Addressed	Removal of these structures will connect the drainage area to the Caney Fork River, providing additional headwater habitat	This stream channel is severely degraded and subject to bed and bank erosion. The project will create a stable channel, reducing bed load discharged into the Caney Fork River.
Location	Unnamed tributary with mouth on Caney Fork River at Mile 4.3	Unnamed tributary with mouth on Caney Fork River at Mile 8.9

The Elmwood tailings storage facility is located in Smith County near Carthage, Tennessee about one and a half miles southwest of Elmwood, Tennessee, and approximately 60 miles east of Nashville. An unnamed tributary of the Caney Fork River drains the site. The total drainage area upstream of the storage facility is approximately 530 acres. The tributary flows into the Caney Fork at Mile 4.3 about 22 miles downstream from Center Hill Dam. The site is at approximate longitude 85°54'39" and latitude 36°13'06", and is included on the Gordonsville, Tennessee, USGS 7 ½ minute quadrangle map. See Attachments 2 and 3 of this letter and Appendix A of the ARAP application for location maps.

The Elmwood Impoundment has been in operation for over 30 years. Currently, the impoundment is in Stage 4 with a crest elevation of 575 and an emergency spillway at an elevation of 564.7. Nyrstar estimates there is storage capacity for operation until approximately July 2013 and would like to pursue permitting the final build out of the Elmwood Impoundment to elevation 650. The capacity will be expanded in stages. This 404 application addresses projected stream impacts over the next ten years of operation, with tailings deposition projected to be at elevation 600 at that time.

Construction of the proposed stages will physically alter 3 reaches that are considered to be "waters of the US" (Sites 1-3 as described in this letter). The impact of the impoundment modifications will include the filling of approximately 1,680 linear feet of headwater streams as shown in Attachments 1-3.

In order, to offset the impacts related to the impoundment modifications, Nyrstar evaluated Site 1 (the primary stream channel leading into the tailings impoundment) through the use of habitat assessments, hydrologic/hydraulic evaluation, and a TDEC hydrologic determination. Based on the results of this investigation, Nyrstar identified streams in the surrounding watershed for mitigation. Through this process Nyrstar identified two streams in close proximity to the impacted stream that were viable mitigation streams. Nyrstar investigated these streams from a habitat and hydraulic aspect and determined the streams were similar in nature. Nyrstar proposed to offset the impacts to the waters of the state through the proposed mitigation of 1,615 linear feet of stream and habitat restoration, the first located adjacent to the Elmwood Impoundment and second adjacent to the Gordonsville Mill and Mine. Currently both mitigation streams are severely degraded, encapsulated, or impounded. Based on Nyrstar's investigation through habitat assessments, hydrologic/hydraulic evaluations, and macroinvertebrate survey the proposed mitigation reaches are approximately 30% lower than the average stream in the surrounding watershed and the impacted stream is similar to the mitigation reaches when compared to the optimal streams in the same watershed. In addition, Nyrstar identified two reference reach streams to compare the mitigation improvements and will be the basis of the success of the mitigation.

The proposed improvements include 791 linear feet of stream and habitat improvements for the stream located adjacent to the Elmwood Impoundment (Site 4), which is a tributary to the Caney Fork River. The existing channel contains 2 in-line detention ponds and an 8' vertical drop into the main stem. The proposed stream restoration includes a sequence of step-pools (grade

control structures) that will restore the stream to its historical grade and provide additional aquatic habitat through the pool-riffle-run approach. The step-pools will also be used to raise the stream invert (i.e., to reverse past channel incision) and/or to maintain the channel invert at a current elevation (i.e., to prevent channel incision). Between the step-pool sequences the stream will be restored by use of natural materials for bank stabilization with the combined use of structural elements, i.e., rock, fabrics, soils and vegetation, which will create a stable streambank that is resistant to internal and external forces. The proposed improvements will develop a stream corridor that is relatively stable and mimic the historic stream hydrology prior to the installation of the detention ponds. In addition to the proposed improvements, the mitigation will re-establish in-stream habitat by restoring bed form diversity in the form of step-pools and cross vanes, and the enhancement of riparian zone by planting native vegetation and woody plants.

