SESPE CONSULTING, INC.

343 E. Main Street, Suite 201 • Ventura, California 93001

February 22, 2010

Mr. Conal McNamara
City of Azusa
Department of Economic & Community Development
213 E. Foothill Blvd
Azusa, CA 91702

Re: Additional Air Quality Information
Azusa Rock Draft Environmental Impact Report (DEIR)

Dear Mr. McNamara:

This letter is being submitted on behalf of the Project Applicant to provide additional air quality information. The DEIR concludes that impacts will be less than significant; however the effect of the mountainous terrain on the dispersion of plumes that will originate on-site has been a topic of discussion during the public review process. This letter provides additional analysis about whether emissions associated with the project could affect children and staff present at the Valley View School ("School"). The analysis provided herein demonstrates that there is no adverse affect to children or staff, and is consistent with the finding of the DEIR that the emissions impacts are less than significant.

The School, elevation 665-feet above mean sea level (amsl), is located within the San Gabriel Valley approximately 1,000 vertical feet below the current surface height of the West 80 Acre Parcel that will be quarried. The nearest project boundary is 3,300-feet and the farthest boundary is about 6,200-feet from the School. Based on the project description in the DEIR, the majority of the operations occur in the center of the project and the average distance from the project to the school is estimated to be 4,750-feet.

1.0 MODELING

The air quality model in the DEIR assumes the elevation of mining to be at a mid-point between the initial and final elevations. US EPA Guidance (attached) suggests that a flat model be run for "down-sloping terrain where expert judgment suggests that the plume is terrain-following (e.g. down-slope gravity/drainage flow)." Two types of modeling are presented in the DEIR: ambient air quality standards (AAQS) and health risk assessment (HRA).

AAQS apply at the point of maximum impact (PMI) offsite. The PMI for each pollutant is located on the boundary of the property rather that in the San Gabriel Valley below. Thus, terrain is appropriate to use in AAQS modeling and is the regulatory default. The DEIR correctly uses terrain for AAQS modeling.

HRA thresholds apply at receptors including the School which is considered a sensitive receptor. CEQA requires analysis of the incremental changes due to the project. In this case, the project results in a decrease in cancer risk because diesel particulate matter (DPM) from off-road equipment is nearly halved by the introduction of new equipment (i.e. reduction from 3,370 lb/yr to 1,735 lb/yr of DPM in the peak year, see DEIR Appendix C.2.3, Sub-Appendices II-C and II-D). Fugitive dust will increase due to the project but the effects on health including the effects of crystalline silica do not typically cause a project to be significant for health risk. On an incremental basis, the project will have a beneficial impact on health risk because it will reduce DPM which is the pollutant that constitutes the majority of risk from the facility.

In the interest of disclosure, the DEIR goes beyond incremental change and assesses health risk for the entire facility. On this basis and upon careful consideration of the principles of atmospheric science that are presented later in this letter, an expert judgment was made to include terrain in the health risk assessment modeling.

This letter presents the results of two (2) additional AAQS models that are based upon, and compared to, the DEIR annual PM_{10} model. The additional AAQS models are provided to demonstrate the sensitivity of the model results to elevation and corroborate the approach taken in the DEIR. The additional AAQS models include:

- A flat model (i.e. non-default simple terrain option).
- A model with terrain (i.e. default complex terrain option) and the emissions sources located just above the highest elevation within the area covered by the area source (Peak Elevation Model).

As shown in Table 1, the model has little sensitivity to change in elevation of the sources.

Table 1. Annual PM10 Model Results (μg/m3)

Unit	R1	R2	R3	R4	R5	R6	R7	R8
Peak Elevation Model	0.03	0.07	0.04	0.01	0.01	0.03	0.04	0.04
DEIR Model (Average Elevation)	0.03	0.07	0.04	0.01	0.01	0.03	0.04	0.04
Flat Model	0.04	0.08	0.05	0.02	0.02	0.04	0.04	0.04
Note: Valley View School is Receptor R1. Other receptors are residences as shown in the DEIR.								

The model results are not sensitive to height because the distance between the sources and receptors is great in relation to the emissions rates modeled for the project. Concentration of pollutants decreases rapidly with distance near the source and then more gradually far from the source (i.e. logarithmic decay due to divergence of the plume and vertical/lateral mixing). The model assumes that plumes are neutrally buoyant and disperse according to Gaussian physics. When the plume encounters the ground it is reflected and no mass is lost to deposition on the ground surface. The School is at the end of the long tail of the logarithmic decay curve for concentration and distance.

Fugitive dust consists of many sizes of particles, only the smallest of which (i.e. less than 10-microns in aerodynamic diameter) are considered to warrant health-based criteria. The criteria pollutant portion of fugitive dust (i.e. PM_{10}) is so light that for short-term air modeling purposes it disperses like a neutrally buoyant gas. Particles larger than PM_{10} which settle out of the air more rapidly are not considered by state and federal air agencies to pose a health hazard that warrants development of criteria.

Crystalline silica is a toxic air contaminant (TAC) which constitutes a very small fraction of fugitive dust. Crystalline silica only presents a health hazard if it is smaller than 4 µm in aerodynamic diameter (PM_4). Thus, crystalline silica would also behave like a neutrally buoyant gas in the short-term and discussions of dispersion of PM_{10} would also apply to any small amount of crystalline silica that may be present in fugitive dust emissions from the Project.

