TUXEDO RESERVE
PERFORMANCE STANDARDS
FOR

Stormwater Management
*
Grading and Steep Slope Protection
*
Road Standards
*
Sanitary Sewer
*
Water Supply
*
Soil Erosion and Sediment Control
*
Tree Surveys
*
Water Quality Testing
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Environmental Compliance
*
Rock Blasting and Stabilization

DOCUMENT INTENT

These Performance Standards, which consist of detailed engineering and construction specifications and requirements, are a component of the Design Standards which have been incorporated into and made part of the Special Permit for Tuxedo Reserve. They have been designed to address conditions specific to the Tuxedo Reserve site. In the event of any conflict between a Performance Standard and an otherwise applicable general Town standard, the Performance Standard shall apply unless such standard is otherwise expressly prohibited by the provisions for Design Standards in the Planned Integrated Development Law under which the Project is grandfathered. In the instances where a Performance Standard is not identified, the relevant Town of Tuxedo or New York State standard, whichever is more stringent, shall apply. The Planning Board is hereby authorized during its site plan and/or subdivision review to grant a non-material waiver or waivers to the standards set forth herein.

A. STORMWATER MANAGEMENT

The stormwater management system shall be designed in accordance with the current requirements of the NYS Stormwater Management Design Manual.

Design shall meet the NYSDEC sizing requirements for water quality volume, channel protection volume, overbank flood control and extreme flood control. Requirements for channel protection overbank and extreme flood control may be waived in certain instances where the conditions specified in the NYS Stormwater Management Design Manual are met.

Where required, stormwater management systems shall be designed to provide for a zero net increase in the peak rate of stormwater runoff from the developed project to Offsite areas. In addition to the water quantity structural controls to be provided, grassed swales, water quality basins or other means will be developed to provide for water quality control measures. These water quality control best management practices will be provided in accordance with current NYSDEC requirements. Appropriate hydrologic and hydraulic calculations will be provided to demonstrate project impact to receiving channels or drainage systems immediately downstream.

1. Storm Drain System

a. Drainage Collection System

1) The drainage collection system should be designed to convey the 25-year storm event.

2) The Rational Method Q=CIA shall be used to size storm water conveyance pipes where the drainage area is less than half a square mile or 320 acres.

Q =The peak runoff rate in cubic feet per second (CFS)
C = The composite runoff coefficient based on the surface conditions:

Condition	C
Grass/ Landscape areas	0.65
Wooded areas	0.59
Paved/ Impervious area	0.99

I = The average rainfall intensity in inches per hour, taken from the intensity-duration- frequency curve for Orange County, NY.
Tc = The time of concentration in minutes, and the minimum Tc shall be 6 minutes.
A = The size of the drainage area in acres.

3) USDA Soil Conservation Service Technical Release TR-20 methodology shall be used to size stormwater conveyance pipes where the drainage area is greater than half a square mile or 320 acres.

4) The stormwater management report shall analyze the 25-yr storm event to determine the effect of stormwater runoff from the proposed development to existing downstream drainage facilities outside the area of the subdivision. Impacts to the existing downstream drainage facilities shall be addressed in accordance with the requirements of the agency having jurisdiction.

5) Storm drainage pipes will be sized based on Manning's Equation (with n= 0.012 for RCP and HDPE sewer pipes).

   a) Minimum pipe slope shall be 0.50% for pipes up to 15” diameter. Minimum pipe slope for pipes 18” diameter or larger shall follow the Town ordinance minimum of 0.05%.
   b) Minimum storm sewer pipe shall be 15" diameter.
   c) Maximum distance between inlet and manhole structures on roads will be 300'.
   d) Each catch basin shall be designed in accordance with acceptable flow rates to the specific basin, but not to exceed 6 cfs in any case.

b. Storm Drain Culvert

1) The Soil Conservation Service Method TR20 shall be used for designing storm drain culverts.

2) Storm drainage culverts for roadways and pavements are to be designed for a 50 year storm, except that any facilities provided at a low point of the pavement/structure shall be able to pass a 100-year storm under surcharge conditions without flooding the roadway.

3) For watersheds with drainage areas of less than 320 acres, the drainage culvers will be designed to convey the peak runoff for a 25-year storm event. For watersheds with drainage areas of between 320 and 640 acres, the drainage culverts will be designed to convey the peak runoff for a 50-year storm event. For watersheds with drainage areas larger than one square mile, the drainage culverts will be designed to convey the peak runoff for a 100-year storm event.

4) The type of culvert structure material shall be selected based on size, structural strength, constructability, preservation of natural stream channel, aesthetics and cost.

5) In vehicular areas, provide a minimum cover of 18 inches or Class V RCP where cover is less than 18 inches.

2. Stormwater Detention Basins

a. Hydrology for stormwater detention basins shall be based on USDA Soil Conservation Service Technical Release TR-20 methodology.

b. Where detention facilities are required, the release of stormwater runoff to offsite areas shall not exceed the pre-development peak rate of runoff. To accomplish this, the rate of stormwater runoff shall be controlled through the use of detention basins or underground detention facilities, so that the post-development discharge rate is equal to or less than the existing discharge rate.

c. The runoff generated from a 2 year, 10 year, and a 100 year storm shall be based on the

24 hour SCS Type III cumulative rainfall distribution for both existing and proposed conditions.

d. Unless a site-specific soils evaluation is provided, the Rockland and Orange County soils maps shall be used to determine soil types to calculate CN factors. Additionally, the Town can require soil testing for specific locations.

e. The water quantity basin design shall conform to the current design requirements contained in the NYS Stormwater Management Design Manual.