Additionally, Nyrstar proposes to mitigate a stream adjacent to their Gordonsville Mine and Mill (Site 5), which includes 824 linear feet of stream restoration. The stream runs along the Gordonsville site and flows into the Caney Fork. The existing reach is channelized and deeply incised with high, vertical banks. Additional features include a highly channelized low flow channel and limited or no riparian buffer. The combination of these factors has resulted in severe streambank erosion and an instable channel actively aggrading/degrading. The proposed mitigation will restore the riparian and aquatic habitat and provide a stable non-eroding channel. The design elements include re-grading to restore channel geometry and to re-establish a riparian buffer through planting of native vegetation and structural elements, such as, rock vanes, root wads, and boulder clusters.

The entire project will restore approximately 1,615 linear feet of stream to compensate for the aquatic resources impacted by the impoundment modifications. The impacted stream reaches are low in habitat quality and currently are routed through the existing impoundment before being discharged to two small polishing ponds and finally reconnecting to the Caney Fork River. The proposed mitigation will sufficiently replace the loss of the impacted aquatic resources and provide enhancements both to the watershed and the main stem of the Caney Fork River.

B. Site selection

The preferred alternative of on-site mitigation is practical, as most of the mitigation work will occur adjacent to the point of impact at the tailings facility in Elmwood. Additional mitigation activity at Gordonsville will take place within the same general watershed of the lower Caney Fork, approximately 5 miles upstream. The mitigation projects will be ecologically self-sustaining aquatic resources.

C. Site protection instrument

Nyrstar owns the property on which the activities will occur and will ensure long-term protection with signage to prevent inadvertent alterations to the constructed streams. The streams are adjacent to, but will be excluded from, the NPDES permit boundaries for Elmwood Mine and Gordonsville Mine & Mill (Permits TN0004227 and TN0029360, respectively). These operations are inspected annually by TDEC to determine compliance with the NPDES permits.

D. Baseline information

Preliminary Jurisdictional determinations have been submitted for the mitigation and impacted reaches. Please refer to Attachments 1-3 of this letter and Appendix C of the initial 404 application prepared by AMEC.

The proposed impoundment modifications will impact approximately 1,680 linear feet of stream due to the placement of additional tailings within the storage impoundment (Sites 1-3). Nyrstar proposes to mitigate the unavoidable losses to the stream by restoring and/or enhancing 1,615 linear feet of stream at two locations (Sites 4 and 5). This includes the creation of a stream channel with a natural stream pattern, an appropriately sized channel, in-stream best management practices including habitat creation and restoration, and a forested riparian zone on each side of the stream channel. Fees in lieu of mitigation are proposed for the additional 65 feet of impacted streams.

D.1. Existing Conditions (impacted reach)

The impacted reaches are characterized as intermittent to ephemeral streams. Drainage areas at the location where the streams currently enter the impoundment are shown in Attachment 2. The impacted stream condition was determined by TDEC's hydrologic evaluation and AMEC's habitat assessment. The streams are considered low quality with limited benefit to the Caney Fork watershed. The existing impacted streams typically include step pools with vertical drops approximately every 100 to 200 feet, which has inhibited the movement of aquatic species. As previously stated, the streams are separated from the main river system by the permitted tailings impoundment.

The existing stream cross-sections typically consist of a high entrenchment trapezoidal section with dimensions as shown below. The stream substrate consists primarily of alluvial and colluvial soils intermixed with ground litter. At some locations these soils have been cut to the limestone bedrock. Streamside vegetation is judged to be marginal, consisting of mixed hardwoods typical of upland woodlands ecosystems. AMEC's certified biologist performed a habitat assessment for Site 1 using the TDEC Habitat Assessment Data Sheet for High Gradient Streams and determined the stream condition to be marginal with an overall score of 94. More detail of the impacted stream, reference reach, and habitat assessments can be found in the Data Collection and Assessment Section presented below in Part D.3.