In order to better understand the effects of TACs that are constituents of fugitive dust, an additional HRA model was run using the non-default simple terrain option. Table 2 contains risk estimates produced by the model for the School.

Table 2. Risk from TACs in Fugitive Dust

	Chronic Hazard Index	Cancer Risk
Valley View School	0.02	< 0.5
Significance Threshold	1.0	10
Significant?	No	No

Table 2 health risks are less than the risks shown in the DEIR because the DEIR evaluated the total facility emissions rather than the incremental change in emissions. DPM is reduced on an incremental basis and therefore is omitted from the modeling results in Table 2. Table 2 results are conservative because they reflect total dust.

Modeling complex terrain rather than simple terrain (i.e. flat) has little effect on air pollutant concentrations that are predicted to occur at the School. The HRA results in the DEIR are conservative estimates of the total health risk that may occur at the School and other receptors over the remaining years of the facility and arguably a total of 70 years into the future because the Reclamation Plan scopes the reclaimed uses for the site which are low emitting (e.g. open space).

The incremental change in health risk due to the project may be a reduction in health risk because newer engines would be provided with the project that would emit less DPM. Based upon the results presented in Table 2 which exclude DPM, health risk impacts are estimated to be orders of magnitude less than the applicable significance thresholds. Whether the modeling uses simple or complex terrain is of no consequence to the significance determination at these levels of risk.

The “no project alternative” would retain the existing fleet of off-road vehicles which have higher DPM emissions than the project fleet. In addition, throughput under the “no project alternative” may increase. Thus, health risk has the potential to increase substantially if the project is not approved.

In summary, the facility does not pose a health risk to individuals at the School and the incremental change in health risk due to the Project is clearly less than the significance thresholds and may be beneficial.

2.0 FACTORS THAT AFFECT PLUMES

Wind conditions and physical barriers are two factors which affect dispersion of particulate matter. In addition, US EPA describes other factors in the following excerpt:

> *The potential drift distance of particles is governed by the initial injection height of the particle, the terminal settling velocity of the particle, and the degree of atmospheric turbulence. Theoretical drift distance, as a function of particle diameter and mean wind speed, has been computed for fugitive dust emissions. Results indicate that, for a typical mean wind speed of 16 km/hr (10 mph), particles larger than about 100 μm are likely to settle out within 6 to 9 meters (20 to 30 feet [ft]) from the edge of the road or other point of emission. Particles that are 30 to 100 μm in diameter are likely to undergo impeded settling. These particles, depending upon the extent of atmospheric turbulence, are likely to settle within a few hundred feet from the road. Smaller particles, particularly IP [Inhalable Particulate, PM-15], PM-10, and FP [Fine Particulate, PM-2.5], have much slower gravitational settling velocities and are much more likely to have their settling rate retarded by atmospheric turbulence.* (AP-42 Section 13.2).

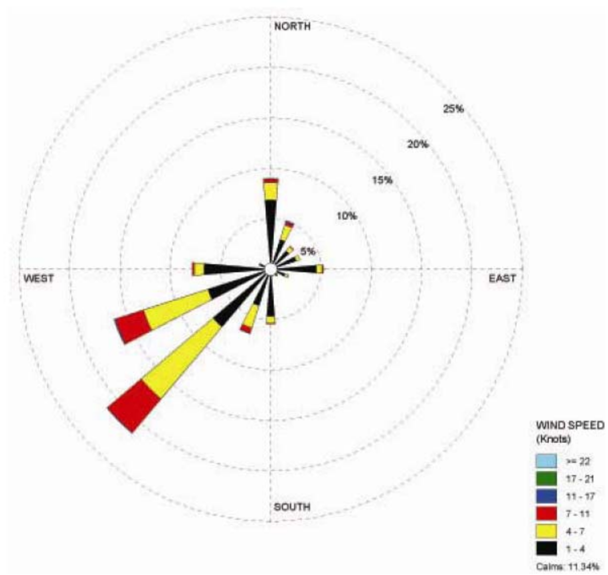
The remainder of this letter presents scientific basis for understanding plume dispersion by including further explanation of the factors described above.

2.1 Wind Direction and Speed (Meteorology)

The wind direction and speed greatly affect the dispersion of air pollutants. For the Azusa Rock air dispersion model, wind direction and speed is provided by SCAQMD in an Azusa meteorological file (reference file name and year). Figure 1 presents a windrose of that data. Given the orientation of the Project to its surroundings, winds from the north and northeast are of particular interest because they may drive pollutants towards populated areas of concern.

The windrose in Figure 1 indicates that winds from the north and northeast are rare and occur approximately 15% of the time at typical speeds of 7 mph or less. The strongest and most frequent wind conditions are from the south and west. Winds speeds are relatively low and do not exceed 11 mph on the hourly average basis used in the meteorological file. Statistical analysis of the meteorological data file shows that 8492 hours of the year (97%) have wind speed less than 10 mph and 5667 hours of the year (65%) have wind speed less than 5 mph.