3. Water Quality Basin Design

a. The water quality basin design shall conform to the current design requirements contained in the NYS Stormwater Management Design Manual.

b. The design approach shall utilize a "kit of parts" philosophy that encourages a variety of stormwater management practice (SMP) types. The selection of a specific SMP shall be based upon guidance from Chapter 7 of the Design Manual, and shall be depend on topography, soil and groundwater conditions, habitat, watershed characteristics, aesthetics, and other pertinent factors. Examples of SMP types to be considered from Chapter 6 of the NYS Stormwater Management Design Manual include:

- ponds
- wetlands
- infiltration practices (infiltration trenches, basins, dry wells)
- filtering systems (sand filters, organic filters, bioretention facilities)
- open channels (wet swales, dry swales).

Where practicable, alternative approaches from Chapter 9 of the NYS Stormwater Management Design Manual shall also be considered to mitigate potential adverse impacts. These measures include:

- rain gardens
- green roofs
- stormwater planters
- permeable paving
- cisterns.

c. Where appropriate, water quality basins may be designed and incorporated as part of stormwater detention basin systems.

d. Underground water quality treatment units may be used to satisfy the NYSDEC "pretreatment" criteria.

e. Water quality treatment practices may include small decentralized facilities to serve localized drainage areas.

4. Open Channels

a. Side slopes should not be greater than 2H:1V.

b. Channels shall have a capacity to convey the runoff from a 25-year storm event with 0.5 foot of free board.

c. The top width of parabolic waterway shall not exceed 30'; and the bottom width of

trapezoidal waterway shall not exceed 15 feet.

d. Channel stabilization measures shall be provided as required to prevent erosion.
e. Rock Catchment areas may also be used to convey storm water runoff.

B. GRADING & EARTHWORK AND STEEP SLOPE PROTECTION

1. Grading & Earthwork

To minimize impacts to the natural resources, grading activities will be kept to the absolute minimum. Development activities will be generally limited to within those areas where the ground surface slope is no greater than 33%. The design of the roads and building areas will be completed to maintain less than a 20 foot cut or fill where ever possible. There will be those areas within the project site with existing topographic conditions which will require cuts and/or fills to be greater than 20 feet. Areas with cuts and/or fills greater than 20 feet will require evaluation and recommendations from the geotechnical engineer.

a. Maximum slope for embankments and all landscaping areas shall be 2 horizontal to 1 vertical. Rock cut slopes and rock catchment areas will be based on the analysis and recommendations of the project geotechnical engineer.

b. Grading plans to be designed to produce a minimum disturbance to natural resources. Balance earthwork where possible. Reuse excess rock for general fill and, if possible, for slope stabilization (i.e.; gabion walls) or for channel stabilization.

c. Erosion control will be in compliance with New York State Guidelines. An erosion control plan will accompany all grading, utility and paving plans for both on-site and off-site improvements.

d. Border areas shall be provided along Major, Collector, Local, Country and private roads. Guide rail should be considered where minimum border area cannot be provided.

   (1) Major and Collector Road Border Area = min 9 ft wide measured from the edge of cartway. Maximum slope 3H:1V.

   (2) Local, Country and Private Road Border Area = min 6 ft wide measured from the edge of cartway. Maximum slope 3H:1V.

e. Retaining walls, rock catchments and slopes shall be permitted within the road R.O.W. provided these elements are located outside of the road border area or coordinated with guide rail protection.

2. Blasting

See Rock Blasting and Stabilization Protocol attached as Exhibit A.

C. ROAD STANDARDS

1. Streets

Street hierarchy and guidelines for gradients, sight distances, intersections, horizontal and vertical alignment, driveways, curbs and sidewalk have been addressed in the SMART Code.

2. Paving

Pavement sections will be based on Geotechnical Engineers recommendations and after completing a paving design analysis. The following are typical bituminous pavement sections to be used.

Major:	1½" Asphalt Concrete Top Course, NYSDOT HMA 12.5 mm 1½" Asphalt Concrete Binder, NYSDOT HMA 19.0 mm 4" Asphalt Concrete Base Course, NYSDOT HMA 37.5 mm 8" Subbase, NYSDOT Type 1
Collector:	1½" Asphalt Concrete Top Course, NYSDOT HMA 12.5 mm 4" Asphalt Concrete Base Course, NYSDOT HMA 37.5 mm 8" Subbase, NYSDOT Type 1
Residential, Local, Private: Country Lane	1½" Asphalt Concrete Top Course, NYSDOT HMA 12.5 mm 3" Asphalt Concrete Base Course, NYSDOT HMA 37.5 mm 8" Subbase, NYSDOT Type 1
Parking Lots:	1½" Asphalt Concrete Top Course, NYSDOT Type 6 3" Asphalt Concrete Base Course, NYSDOT Type 3 6" Subbase, NYSDOT Type 1

D. SANITARY SEWER

Sanitary sewers shall be designed based on the standards and regulations of Orange County Health Departments and the NYS DEC Design Standards for Wastewater Treatment Works.

1. Wastewater Design Flow

The flow rate is based on the NYS DEC Design Standards for Wastewater Treatment Works latest edition, Table B-3. Except for the 110/130/150 gpd per unit values, the per-unit hydraulic loading rates in Table B-3 may be reduced by 20 percent for establishments equipped with water saving plumbing fixtures.

Assumed bank, postal office, food, sport/health, day care, retail, office & business center all based on the flow rate of 0.10 gpd/sf in Southern Tract; and 0.08 gpd/sf for office, light industrial and warehouse in Northern Tract.

Wastewater peak wet weather design flows will be based on the following:

- Domestic sanitary flows based on above average daily domestic sanitary flow rate times a peak hourly factor of 3.3.
- Infiltration flow allowance (included as part of the 3.3 peak hourly flow factor).