D.2. Existing Conditions (mitigation reaches)

The proposed mitigation will occur on two streams in the lower Caney Fork watershed and with similar habitat features and stream morphology. The two streams are unnamed tributaries to the Caney Fork River. Site 4 is adjacent to the Elmwood tailings impoundment and is referred to as the Elmwood Mitigation Stream. The second mitigation stream (Site 5) is also an unnamed tributary to the Caney Fork River and is located adjacent to the Gordonsville Mine and Mill. This reach is referred to as the Gordonsville Mitigation Stream

The existing conditions of the Elmwood mitigation stream (Site 4) includes two (2) inline detention ponds and under previous owners were used as raw water holding ponds. The ponds have been out of service for decades and provide little value to the aquatic life or the watershed water quality. The detention ponds currently encompass approximately 570 linear feet of stream and then are routed through approximately 110 linear feet of spillway and pipes before being discharged to open channel. The open channel section below the ponds has poorly defined bed and banks and has a braided channel with depths ranging from ½ - 1 foot. Proposed mitigation activities will restore 111 linear feet of this lower reach. The pictures presented below were taken during multiple site visits and are representative of the current conditions. The pictures are shown from the upstream to downstream of the proposed mitigation stream, starting with the detention ponds.



Photo 1: Lower Elmwood Detention Pond



Photo 2: Upper Elmwood Detention Pond Outlet and Spillway



**Photo 3: Elmwood Project Downstream End Point
(Connection of lower mitigation reach to unnamed tributary)**

The Gordonsville mitigation stream (Site 5) is a low quality stream with heavily channelized sections and incised stream bank. In addition, the channel has experienced major degradation and aggregation and continues to degrade causing higher than normal sediment loads in the stream and the Caney Fork River. Nyrstar proposes to restore 824 LF of this stream to provide compensatory mitigation for impacts due to increases tailings elevation within the existing impoundment at Elmwood. The pictures presented below were taken during multiple site visits and are representative of the current conditions. The pictures are shown from upstream to downstream in the proposed mitigation stream, starting with an existing span bridge crossing.



Photo 4: Downstream of existing crossing (aggregation location)



Photo 5: Severely Incised Stream Bank

D.3. Data Collection and Assessment

In order, to accurately characterize the impacted streams and the proposed mitigation streams, AMEC performed the following data collection, including hydrologic determinations, habitat assessments, and macroinvertebrate surveys. The purpose of the data collection was to develop an understanding of the impacted streams, as well as the proposed mitigation streams. In addition AMEC reviewed the surrounding watershed for streams that are consistent with a quality stream providing both high water quality and aquatic habitat. The following information presents the findings of the data collection and interpretation of the data.

Upon a request by Nyrstar, TDEC performed a hydrologic determination on Site 1 on August 23, 2011. As stated in the TDEC Hydrologic Determination report (included in Appendix D of the ARAP application) the stream has a defined bed and bank; however, the primary hydrologic indicators on the field data sheet were absent. The presence of secondary stream indicators were sufficiently present to determine the stream to be waters of the state from an upper elevation of 615 to the impoundment permanent pool elevation 564. Above 615, TDEC determined this channel to be a wet weather conveyance.

As shown in the AMEC habitat assessment worksheet (included in Appendix C of the ARAP application) and the TDEC report, the proposed modification to the impoundment will encapsulate a low quality stream. The proposed mitigation described below will offset these impacts with no net loss of resources, with the major benefit of the mitigation stream being connected to Caney Fork River. Therefore, the mitigation will provide benefits to the entire watershed.

In order to develop an understanding of the watershed and stream potential, Nyrstar investigated several streams in the surrounding watershed to identify streams that are providing optimal habitat and water quality. Nyrstar has proposed to mitigate two streams. The Elmwood mitigation stream (Site 4) is characterized as an intermittent stream and would be comparable to the impacted streams (Sites 1-3). In order to understand the potential mitigation success Nyrstar investigated several streams in Ecoregion 71H (Outer Nashville Basin). Several suitable tributaries were identified on Little Indian Creek and will be used as the reference reach for the Elmwood mitigation stream. During the field investigation in June 2012 the region was experiencing drought conditions and Nyrstar could not collect data due to the lack of water and instead will revisit in the fall during wetter conditions. The proposed tributary is located off Hopewell Road (36° 08' 08.29"N, 85° 46' 23.48"W) and has similar watershed size and stream characteristics.