Figure 1. Azusa Monitoring Station Windrose



Source: ftp://ftp.aqmd.gov/pub/metdata/azusa.exe

<ins>How to Read a Windrose:</ins> A wind rose gives a very succinct but information-laden view of how wind speed and direction are typically distributed at a particular location. Presented in a circular format, the wind rose shows the frequency of winds blowing ***FROM*** particular directions. The length of each "spoke" around the circle is related to the frequency of time that the wind blows from a particular direction. Each concentric circle represents a different frequency, emanating from zero at the center to increasing frequencies at the outer circles. The wind roses shown here contain additional information, in that each spoke is broken down into discrete frequency categories that show the percentage of time that winds blow from a particular direction and at certain speed ranges. All wind roses shown here use 16 cardinal directions, such as north (N), NNE, NE, etc.

The meteorological data reflects conditions in the San Gabriel Valley and not the conditions specifically at the West 80 Acre Substitution parcel, which is nearby but at a much higher elevation (see Figure 2 for the location of the meteorology station). Nevertheless, the Azusa Monitoring Station provides the closest and most representative meteorological data available because it describes the conditions near receptors of concern.

Figure 2. Aerial Photo with Notations

2.2 Physical Barriers

The effect of physical barriers (in this case, mountains) on particulate matter plume dispersion is two-fold. On the one hand, particulate matter striking an object has potential to become deposited on that object. On the other hand, physical barriers can cause localized effects such as downwash.

The Azusa Rock operation is on the southern flank of the San Gabriel Mountains which extend east and west, bordering the San Gabriel Valley to the south. Mining activities near the top of the west-side mountain will be separated from public receptors in the San Gabriel Valley by lateral distance of at least 0.5 mile, an elevation difference of 750 feet (230 meters) or more, and the natural ridgeline (see Figure 2) which will remain intact by design (see enclosed drawing titled “Azusa Rock Final Reclamation Phasing”).

Deposition is the process by which particles settle out of the atmosphere on to the ground due to gravity. The more objects that are in the path of the particle, the higher the potential for deposition. For instance, emissions from mining operations that occur on the north side of the ridgeline would have to travel up and over the ridge and down the mountain in order to impact the San Gabriel Valley. On this journey, some particulates would settle to the ground due to gravity, others would impact and adhere to vegetation, and some may remain after reaching the ridge. Thus, the mountain itself is a physical barrier that will mitigate some effects on the local residences.

Downwash is the tendency for air to move downward from an area of high pressure to an area of low pressure after passing over an object. Downwash is normally a concern near buildings that are located downwind of an elevated stack. In the case of Azusa Rock, there is no stack or building, but the intervening terrain that falls off rapidly south of the ridgeline may cause some downwash. Terrain induced downwash is possible but only occurs during specific, unstable atmospheric conditions. The following excerpt describes flow in the leeward side (downwind) of terrain obstacles as follows:

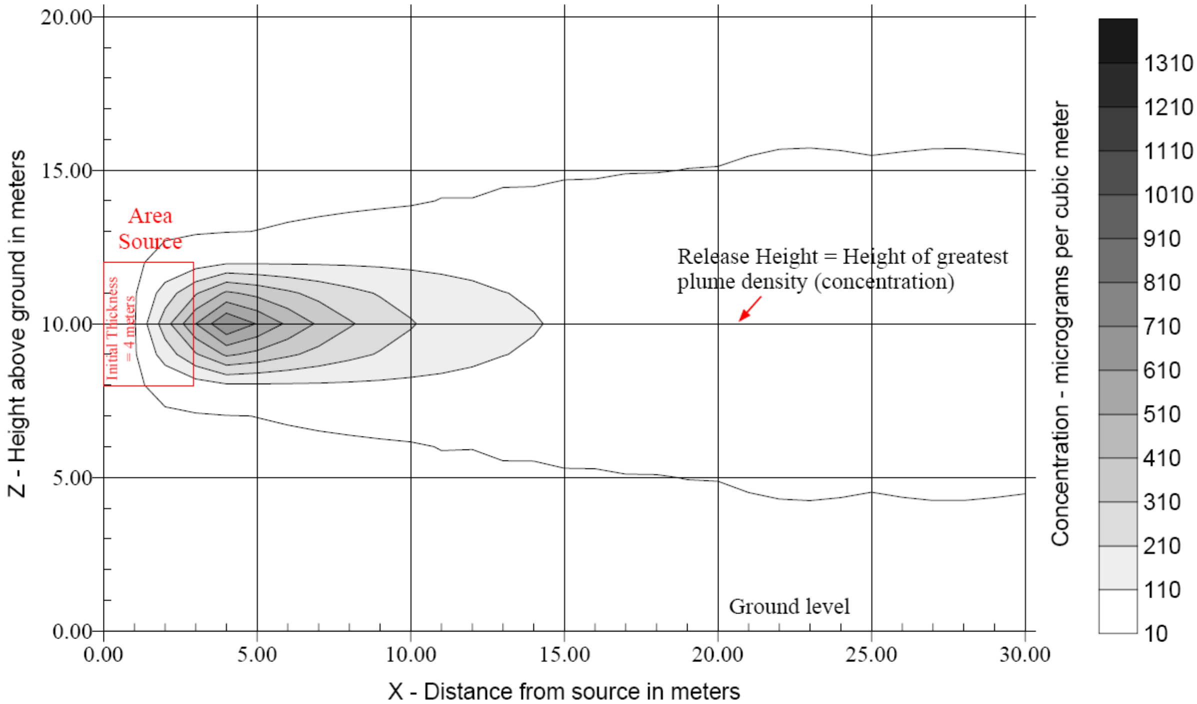
> *Flow downwind of terrain obstacles is different from flows approaching an obstacle. The combined effect of frictional retardation of the flow in the presence of an increasing pressure gradient on the lee side results in a separation of streamlines and the production of turbulent eddies that affect the wake region for a considerable distance downwind. For relatively smooth terrain features, eddy formation will generally be stronger in the horizontal plane than in the vertical. The formation of eddies ultimately shows up as an increase of turbulence intensities downwind of terrain.*
>
> *If the upwind flow is stably stratified, then there may be a suppression of flow separation in the vertical plane and, in fact, upper level flows may accelerate, fully attached, down the lee side. Mountain lee waves or gravity waves are commonly initiated on the lee side of mountains with stably stratified flow.*
>
> *A specific concern for sources located near prominent terrain features is terrain-induced downwash when winds blow from the direction of the terrain. Flow over obstacles causes turbulence that results in a systematic mixing toward the ground of pollutants that would otherwise begin their journey downwind in an elevated plume. In some cases, a cavity region with recirculating flow exists immediately downwind of the obstruction, limiting the exchange of air in and out of the wake region. Depending upon the location of the source within the cavity, the plume may be carried in the opposite direction from the winds aloft*. (adapted from Pages 113 and 114, Encyclopedia of Environmetrics, By Abdel H. El-Shaarawi, Walter W. Piegorsch).