2. Gravity Sewer

a. Pipe

1) Gravity system shall be designed for peak wet weather flow and without surcharging the system. Gravity sewers shall be designed when possible to provide a minimum velocity of not less than 2 fps when flowing half full. During initial years of development frequent sewer line flushing or cleaning may be required to flush and sediments that may be deposited during the low flows.

2) Minimum diameter of sewer lateral shall be 6" for commercial connection, 4" for residential connection, and 8" for public sewer extension.

3) Cleanout shall be provided at each lateral connection.

4) Sanitary pipes will be designed with following minimum hydraulic slope for all pipe

types using n=0.013 for ductile iron and n=0.010 for PVC to provide a minimum velocity of 2 fps.

5) The maximum velocity shall be 15 fps, where 10 fps is preferred where possible.

6) When a smaller sewer joins a larger one, the invert of the larger sewer should be lowered to place the 0.8 depth point of both sewers at the same elevation.

7) Minimum cover above sanitary sewer pipe shall be 4'.

8) Minimum 3' of cover from the bottom of stream at stream crossing.

9) Minimum 10' of lateral separation and 18" of vertical separation shall be provided between sanitary sewers and water main.

10) Where appropriate separation from a water main is not possible, the sewer shall be encased in concrete or constructed of ductile iron pipe using mechanical or slip-on joints for a distance of at least 10' on either side of the crossing.

11) No sewer main shall be constructed within:

- 200' from a water supply well or a below-grade reservoir, unless otherwise approved by the Orange County Department of Health;
- 25' from surface water or open drainage/ culvert;
- 10' from a water pipe;
- 25' from top of embankment or steep slope.

12) Sanitary sewers crossing streams or wetlands, or located within 25' of the stream embankment shall be constructed of steel, reinforced concrete or ductile iron pipes.

13) Maximum distance between manholes shall not exceed 400 feet.

14) Sewers on 20% slopes or greater shall be anchored securely with concrete or equal, anchors spaced as below:

- Not over 36' center to center on grades 20% and up to 35%;
- Not over 24' center to center on grades 35% and up to 50%;
- Not over 16' center to center on grades 50% and over.

15) Except where otherwise approved by municipality or utility authority, the centerline of sanitary sewer manholes, when located within the municipal right-of-way, shall be located where possible 5ft from the center line of the paved cartway. If conditions prevent location near the centerline, the manhole shall be located within the cartway a minimum of five-feet from the gutterline.

b. Sanitary Sewer Manholes

1) Minimum inside manhole diameter for a standard sanitary sewer manhole shall be 4848". All other manholes will comply with NYS DEC Design Standards for Wastewater Treatment Works latest edition, Table C-1.

2) Provide minimum 0.1' drop across the sanitary sewer manhole.

3) Provide a drop connection when the difference between inverts is more than 2 feet. Inside or outside drop shall be used. Inside drop connections shall require a larger

inside diameter manhole

4) No manholes are permitted within 100' of a public water supply well or a below grade reservoir**.**

5) Watertight manhole cover shall be provided within the 100-year flood level or 50' from the wetlands limit.

3. Force Main

a. The minimum building service connections from individual grinder pumps to the collectors shall be 1-1/4" PVC pipe.

b. The minimum force main diameter shall be 4".

c. The minimum velocity shall be 2 fps.

d. Force main shall enter the gravity sewer system at a point not more than 2 feet above the flow line of the receiving manhole.

e. Cleanout shall be provided every 400’ to 500', at major change in direction, and at where one collector main joins another main.

4. Pump Station

a. Pump station shall be located outside of the 100-year floodplain and be accessible during the 25 year flood.

b. Pump suction and discharge openings shall be at least 4" in diameter, unless otherwise approved in writing by the Town.

5. Sewage Disposal System

a. All design and construction of sewage disposal systems shall be in accordance with the standards and regulations of Orange County Department of Health, and New York Department of Environmental Conservation, as outlined in the with Appendix 75-A of Part 75 of the Administrative Rules and Regulations contained in Chapter 11 of Title 10 (Health) of the Official Compilation of Codes, rules and Regulations of the State of New York.

b. Mounded septic system is not permitted in Orange County

E. WATER

Water mains, pumping facilities and distribution storage design shall be designed in accordance with the latest edition of Recommended Standards for Water Work (also known as the Ten State Standards) and Part 5 of the New York State Sanitary Sewer Code.

1. Water Demand

Water demand is the sum of the residential and non-residential water demand. Fire flow volume is provided in dedicated storage and is, therefore, not a demand. The residential and non- residential water demand will be based on the following:

Parameter	Water per Unit Basis	2022, Development Program	Water Demand
Residential			
1BR Dwellings	110 gal/unit/day	285 units	31,350 gpd
2BR Dwellings	220 gal/unit/day	858 units	188,760 gpd
3BR Dwellings	330 gal/unit/day	351 units	115,830 gpd
4BR Dwellings	440 gal/unit/day	115 units	50,600 gpd
Residential Average Daily Demand			**386,540 gpd**
Non-Residential			
Commercial Non-Amenity Uses	0.10 gal/sf/day	42,000 sq. feet	4,200 gpd
Amenity Uses (used by development residents, water / wastewater demands included in bedroom count)	0. 0 gal/sf/day	61,000 sq. feet	0 gpd
Non-Residential Average Daily Demand			**4,200 gpd**
Totals			
Total Avg Daily Demand			**390,740 gpd**
Total Maximum Day Demand		1.76	**687,700 gpd**
Total Available Max Day Supply (24 hrs per day)			**835,200 gpd**

Notes:

1) Up to 2,860 bedrooms for non-age restricted residential units and no bedroom limitation for age restricted residential units will be allowed.