The Gordonsville mitigation stream (Site 5) is a perennial stream and had several nearby streams that were similar in geometry, watershed size, and habitat characteristics. After evaluation of several streams, it was determined that Wolf Creek exhibited the highest quality of habitat and water quality and was chosen as the reference reach for the Gordonsville mitigation stream. Data was collected in May 2012 and is presented below. In order, to demonstrate the quality of the impacted stream, reference reaches, and mitigation streams AMEC's certified biologist performed habitat assessments using the TDEC habitat assessment worksheet for high gradient streams. A summary of the results of the habitat assessment are presented below and the worksheets are presented in Appendix C of the ARAP application.

	Epifaunal Substrate/ Available Cover	Embed-ness	Velocity/ Depth Regime	Sediment Deposition	Channel Flow	Channel Altera-tion	Frequency of Riffles	Bank Stability	Vegetative Protective	Riparian Vegetative Zone Width	Total Score
Impacted Stream (Site 1)	5	8	7	6	8	8	6	16	16	14	94
Wolf Creek (Gordonsville Reference Reach)	17	17	13	13	14	13	11	16	14	14	142
Gordonsville Mitigation Stream	15	14	11	14	7	10	8	6	8	8	101
Elmwood Mitigation Stream*	1	1	1	1	1	1	1	10	8	2	27
Little Indian Cr. (Elmwood Reference Reach)**	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

*Elmwood reach is comprised of two detention ponds and spillways, habitat assessment performed on detention pond

** Results for Little Indian Creek to be determined (TBD) in Spring 2013.

In addition to the habitat assessments, AMEC performed a biological survey using the Modified Semi-Qualitative Kick (SQKICK) sampling procedures at each location. The sampling was conducted in accordance with the Tennessee Department of Environment and Conservation - Quality System Standard Operating Procedure (TDEC's: QSSOP). The survey was conducted on May 24, 2012. At the time of the sampling event the region was experiencing drought conditions and flow in all three of the streams sampled appeared to be below normal.

Each site was sampled by performing 20 kicks into an 18 inch, single handle 500 micron rectangular net. Upon completion of the kicks, the material was composited for each site, labeled, and placed in a cooler. The samples were hand delivered to Pennington and Associates, Inc. in Cookeville, Tennessee. Pennington and Associates, Inc. calculated the Tennessee Macroinvertebrate Index (TMI) values which includes identification, counts, and calculation of each of the following seven biometrics for each sample:

- Taxa richness (TR)
- Insect orders Ephemeroptera, Plecoptera and Trichoptera (EPT richness)
- % percent EPT abundance (%EPT – Cheum)
- Oligochaeta and Chironomids (%OC)
- North Carolina Biotic Index (NCBI)
- Percent contribution of organisms that build fixed retreats or have adaptations to attach to surfaces in flowing water (%Clingers)
- Percent TN Nutrient Tolerant Organisms (%TNUTOL)



The laboratory results from Pennington and Associates are summarized in the table below:

	Elmwood*		Little Indian Creek**		Gordonsville		Wolf Creek		Target TMI (Region 71H)
	Value	Score	Value	Score	Value	Score	Value	Score	Score
TR	17	2	TBD	TBD	20	4	41	6	6
EPT Richness	4	2	TBD	TBD	3	0	9	4	4
% EPT –Cheum	12.08	0	TBD	TBD	14.62	0	18.96	2	4
% OC	19.43	6	TBD	TBD	48.11	4	48.33	4	4
NCBI	6.89	2	TBD	TBD	4.76	6	3.95	6	6
% Clinger	19.43	2	TBD	TBD	47.64	4	31.25	2	4
% TNUTOL	29.86	4	TBD	TBD	20.28	6	27.08	6	4
	20 Slightly Impaired		TBD		24 Slightly Impaired		30 Slightly Impaired		32