Turbulent conditions may occur during a north originating wind on the leeward flank of the San Gabriel Mountains and induce some level of downwash. While the downwash effect may promote slightly increased ground level concentrations, the overall effect of turbulence is to promote dispersion both laterally and vertically. Such a plume would fan out laterally and downward from the ridgeline. Increased lateral mixing may offset the increase in concentration due to downwash. In summary, terrain-induced downwash may occur infrequently during a north wind and unstable atmospheric conditions, predicting the specific effect of downwash combined with increased lateral mixing remains unknown, but is expected to be minimal. The frequency of unstable atmospheric conditions in Azusa is discussed further in Section 5.

2.3 Release Height

The release height of a pollutant has a direct impact on the ground level concentration of that pollutant. The higher the release, the lower the ground level concentration. “Modeling Fugitive Dust Sources” (NSSGA, 2004) includes Figure 4, which illustrates how release height affects downwind concentration. Figure 4 shows the plume of an above ground area source without ground effects. Note that the plume is assumed to be symmetrical in the vertical plane (i.e. neutrally buoyant, see Section 2.4) and that concentration falls off rapidly with distance from the source. The point of maximum impact (709 $\mu g/m^3$) is at the same height as the release and about 4 meters downwind. This concentration is reduced by an order of magnitude within 20 meters.

Figure 3. Vertical Concentrations Profile from an Elevated Source



For a large industrial stack, good engineering practice for stack height is defined in federal regulations to be "65 meters, measured from the ground-level elevation at the base of the stack" (40CFR51.100(ii)(1)). Emissions from the Project will have to travel over the ridgeline, which is 230 meters (750 feet) above the San Gabriel Valley, before impacting the local residences. This "release height" is much greater than would be required for a large industrial stack. Air dispersion models assume that the plume is neutrally buoyant, so the maximum concentrations occur at the height of the release and only half of the particulates will disperse to elevations below the release height. At a release height of 230 meters, the plume will disperse considerably before reaching ground level in the Valley.

2.4 Atmospheric Turbulence

The amount of turbulence in the ambient atmosphere has a major effect on the dispersion of pollutants because it enhances plume dispersion and thereby acts to reduce the concentration of pollutants in the plume. It is therefore important in dispersion modeling to categorize the amount of atmospheric turbulence present at any given time.

The oldest and most commonly used method of categorizing the amount of atmospheric turbulence is the method developed by Pasquill in 1961. He categorized the atmospheric turbulence into six stability classes named A, B, C, D, E and F with class A being the most unstable or most turbulent class, and class F the most stable or least turbulent class. Table 3 provides the meteorological conditions that define each class.

Table 3. Meteorological Conditions that Define the Pasquill Stability Classes

Surface Wind Speed		**Daytime incoming solar radiation**			**Nighttime cloud cover**	
m/s	**mi/h**	**Strong**	**Moderate**	**Slight**	**> 50%**	**< 50%**
< 2	< 5	A	A – B	B	E	F
2 – 3	5 – 7	A – B	B	C	E	F
3 – 5	7 – 11	B	B – C	C	D	E
5 – 6	11 – 13	C	C – D	D	D	D
> 6	> 13	C	D	D	D	D

Notes: Class D applies to heavily overcast skies, at any wind speed day or night. ISCST translates stability classes A though F into numbers 1 through 7. Stability classes 6 and 7 are both treated as Pasquill's class F, very stable.
Source: Pasquill, 1961. (see also http://www.arl.noaa.gov/READYpgclass.php).

As shown in Table 3, daytime is generally less stable than nighttime. Daytime periods of light wind are less stable than daytime periods of high wind due to effect of the sun's heat which induces a vertical temperature gradient. Conversely, nighttime periods of light wind are more stable than nighttime periods of high wind because the sun does not induce a temperature gradient at night.

As shown in Table 4, Azusa meteorology is more often stable than unstable. A stable atmosphere will retard vertical mixing and downwash effects over terrain. Thus, during most hours of the year, emissions occurring at the top of the mountain have a lower probability of reaching the valley below due to lack of vertical mixing and downwash effects.