2) Weighted Average Peaking Factor is calculated as follows: [(SFD X 2.5) + (MFD X 1.5)] / Total Units
   (SFD) Single Family Dwellings: 413 units
   (MFD) Multi Family Dwellings: 1,196 units
   Total: 1,609 units
   Peaking Factor: [(413 X 2.5) + (1,196 X 1.5)] / 1,609 = 1.76

The water supply system should be designed to carry and deliver the peak-hour flow demand and the fire flow requirement whichever is greater. The storage facility shall contain average day demand plus the fire flow requirement.

2. Fire Flow

The fire protection need will be based on Insurance Services Office (ISO), *Fire Suppression Rating Schedule* and the ISO formula for estimated Needed Fire Flow (NFF) and the American Water Works Association's (AWWA). Manual of Practice 31, *Distribution System Requirements for Fire Protection* **(M31).**

The following fire flow values will be provided:

- 2000 gpm for 2 hours for the multi-family dwellings and townhomes
- 1060 gpm for 2 hours will be provided to the school
- 1000 gpm for 2 hours will be provided for the single family homes.

The minimum fire flow requirement is based on 2000 gpm for two hours.

3. Fire Hydrant

a. Fire hydrants shall be spaced in accordance with New York State requirements.

b. Fire hydrants shall be generally located in the vicinity of low and high points of the streets and in the vicinity of street dead ends.

4. Water Main

a. All water mains shall be sized to maintain a minimum pressure of 20 psi at ground level at all points in the distribution system under all conditions of flow, including fire.

b. The normal working pressure in the distribution system should be approximately 60 psi and not less than 35 psi.

c. Water main shall be separated both horizontally by 10' minimum and vertically by 18" minimum with any pipe lines carrying non-potable water such as sanitary and storm sewer.

d. Water mains will be installed with minimum 4 feet of cover.

e. Minimum water main size shall be 6" diameter CC-900 PVC or as approved by the Orange County Department of Health.

f. Maximum valve spacing shall be 500' for commercial and 800' for residential development.

g. Water mains shall be installed with minimum 2 feet of cover when crossing water course 15 feet wide. The pipe shall be of special construction having flexible watertight joint, and valves and permanent taps shall be provided on both sides of major stream crossings.

5. Water Storage Tank

a. Water Storage tank shall be tucked below the ridge lines where possible.

b. The minimum capacity of a water storage facility shall contain average day demand and fire flow. The tank has 672,000 gallons of storage and an associated average day capacity of 432,000 gpd when accounting for a 2 hour fire flow of 2,000 gpm.

6. Wells

Public water supply wells shall be located to meet State regulatory requirements.

F. SOIL EROSION AND SEDIMENT CONTROL

Soil Erosion and sediment control devices and application shall be in accordance with New York State Standards and Specifications for Erosion and Sediment Control.

G. TREE SURVEYS

Given the intention of clustered development at Tuxedo Reserve is to preserve large swaths of open space, it is understood that construction activities within the limits of disturbance of roads and lots will generally require the clear-cutting of trees. In addition to clearing, grading activities will generally prohibit the ability to preserve specific trees on proposed lots. To mitigate the visual impact of these clearing and grading activities, the Special Permit adopted the Design Guidelines which includes standards for on-lot landscaping.

The Planning Board may require a tree survey and protective measures to ensure the survival of the tree or stand of trees in the specific circumstances when a specimen tree or a stand of specimen trees (pertaining to trees 18 inches caliper DBH and larger) are located within the limits of disturbance and:

1. The preservation of the tree or trees does not significantly alter the alignment of a road or its associated infrastructure;
2. The preservation of the tree or trees does not eliminate or require the relocation of any lot or lots such that the new lot or lots have less usable land area;
3. The preservation of the tree or trees does not render any lot unbuildable, or substantially increase the cost or difficulty of developing a lot;
4. The proposed grading is such that the tree's or stand of trees' survival is feasible.

H. WATER QUALITY TESTING

To ensure the protection and preservation of the water quality at Tuxedo Lake, Mountain Lake, and on the site, in general, the applicant must test surface water samples following any storm greater than 1.5 inches, or the water quality storm rainfall provided in the New York State Stormwater Management Design Manual, latest edition whichever is more restrictive, as follows:

Construction Occurring Within:	Test samples taken from:	Any time before construction, test for:	During construction, test for:	Six months post-construction and soil stabilization, test for:
All Phases	The existing stream on the Sloatsburg parcel before it enters the culvert in Route 17	• Total suspended solids (TSS) • Total phosphorus • Total nitrogen • pH • Chloride	• Total suspended solids (TSS) • If a spill occurs, test for appropriate substances (e.g. petroleum products)	• Total suspended solids (TSS) • Total phosphorus • Total nitrogen • pH • Chloride
1,000 feet of the nearest edge of Mountain Lake	The existing swale near the proposed recreation facility			
The Tuxedo Lake watershed	The outlets from sediment traps at the locations of Pocket Pond 5a and Dry Swale 5b*			

*Note: Only test outlet from sediment trap at the location of Pocket Pond 5a for pre-construction test.

I. ENVIRONMENTAL COMPLIANCE

Prior to the first site disturbance, the developer must submit an Environmental Compliance Document to the Town Engineer for his review and approval. It is the responsibility of the developer to maintain signed copies of the Environmental Compliance Document for each of the Project's contractors at the Project's construction office. In addition, copies of the executed Environmental Compliance Document must be attached to each Clearing and Grading Permit and Building Permit.

The approved Environmental Compliance Document must require compliance with the Project's NYSDEC-approved Stormwater Pollution Prevention Plans as well as identify additional measures for the following:

- Spill Protection: Preventative measures, emergency spill event action plan, and non-emergency spill event action plan;
- Hazardous Waste Management: Identification, reporting, storage, and disposal;
- Solid Waste Management: Storage and disposal; and
- Natural & Cultural Resources: Identification and reporting.