*Elmwood Macroinvertebrate survey performed downstream of detention ponds

**Little Indian Creek survey will be performed with the Macroinvertebrate Survey in Spring 2013.

E. Determination of credits.

The proposed 10-yr build out of the impoundment will physically alter “waters of the US” from the current slurry level to elevation 600 feet. Nyrstar has visited the site with USACOE personnel and determined that approximately 1,680 feet of stream length will be impacted as shown on the drawings and indicated in the table below. Please refer also to the Preliminary Jurisdictional Determination (PJD) provided in Appendix C of the initial 404 application and Attachments 1-3 of this letter. Nyrstar is proposing 1,615 feet of stream restoration that will be used to credit a similar amount of impacts to waters of the US. The remaining 65 feet will be mitigated with payments in lieu of mitigation to be determined by the USACOE. The impacted reaches (Sites 1-3) are also shown in Appendix A of the initial 404 application.

Elmwood Tailings Dam Stages 5, 6, 7 Waters of the U.S. Mitigation (Linear Feet of stream)			
	U.S. Waters Impacted Length	Mitigation Reaches	In-lieu Fees Compensation
Site 1	830		
Site 2	450		
Site 3	400		
Site 4		791	
Site 5		824	
Total	1680	1615	65

F. Mitigation work plan

This section includes descriptions of the mitigation activities, a proposed schedule, and details of the construction sequencing. Construction drawings for the mitigation projects are located in Appendix F of the ARAP application.

F.1 Mitigation Sites

The chosen mitigation sites are located in the same watershed as the impacted stream (lower Caney Fork river, miles 4-9). All of the proposed mitigation activities will be performed entirely on Nyrstar property. Efforts to offset the impacts of the impoundment modifications will primarily involve the creation and/or restoration of existing stream sections within the unnamed tributaries to the Caney Fork River. The following mitigation streams have been chosen based on the known reference reaches and comparison of the quality streams in ecoregion 71H, Outer Nashville Basin.

F.1.1 Elmwood Mitigation Stream

The first mitigation site is the Elmwood Mitigation Stream (Site 4, an Unnamed Tributary to the Caney Fork River near mile 4.3). The mitigation will include the removal of two in-line detention ponds and approximately 110 linear feet of pipe and spillway. The restoration and enhancement of the mitigation stream will involve returning the inline detention ponds into a natural meandering stream with the appropriate width, pattern and profile based on the reference reach section. Restoration activities will also include the rebuilding of a functional riparian zone that is typical of a healthy natural stream.

The remainder of mitigation activities will focus on restoration of a stable gradient using a sequence of step-pool (grade control structures) that will restore the stream to its historical grade and provide additional habitat. The step-pools will also be used to raise the stream invert (i.e., to reverse past channel incision), and/or to maintain the channel invert at a current elevation (i.e., to prevent channel incision).

Between the step-pool sequences the stream will be restored by use of natural materials for bank stabilization with the combined use of structural elements, i.e., rock, fabrics, soils and vegetation, which will create a stable streambank that is resistant to internal and external forces. The proposed improvements will develop a stream corridor that is relatively stable and mimic the historic stream hydrology prior to the installation of the detention ponds. The proposed improvements will re-establish in-stream habitat by restoring bed form diversity in the form of step-pools and bank stabilization; and enhancement of riparian zone by planting native vegetation. In addition to the above restoration Nyrstar will incorporate several cross vanes to protect the streambank by redirecting the thalweg away from the streambank and towards the center of the channel, and improve in-stream habitat through scour, oxygenation, and cover. The cross vanes will also simulate the natural pattern of pools and riffles occurring in undisturbed streams while forming gravel deposits which fish use as spawning grounds.