Table 4. Azusa Meteorological Stability

Stability Class	**A**	**B**	**C**	**D**	**E**	**F**
Amount of Time (hr/yr)	202	978	1,168	2,217	895	3,300
Percent of Time	2%	11%	13%	25%	10%	37%

Note: Table values based on meteorological data file provided for Azusa on the SCAQMD website.

3.0 SUMMARY

The air dispersion model in the DEIR yields results that are reproducible and significantly conservative within the standard of practice for performing project-level air quality modeling. The modeling and air quality impact assessments in the DEIR conclude that impacts will be less than significant in all cases. Additional analysis has been conducted herein to specifically address potential impacts to the Valley View School due to terrain effects and concludes that impacts remain unchanged and less than significant. Physical phenomena that affect the dispersion of particulate matter plumes are presented in this letter to foster better understanding of the nature of air pollution from a stationary source.

The incremental change in health risk due to the project may be a reduction in health risk because newer engines would be provided with the project that would emit less DPM. Based upon the results presented in Table 2 which exclude DPM, health risk impacts are estimated to be orders of magnitude less than the applicable significance thresholds. Whether the modeling uses simple or complex terrain is of no consequence to the significance determination at these levels of risk.

The "no project alternative" would retain the existing fleet of off-road vehicles which have higher DPM emissions than the project fleet. In addition, throughput under the "no project alternative" may increase. Thus, health risk has the potential to increase substantially if the project is not approved.

In summary, the facility does not pose a health risk to individuals at the School and the incremental change in health risk due to the Project is clearly less than the significance thresholds and may be beneficial. Please feel free to call me or Mr. John Hecht at (805) 275-1515 if you have any questions or if you need additional information.

Respectfully submitted,

Scott D. Cohen, P.E., C.I.H.
Project Manager
Sespe Consulting, Inc.

Attachments Page 9, AERMOD Implementation Guide
Sheet 10 – Azusa Rock Final Reclamation Phasing dated 3/16/2009 (#505-011-002-RCL-R010)
CDROM with Modeling Files

4.0 TERRAIN DATA AND PROCESSING

4.1 MODELING SOURCES WITH TERRAIN-FOLLOWING PLUMES IN SLOPING TERRAIN (01/09/08)

Under the regulatory default mode (DFAULT option on the MODELOPT keyword), for all situations in which there is a difference in elevation between the source and receptor, AERMOD simulates the total concentration as the weighted sum of 2 plume states (Cimorelli, *et al.*, 2004): 1) a horizontal plume state (where the plume's elevation is assumed to be determined by release height and plume rise effects only, and thereby allowing for impingement if terrain rises to the elevation of the plume); and, 2) a terrain-responding plume state (where the plume is assumed to be entirely terrain following).

For cases in which receptor elevations are lower than the base elevation of the source (i.e., receptors that are down-slope of the source), AERMOD will predict concentrations that are less than what would be estimated from an otherwise identical flat terrain situation. While this is appropriate and realistic in most cases, for cases of down-sloping terrain where expert judgment suggests that the plume is terrain-following (e.g., down-slope gravity/drainage flow), AERMOD will tend to underestimate concentrations when terrain effects are taken into account. AERMOD may also tend to underestimate concentrations relative to flat terrain results for cases involving low-level, non-buoyant sources with up-sloping terrain since the horizontal plume component will pass below the receptor elevation. Sears (2003) has examined these situations for low-level area sources, and has shown that as terrain slope increases the ratio of estimated concentrations from AERMOD to ISC (which assumes flat terrain for area sources) decreases substantially.

To avoid underestimating concentrations in such situations, it may be reasonable in cases of terrain-following plumes in sloping terrain to apply the non-DFAULT option to assume flat, level terrain. This determination should be made on a case-by-case basis, relying on the modeler's experience and knowledge of the surrounding terrain and other factors that affect the air flow in the study area, characteristics of the plume (release height and buoyancy), and other factors that may contribute to a terrain-following plume, especially under worst-case meteorological conditions associated with the source. The decision to use the non-DFAULT option for flat terrain, and details regarding how it will be applied within the overall modeling analysis, should be documented and justified in a modeling protocol submitted to the appropriate reviewing authority prior to conducting the analysis.