Exhibit A

Rock Blasting and Stabilization Protocol

ROCK BLASTING and STABILIZATION PROTOCOL

Tuxedo Reserve
Tuxedo Park, New York

Prepared For:

Tuxedo Reserve Owner LLC
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APPENDICES

EXECUTIVE SUMMARY

This Rock Blasting and Stabilization protocol document has been prepared to provide a "road map" for all rock blasting and subsequent stabilization activities, as well as, to identify protection measures for public and private supply wells and on-site wetlands during construction of the residential development at Tuxedo Reserve in Tuxedo Park, New York. It is the intent of the Owner to implement at the onset of mass excavation all mass and trench blasting within any development phase. However, written modifications to this protocol may be made, with the concurrence of the Town's Engineer, based on performance of the work. This protocol is not intended to provide details for the work described herein; construction drawings and technical specifications will be prepared to provide the required detail that will be consistent with the guidance provided in this protocol document.

The three main components of this protocol address the following activities:

1. Blasting to facilitate mass and trench excavation of rock.
2. Rock cut stabilization and rock fall protection.
3. Protection of sensitive receptors, such as wetlands and supply wells.

A brief description of each of these activities, including a summary of required notifications, hours of operation, and vibration and noise level thresholds, beginning with a summary of site geologic conditions is provided in the following sections.

REGIONAL AND LOCAL GEOLOGY & HYDROGEOLOGY

Based on the USDA Soil Conservation Service Soil Survey for Orange County, New York, dated 1981, and the 1995 "Surficial Geology Map of New York - Lower Hudson Street", published by the New York State Geologic Survey, the majority of the surficial layer of the site consists of shallow well drained soils and rock outcrops; see Figure 1 for surficial geology map. The soils tend to be a thin mantle of glacial till deposits. In general, the surface layer is dark brown gravelly sandy loam, gravelly silt loam, or gravelly loam, with protrusions of large boulders. Localized deeper soil deposits exist typically between ridges, along shallow drainage ways of the uplands, and consists of stony glacial till debris from schist and gneiss bedrock. These deeper deposits are generally a yellowish-brown gravelly sand loam with new soils deposited over the old soils by wind/water and occasionally cemented together ("fragipan").

Rock outcrops tend to form large protruding blocks and ledges that occur throughout the site. These rock outcrops are predominantly sloping and moderately steep. Low lying basins and depressions in the area generally consist of well decomposed woody and herbaceous plant remains forming a black muck, which overlies a very poorly drained layer of bluish gray muck formed from organic deposits. The water table in the region tends to be perched only over

areas of poorly jointed rocks. Based on the results of our subsurface investigations, which have included borings and testpits, groundwater within the rock mass is typically expected to be at depths greater than 75 ft.

Over 100 testpits and borings have been performed on site; In addition, structural mapping of rock outcrops across the site was also performed. The site investigation findings indicate up to about 10 feet of sandy soils typically overly hard, irregularly or non-distinctly foliated gneiss possessing typically moderate to very widely spaced generally rough jointing. Occasionally low lying areas contain dark soft silts and clay or muck. Refer to the latest geotechnical engineering studies for a complete description of subsurface conditions.

The 1995 "Geologic Map of New York – Lower Hudson Sheet" published by the New York State Geologic Survey indicates the predominant bedrock type beneath the site consists of quartz plagioclase gneiss; see Figure 2.

ROCK BLASTING PROTOCOL

Because of the significant amount of hard rock that exists above proposed finished grades, blasting is expected to be the most expeditious method to facilitate rock excavation. Blasting should be properly sequenced and coordinated such that mass-cut production blasting is done to simultaneously address any necessary site utility trenches. Rock excavation should be controlled where necessary to prevent excessive vibrations that may adversely affect nearby residences, utilities, supply wells and on-site wetlands, and to prevent rock overbreak of the final excavation faces. The contractor's means and methods should be adjusted to comply with these requirements. Hoe-rams, splitters, or other mechanical equipment may also be required. The Contractor's means and methods for rock excavation and sequence of operations should be developed by a Blaster licensed in the State of New York, experienced in similar controlled rock excavation activities, and should be submitted for review by the Owner's Geotechnical Engineer prior to the start of work. The drilling/blasting methods and procedures selected will depend upon the relative location of the excavation work to the adjacent roadways, stormwater basins, supply wells, wetlands, utilities, and residential structures, and should be prepared in accordance with this approved blasting protocol. See Drawing BP-1 in Appendix A for a description of work associated with blasting and excavation. General blasting procedures and MSDS sheets for typical explosive agents/materials are provided in Appendix A. Blasting components containing perchlorates are not permitted. A summary of key notifications, hours of operation, and vibration and sound threshold levels are provided herein.

The mass rock removal work should be performed in such a manner to prevent over-excavation or the creation of an unstable condition. After blasting the contractor must clear all loose material to proposed building or site sub-grade elevation to the satisfaction of the Owner's

Geotechnical Engineer to assure that the rock has been fractured to the appropriate depth. Rock within building footprints should be over-blasted below the proposed finished subgrade levels; the depth of over blasting should be coordinated when building plans are completed. Rock in the over-blast zone need not be removed (except for building footing excavations), but should allow for normal trenching excavation for installation of utilities.

Exposed rock faces should be monitored and jointing mapped by the Owner's Geotechnical Engineer as the work progresses downward. If unstable wedges or blocks of rock occur during excavation, these blocks should be removed, or restraint should be provided as the work progresses as described in the following section.

Blasting and rock processing operations are to be contained on site. The owner proposes to utilize all blasted and processed materials for fill. Noise levels will be monitored at the nearest sensitive receptor location during the rock processing operation.