F.1.2 Gordonsville Mitigation Stream

The second proposed mitigation site is at the Gordonsville Mine & Mill (Site 5, an Unnamed Tributary to the Caney Fork River near mile 8.9). The Gordonsville mitigation stream is severely degraded and has highly incised banks with no vegetative protection. The proposed mitigation on the stream includes restoring the historic hydraulic conditions, as well as restoration of the severely incised banks and establishment of a riparian buffer zone. The proposed channel section includes the development of a naturally meandering stream section with large overbank/riparian areas to provide for habitat creation and diversity.

The proposed mitigation will use natural materials for bank stabilization with combined structural elements to create a stable stream and streambank. The proposed improvements will halt the current degradation and provide a stable stream section mimicking the historic stream hydraulics. In order to develop a healthy stream Nyrstar proposes to use several bioengineering practices to provide both stream bank protection as well as habitat creation. The Gordonsville mitigation reach will incorporate three main bioengineered techniques boulder clusters, rock vanes, and root wads. The design intent is to incorporate multiple boulder clusters to provide aquatic habitat cover and flow separation around the boulders which will lead to the formation of eddies or vortices in their wake. These vortices diffuse sunlight and create overhead cover for fish. They will also generate scour that develops pockets of deeper water and associated coarse

substrate that add to the physical diversity of a stream reach. The boulder cluster features will lead to enhanced turbulence and scour and create habitats used by both juvenile and adult fish, particularly salmonids. The rock vanes will be incorporated throughout the mitigation stream and protect the streambank by redirecting the thalweg away from the streambank and towards the center of the channel, and improve in-stream habitat through scour, oxygenation, and cover. The rock vanes will also simulate the natural pattern of pools and riffles occurring in undisturbed streams while forming gravel deposits which fish use as spawning grounds. The root wads will be installed in several locations to provide streambank armoring by deflecting stream flows away from the bank. They also provide structural support to the streambank, habitat for fish and other aquatic animals, as well as a food source for aquatic insects.

F.2 Scheduling

1. July 2013, begin construction of modifications to the tailings impoundment. Impacts to streams due to increased tailings elevations will proceed slowly. The projected tailings elevation after 2 years of continued deposition is 566 ft at the end of 2014, affecting a total of approximately 310 feet of US waters at Sites 1-3.
2. August to December, 2013, Conduct mitigation activities on 824 LF of stream at the Gordonsville reach (Site 5). This work needs to be conducted during the low flow period of the year due to the relatively large drainage area and high runoff potential of the predominantly bedrock drainage area. The fall is also the preferred planting season for riparian vegetation. At the completion of the Gordonsville reach, mitigation will exceed actual impacts.
3. August to December 2015 or 2016. Conduct additional mitigation activities on 791 feet of stream at the Elmwood reach (Site 4). The tailings elevation in December 2016 is projected to be approximately 576 feet, impacting a total of approximately 800 feet of US waters. In 2017, the length of impacted reaches will exceed the initial 824 feet of mitigation credit, thus requiring additional mitigation to continue placing tailings in the impoundment.
4. 2020 and beyond. The tailings elevation is expected to reach elevation 600 in approximately 10 years. Prior to that elevation, THE Army Corps will be contacted about additional permitting and mitigation requirements. This 404 application provides mitigation for impacts up to that 600 elevation.

F.3 Construction Details

Please refer to the detailed construction drawings in Appendix F of the ARAP application.

The proposed mitigation will be carried out in a very precise way to minimize impacts to the watershed. The following summarizes the proposed sequence for the construction of the impoundment modifications and mitigation.