4.2 AERMAP DEM ARRAY AND DOMAIN BOUNDARY (09/27/05)

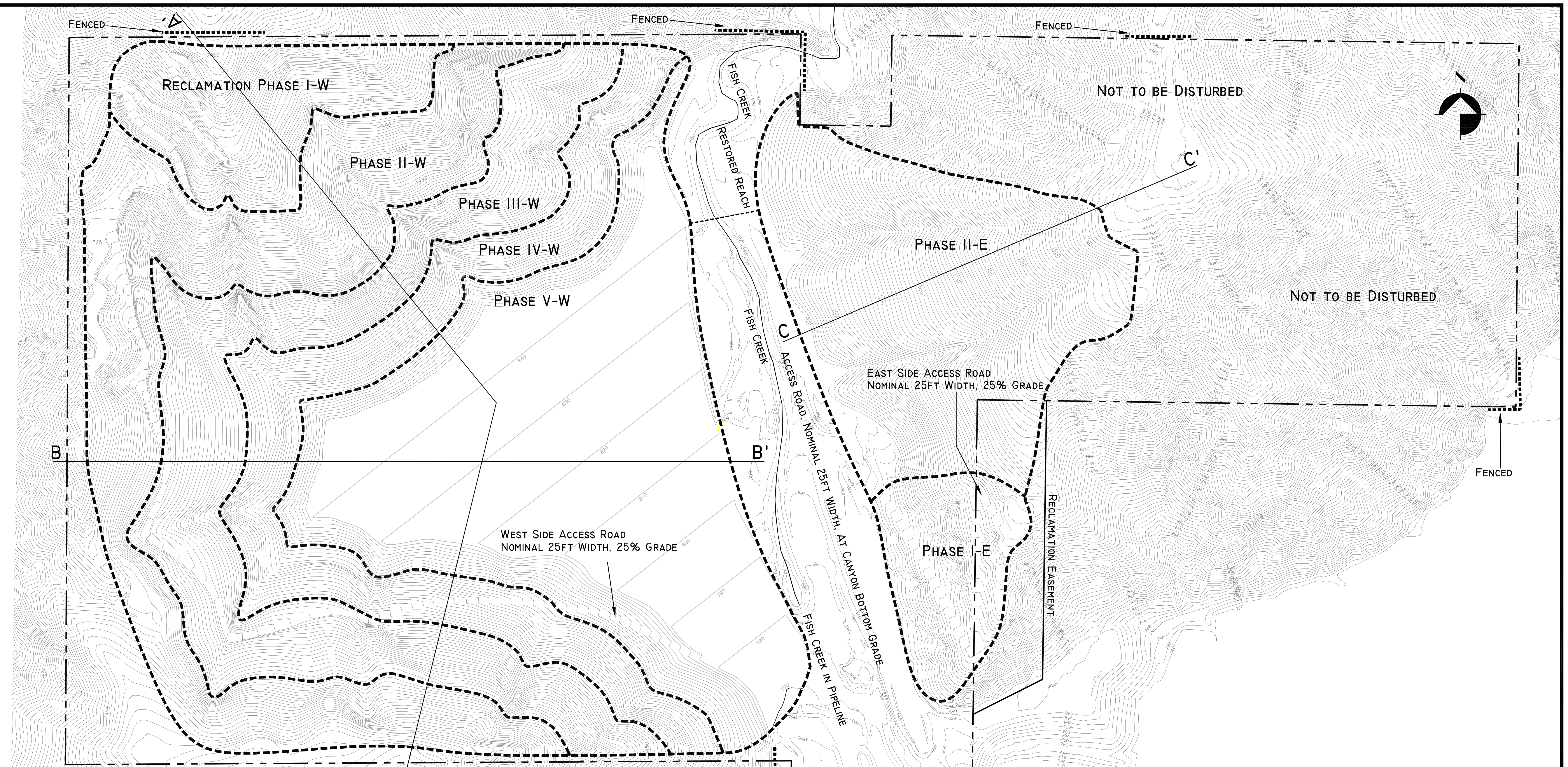
Section 2.1.2 of the AERMAP User's Guide (EPA, 2004c) states that the DEM array and domain boundary must include all terrain features that exceed a 10% elevation slope from any given receptor. The 10% slope rule may lead to excessively large domains in areas with considerable terrain features (e.g., fjords, successive mountain ranges, etc). In these situations, the reviewing authority may make a case-by-case determination regarding the domain size needed for AERMAP to determine the critical dividing streamline height for each receptor.