Vibration control and rock overbreak control methods should be used during construction excavation, especially in the vicinity of the wetlands and supply wells. Because it is widely accepted that openings in rock impede the transmission of shear waves; line drilling or channel drilling at final cut faces and in the vicinity of the wetlands are expected to limit the transmission of energy beyond the final rock face, and beneath the wetlands, respectively. The purpose of these controlled blasting methods is to ensure an air cushion and to establish a crack plane between adjacent periphery holes and thereby minimize the propagation of primary vibrations and strain cracking in the rock mass beyond the excavation perimeter that could open fractures. For example, the stress concentrating effect of a line drilled hole dies away rapidly, and at a distance of approximately 1.5 times the hole diameter, virtually no stress increase is felt by the rock (Hoek and Brown, 1980)[1]. Excavation vibration control can be achieved by limiting the equipment impact energy, or in the case of blasting, the charge per delay, to that value that would produce non-damaging levels of ground vibration. The peak resultant particle velocity should be the measure of the level of vibration.

In addition to the contractor's monitoring, vibration monitoring will be performed by the Owner's Engineer using at least two seismographs located at the nearest receptors. Vibration and noise level thresholds are provided later in this section; these excavation vibration threshold criteria should be considered to be preliminary, subject to review, approval, or modification by any party with jurisdictional control, including the Owner's Geotechnical Engineer, based on the behavior of the adjacent receptors. Once the final criteria are established, they should not be exceeded. The blaster is required by Town Code to control

[1] Hoek, E., and E.T. Brown, 1980. *Underground Excavations in Rock*, London: Introduction of Mining and Metallurgy

vibrations at selected features/structures to within tolerable levels. Control methods are described on Drawing BP-1 in Appendix A.

Vibration and noise (air-pressure) monitoring will be performed prior to and throughout the blasting operations, mass-excavation procedures, and shot rock processing. Before beginning any blasting at the site, existing (ambient) vibration and noise levels will be monitored and recorded for use as a pre-blast baseline in each blasting area. At the beginning of the blasting operations, the results of the vibration and noise level monitoring will be provided on a daily basis to the Town's Engineer. As the construction progresses, based on approval by the Town's Engineer, weekly vibration and noise level monitoring reports may be issued. A copy of the blaster's report will be issued to the Town's Engineer on a daily basis. The Contractor will monitor the train rails of the Metro North Railroad when blasting within 600 feet. A monitoring report will be issued to the Metro North Railroad's office at the end of each work day. The seismographs would measure both vibrations and noise levels throughout the blasting, mass-excavation, and processing operations. The contractor is responsible for installing and maintaining all monitoring equipment and for taking readings and issuing reports to the Owner's Geotechnical Engineer for review and to the pertinent governing agency as required. Should the measured vibration or noise levels exceed the approved threshold levels, the contractor should cease his work and evaluate his means and methods. Work would resume once the modified procedures are reviewed and agreed upon by the Town's Engineer and the Owner's Geotechnical Engineer. The vibration and noise monitoring reports will consist of the pre-blast (ambient) readings, the Town Engineer's approved levels, and the recorded readings over the established monitoring period.

Hours of Operation

Blasting shall be permitted in the Town of Tuxedo Monday through Friday between the hours of 9:00 a.m. and 5:00 p.m. No blasting shall be permitted at any time on Saturdays, Sundays, and public holidays observed by the Town of Tuxedo.

Notifications

These should be issued with copies to the Town's Engineer.

1. First Level - Issued two months prior to excavation:
    - Notify property owners within 600 ft of the work area to inform them of the work and the need to document the existing conditions of the property.

2. Second Level - Issued two months prior to blasting:
   - MetroNorth Railroad
   - New York State Department of Environmental Conservation
   - United States Army Corp of Engineers

3. Third Level - Issued 48 hours prior to blasting:
   - Town Supervisor
   - Town Director of Roads
   - Town Construction Official
   - Town Engineer

Vibration and Noise Threshold Levels

Threshold	PPV (ips) (Frequency > 40 Hz)	PPV (ips) (Frequency < 40 Hz)
Initial	2	0.75
First Warning	1	0.5
Sensitive Receptors	0.5	

Air Pressure Threshold Levels at Corresponding High Pass Filter Frequency

Air Pressure Threshold (dB)	Frequency (Hz)
131	0.1
128	2
125	6

Note 1: Sliding Scale per OSM Alternative Blasting Level Criteria (Modified from Figure B1, RI8507 vs. Bureau of Mines; See Appendix A of this Protocol).

Note 2: Peak Particle Velocities expressed in inches per second (ips) are subject to modification based on the performance of receptors.

Test Blast Program

The Contractor should submit a test blasting program (schedule and design) to the Owner's Geotechnical Engineer and the Town's Engineer for review and any required approvals at least 14 days prior to any test. The required design information should include the preliminary burden and spacing information. The drill hole diameter selection should be based on, but is not limited to, the rock depth to grade, pounds per delay in consideration to the nearest structure, field measured ground vibration levels of previous blasts, and maintaining agreed upon particle size of blasted rock. Staggered blast hole patterns may provide more efficient breakage through rock movement and more uniform distribution of explosive energy throughout the rock bed. The blast-hole patterns will be decided upon by a licensed blaster. Delay timing patterns will be designed to provide optimum breakage and desired rock movement. Whenever possible, one hole per delay sequence will be utilized to ease the effects of the blast on nearby structures. Blasts will be designed whenever possible to allow rock movement into a dew face away from any protected structures. Blasting mats or covers shall be used to help contain flyrock. The plan should include qualifications and proof of insurance.