- The contractor will conduct a pre-construction meeting on site which includes the foreman, erosion and sediment control manager, owner and owner representative to discuss the phasing of construction and temporary erosion and sediment control plan. The contractor should stake out all limits of disturbance prior to the pre-construction meeting so they may be reviewed. The participants will also designate the contractor's staging areas and flag all trees within the limit of disturbance which will be removed for construction access. Trees should not be removed within the limit of disturbance without approval from the owner or owner representative.
- Construction should not begin until all sediment and erosion control measures have been installed and approved by the engineer and the sediment control manager. The contractor should stay within the limits of the disturbance as shown on the plans and minimize disturbance within the work area whenever possible.
- Upon installation of all sediment control measures and approval by the resident engineer, the contractor should begin work at the upstream section and proceed downstream beginning with the establishment of stabilized construction entrances. In some cases, work may begin downstream if appropriate. The sequence of construction must be followed unless the contractor gets written approval for deviations from the owner representative. The contractor should only begin work in an area which can be completed by the end of the day including grading adjacent to the channel. At the end of each work day, the work area must be stabilized.
- Dikes should be situated at the upstream and downstream ends of the work area as shown on the plans, and stream flow should be pumped around the work area. The pump should discharge onto a stable velocity dissipater made of riprap.
- Water from the work area should be pumped to a sediment filtering measure such as a dewatering basin, sediment bag, or other approved source. The measure should be located such that the water drains back into the channel below the downstream sandbag dikes.
- All stream restoration measures should be installed as indicated by the plans and all banks graded in accordance with the grading plans and typical cross-sections. All grading must be stabilized at the end of each week with seed and mulch or seed and matting as specified on the plans.
- After an area is completed and stabilized, the clean water dike should be removed. After the first sediment flush, a new clean water dike should be established upstream from the old sediment dike. Finally, upon establishment of a new sediment dike below the old one, the old sediment dike should be removed.
- A pump around must be installed on any tributary or storm drain outfall which contributes baseflow to the work area. This should be accomplished by locating a sandbag dike at the downstream end of the tributary or storm drain outfall and pumping the stream flow around the work area. This water should discharge onto the same velocity dissipater used for the main stem pump around.

G. Maintenance plan.

The work areas will be inspected regularly to ensure ongoing performance. Any corrective actions will be addressed in a timely manner. Location of the mitigation reaches on company-owned property at active operations will facilitate the ease of regular inspections.

H. Performance standards

The following ecological parameters will be measured to determine if the mitigation activities meet their objectives:

- 1) Taxa richness (TR)
- 2) Insect orders Ephemeroptera, Plecoptera and Trichoptera (EPT richness)
- 3) % percent EPT abundance (%EPT – Cheum)
- 4) Oligochaeta and Chironomids (%OC)
- 5) North Carolina Biotic Index (NCBI)
- 6) Percent contribution of organisms that build fixed retreats or have adaptations to attach to surfaces in flowing water (%Clingers)
- 7) Percent TN Nutrient Tolerant Organisms (%TNUTOL)
- 8) Stream flow (presence and continuity)
- 9) Wetted width of stream channel
- 10) Survival of riparian plantings

I. Monitoring requirements.

According to the Stream Mitigation Guidelines for the State of Tennessee, the type of mitigation treatment determines the type of monitoring required. Nyrstar anticipates Level III monitoring for each stream mitigation reach. As stated in the TDEC Stream Mitigation Guidelines the first monitoring report will be submitted at the beginning of the first growing season after completion of the mitigation project and will be submitted annually for a period 5 years based on the proposed mitigation activity.

The monitoring report will include a narrative description and photos accurately depicting the stream and riparian habitat. Monitoring will also include habitat assessments to document the post-project habitat conditions. Annual riparian vegetation surveys documenting the survivorship of planted riparian species will be performed for all mitigation streams. The monitoring report for the restoration activities will include annual surveys of channel morphology (pattern, profile, and dimension). In addition to the Level III monitoring requirements Nyrstar will collect monthly flows in each mitigation reach and collect observations of the wetted width,

depth, and flow continuity. This information will all be reported in the annual monitoring report to TDEC and the Army Corps.

J. Long-term management plan.

Nyrstar will provide for long-term management of the mitigation reaches. The reaches will become part of the mine/mill operations. The reaches will be protected from future alterations and excluded from the respective NPDES permit boundaries.

K. Adaptive management plan.

Nyrstar will provide for adaptive management of the mitigation reaches. Changes in site conditions or failure to meet ecological objectives will be noted in the annual monitoring reports and corrective measures will be developed and implemented.

L. Financial assurances.

Nyrstar has made a significant investment in the reopening of the Middle Tennessee Mines and will ensure the mitigation activities are completed according to the information submitted in this permit application. No formal financial assurances are proposed.