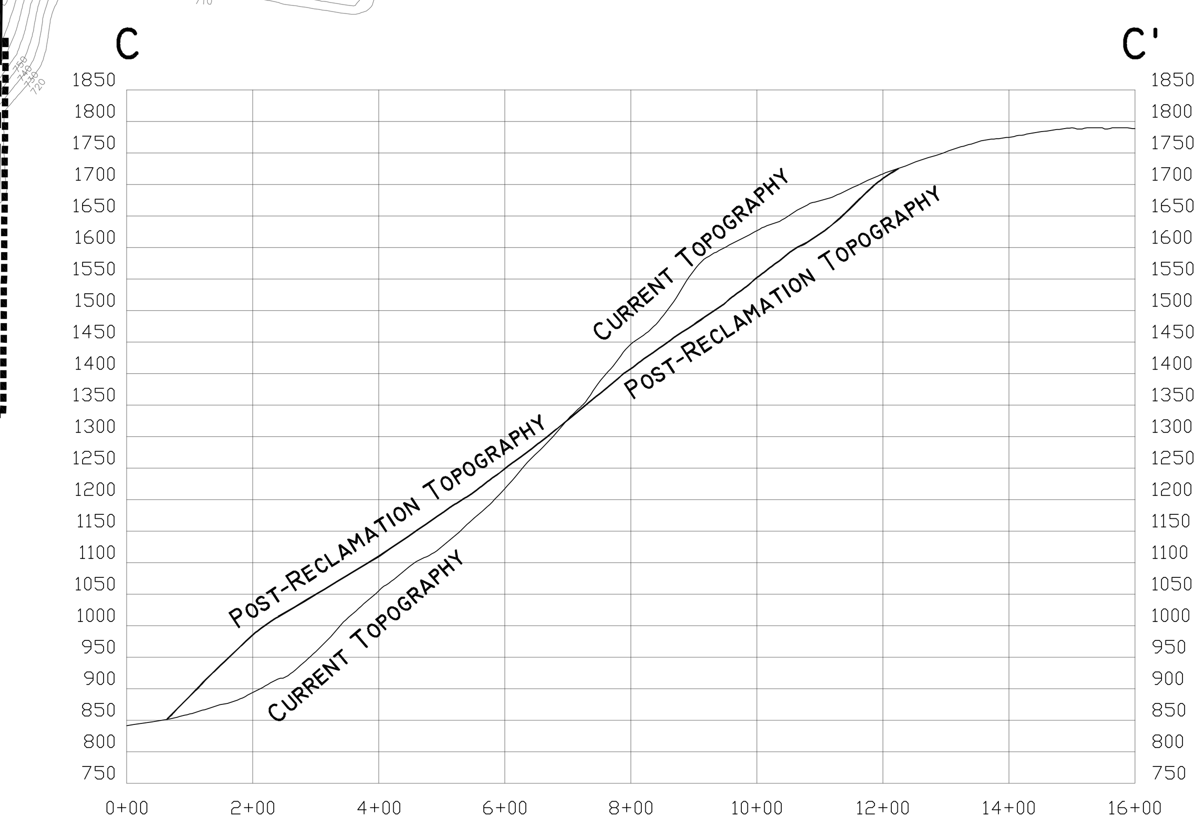
RECLAMATION PHASING TIMELINE

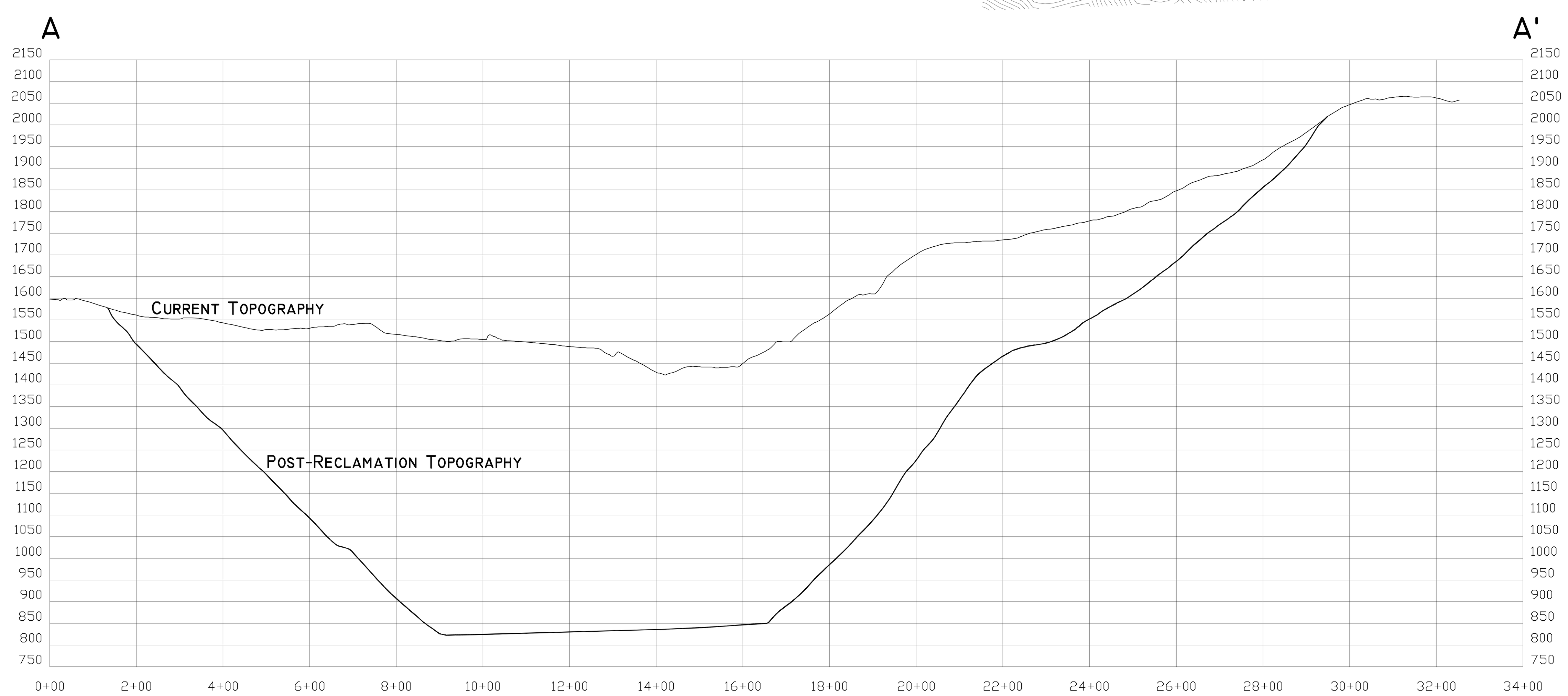
AREA	ANTICIPATED COMPLETION DATE
EAST PHASE	
PHASE I-E	
SUB-PHASE I-E-a	2012
SUB-PHASE I-E-b	2012
PHASE II-E	
SUB-PHASE II-E-a	2016
SUB-PHASE II-E-b	2016
WEST PHASE	
PHASE I-W	2014
PHASE II-W	2021
PHASE III-W	2026
PHASE IV-W	2032
PHASE V-W	2038
FISH CREEK PHASE 1	2002 (1)
FISH CREEK PHASE 2	DEVELOPMENT AGREEMENT NOTIFICATION
FISH CREEK PHASE 3	DEVELOPMENT AGREEMENT NOTIFICATION