An initial test should be performed in an overall area measuring approximately 60 feet by 60 feet and should be located within the central area of the sub-division section. The test blasting program should be used to verify that the contractor can blast the rock into a maximum block and aggregate fill size specified in the geotechnical report. In addition, the Contractor will utilize the information from the test blast program to develop a plan indicating allowable explosive charge weights per delay which will result in the attenuation of ground motions less than the limiting velocities and air blast overpressures defined herein. Test blast holes will be similar diameter and spacing as those to be used for production blasts. Depths of holes and type and quantities of explosives per hole will match the expected depths and quantities respectively for the use in production blasting. Additional test blasts should be performed as needed. Production blasting should be completed using the approved testing program blast parameters (i.e., hole spacing, loading, monitoring, etc).

ROCK STABILIZATION AND ROCK FALL PROTECTION PROTOCOL

Permanent rock cuts are expected to be stable at a slope of 2V:1H. The maximum rock cut height is approximately 50 feet. The stability of these rock cut masses is typically governed by movement along existing joints/fractures. Although the anticipated rock cuts are expected to be stable, potentially unstable blocks of rock and localized potentially unstable areas may be encountered where unfavorable rock joints intersect. Any areas exhibiting potential rock fall may require stabilization. Where space allows, the rock will be re-contoured to a gentler slope to achieve stability. Where this is not practical, rock bolting, shotcrete, buttressing, netting, fence, or a combination of these methods may be required depending on the condition of final

exposed cut rock face. Typical rock fall protection stabilization methods are provided on Figure ST-1 in Appendix B. Therefore, the Owner's Geotechnical Engineer will inspect this excavation work and will provide recommendations for temporary stabilization as needed between blasts and after the blasting operations are completed.

Rock fall catchment ditches will be provided at the base of the road cuts where indicated on the construction drawings. Should water be encountered in roadway rock cuts, the catchment areas or swales will provide drainage. Ditch dimensions will be provided on the contract drawings.

As provided on the construction drawings, a physical barrier such as a fence should be placed at both the top of the ditch or swale adjacent to roadway cuts to restrict access to the ditch or swale and at the top of roadway and detention basin cuts to restrict access to the cut slope. Rock cuts, ditches and swales should be maintained.

Periodic monitoring of rock cut faces and rock catchment areas for all rock cut will be performed by the Owner's Geotechnical Engineer to document the performance of the rock cut and identify conditions that may require attention. Any restraint / rock fall protection measures implemented during construction are performing as intended. Also, changes in site conditions that could affect the constructed cuts and restraint / rock fall protection measures must be monitored. Monitoring on an annual basis after freeze / thaw has ended is anticipated.

PROTECTION OF SENSITIVE RECEPTORS PROTOCOL

Blasting operations will be performed in the proximity of residential and public properties and transportation Rights-of-Way to the north, west, and south of the proposed North Ridge development. The Contractor should perform his rock excavation/blasting work so as not to damage or otherwise adversely impact adjacent properties, utilities, or other sensitive receptors such as wetlands or supply wells. Monitoring should be performed to ensure compliance with the project protocol established herein.

Pre-Blast Documentation and Monitoring

Soil erosion control methods will be in place prior to the commencement of any blasting activities. The owner will provide a written notice via mass mailing to all property owners within 600 feet of proposed blast areas. The Town Engineer and/or Town Building Inspector will review and approve the notice, which will inform of the proposed blasting operation. The notice will also recommend and identify the necessity for allowing the developer to perform pre-construction documentation of their structures. The developer will retain the services of a professional services organization to perform pre-blast documentation of all existing properties surrounding the blast area. The documentation work will include but is not restricted to

accessible portions of exterior and interior home facades facing the blast area, utilities, supply wells, retaining walls, existing rock faces, etc. Vibration and noise monitoring will be performed to establish ambient baseline vibration and noise levels. These levels can be compared to the blasting vibration and sound levels if the occupants of adjacent properties express concern about vibrations and noise that occurs during construction. Ambient vibration and noise level data will be collected using seismographs at several locations around the site. With approval by individual property owners crack monitoring reference lines will be established over selected cracks observed on the above mentioned neighboring structures. These reference lines provide a means for measuring and documenting the selected cracks for changes (if any) during construction. Also, with approval by the same owners vertical elevation control points should be established at selected locations on the sidewalks in front of buildings, and at selected façade locations that adjoin the site. The Owner's professional land surveyor would establish and monitor these elevation control points for movement (if any) during construction. The results of the pre-blasting conditions documentation will be summarized in a report giving a brief description of the documented areas. The report would also include a plan showing the locations where elevation control points and crack monitoring reference lines were established, and ambient vibration and sound level measurements were made. The report would include a tabulated listing of areas inspected along with referenced corresponding videotape and photographs of the respective areas. Copies of the Digital Video Disks (DVDs), would be included in the report. Digital photographs taken would be provided on a CD ROM which would be included with the report. This report would be prepared and submitted to the Town of Tuxedo and the Town Engineer a minimum of two weeks prior to the commencement of blasting operations.

A Pre-Blasting meeting will be held by the Owner with all stake holders prior to the commencement of the blasting operation. The Owner will hold a public meeting to inform the public of the proposed blasting operations prior to the above mentioned Pre-Blasting meeting. Sufficient time will be provided for the public to ask/submit any questions they might have to the Owner.

Wetlands Monitoring and Maintenance

A Wetland Monitoring and Maintenance Plan (WMMP) was developed for the site by EcolSciences, Inc., and is provided in Appendix C. The WMMP outlines investigations needed to document the current state of wetlands conditions and indicators, and inventories species present. The WMMP also establishes the frequency of periodic monitoring to evaluate wetlands performance, the protocols associated with the monitoring, criterion for triggering mitigation, and a schedule of implementation and associated reporting.