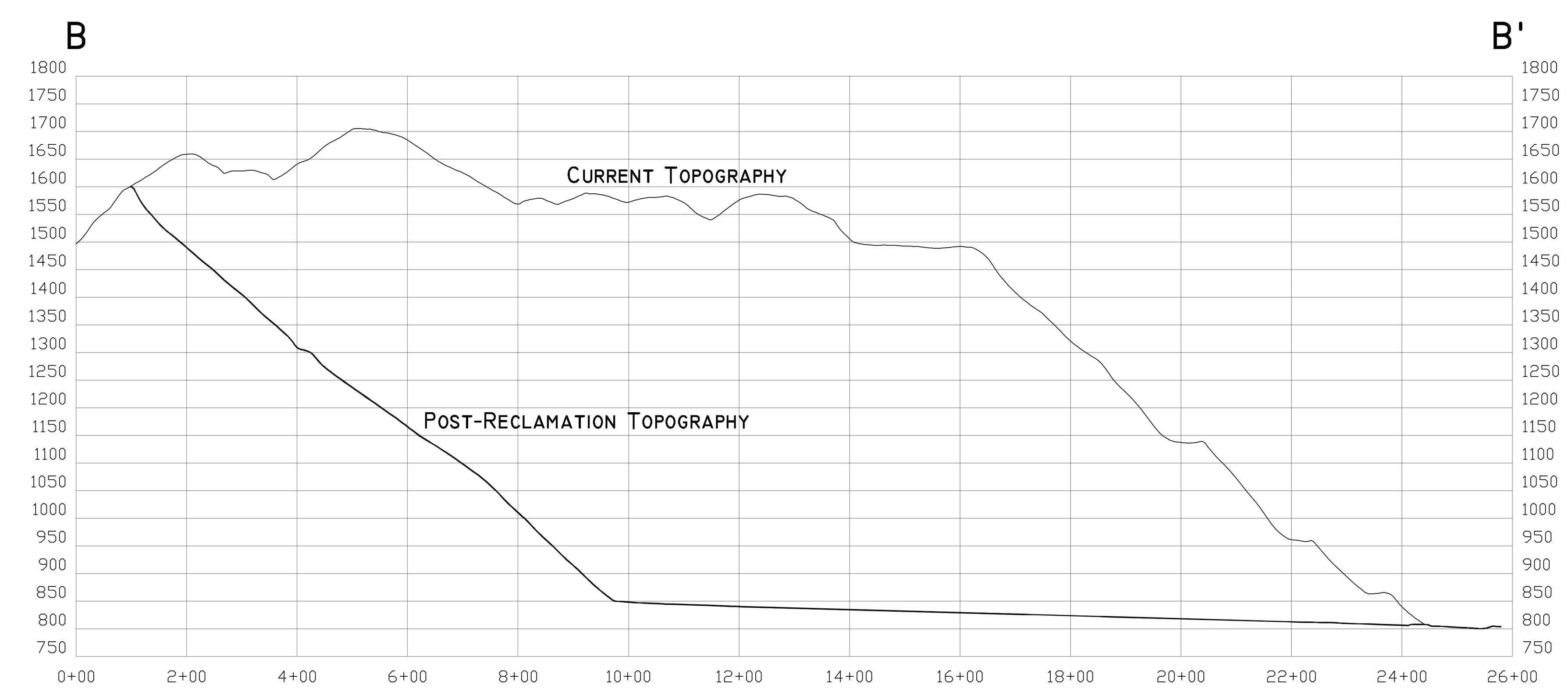
(1) PERFORMED VOLUNTARILY; NOT A REQUIREMENT OF ANY PREVIOUS MINING PERMIT, RECLAMATION PLAN, STATE REQUIREMENTS, OR FEDERAL LICENSES

* EXCEPT FOR PHASE V-W, ALL WEST SIDE COMPLETION DATES ARE APPROXIMATE AND DEPEND ON MARKET DEMAND FOR AGGREGATE PRODUCTS









NOTES:

* All Final Mined and Reclaimed Slopes are 1:1 For West Side Phases I-W Through V-W
* All Reclaimed Slopes are Nominally 1.4:1 For East Side Phase I-E
* All Reclaimed Slopes are Nominally 1.5:1 For East Side Phase II-E
* Safety and Security Features Include Perimeter Fencing, Where Necessary, Gated Entry, and Warning "No Trespassing" Signs as Required by the Lead Agency.

	DATE	REVISION	BY
D			
C			
B	03/16/09	FENCING ADDED	REJ
A	03/11/09	SECTIONS ADDED	REJ
–	11/12/08	INITIAL RELEASE	REJ

TOLERANCES–UNLESS NOTED
FRACTIONAL: ± 1/16"
DECIMAL: ± 0.010"
ANGLE: ± 0.1°

Vulcan Materials Company

SHEET 10

AZUSA ROCK FINAL RECLAMATION PHASING

DIVISION: Western
PLANT: Azusa Rock
DRAWN BY: REJ
DATE: 11/12/08
CHECKED BY:
DATE:
PROJ. NO.: 011
FILE SERVER: w:\
SCALE: See Scale Bar
SHEET 10 OF 11
DWG. NO.: 505-011-002-RCL-R010
REV.: B