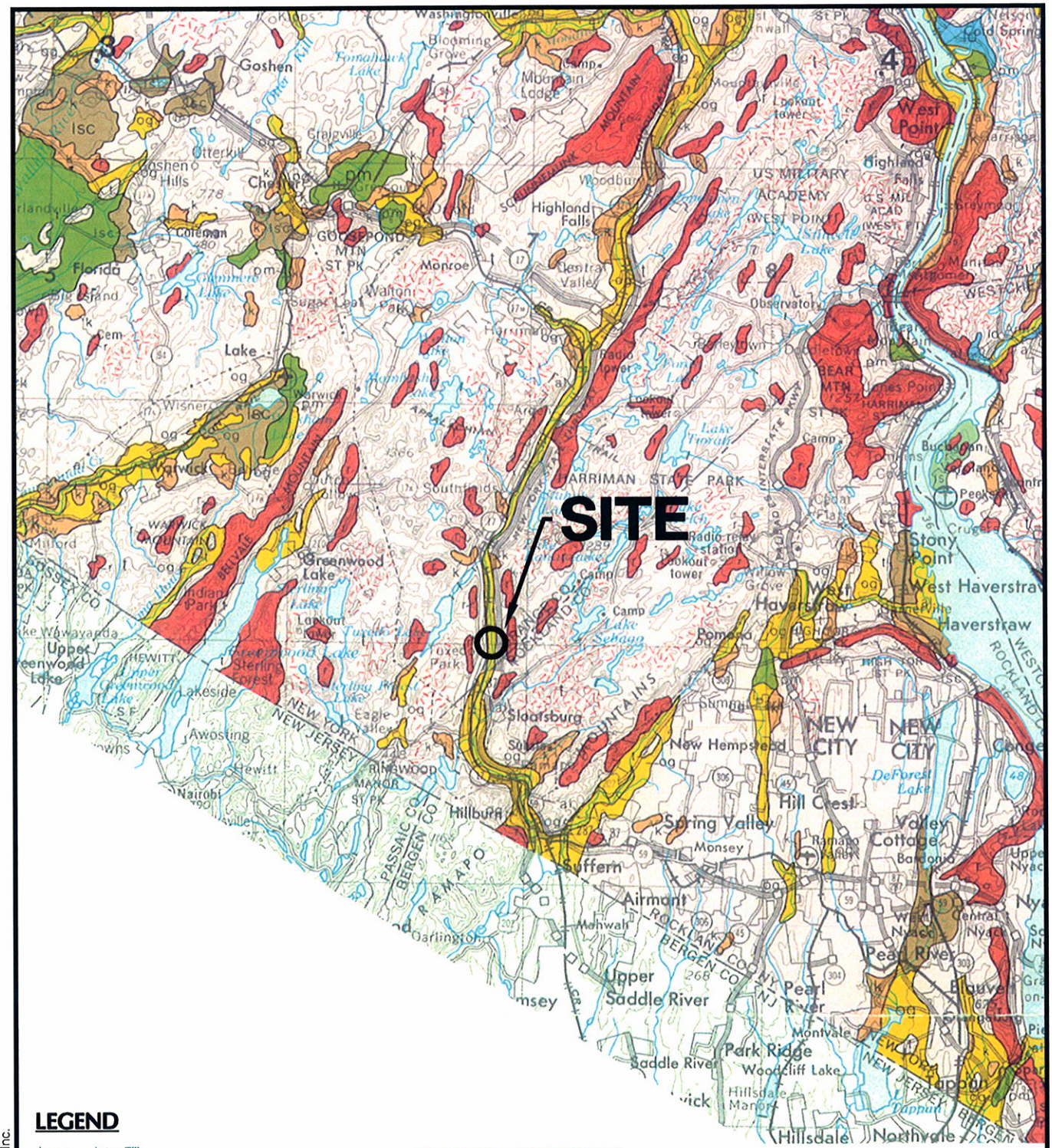
Soft sediment has been observed overlying soil or rock within the wetlands. If the wetlands were filled with water at the time a blast-induced shear wave passed through the sediment, it

is anticipated that the soft unconsolidated material would self heal, preventing the loss of water. However, to determine if blasting causes any deleterious effects on the wetlands, a monitoring program as stipulated in Appendix C will be in place. In the event the wetland is disturbed and/or damaged, as determined during the periodic monitoring, restoration of the subject area will be evaluated and implemented as determined to be necessary.

Well and Hydrogeologic Monitoring

A well and hydrogeologic monitoring protocol was prepared for this development by Leggette, Brashers, and Graham, Inc. and is provided in Appendix D. This protocol was prepared for assessing impacts to nearby supply wells from site blasting operations. Included in the protocol are a discussion of hydrogeology, monitoring methods, sampling procedures, reporting frequency, and a contingency plan for any impacts to wells within 1500 feet of the blast site. In addition, a plan is provided showing supply well locations in the vicinity of the site.

FIGURES



LEGEND

t — **Till**
Variable texture (e.g. clay, silt-clay, boulder clay),
usually poorly sorted diamict,
deposition beneath glacier ice,
relatively impermeable (loamy matrix),
variable clast content — ranging from abundant well-rounded
diverse lithologies in valley tills to relatively
angular, more limited lithologies in upland tills,
tends to be sandy in areas underlain by gneiss or sandstone,
potential land instability on steep slopes,
thickness variable (1-50 meters).

og — **Outwash sand and gravel**
Coarse to fine gravel with sand,
proglacial fluvial deposition,
well rounded and stratified,
generally finer texture away from ice border,
thickness variable (2-20 meters).

REFERENCE: USGS, SURFICIAL GEOLOGIC MAP OF NEW YORK, LOWER HUDSON SHEET, 1989

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NJ Certificate of Authorization No: 24GA27996400

Project TUXEDO RESERVE

SURFICIAL GEOLOGIC MAP

TUXEDO NEW YORK

Project No.	Date	Scale	Fig. No.
9108601	10/16/09	1: 250,000	1

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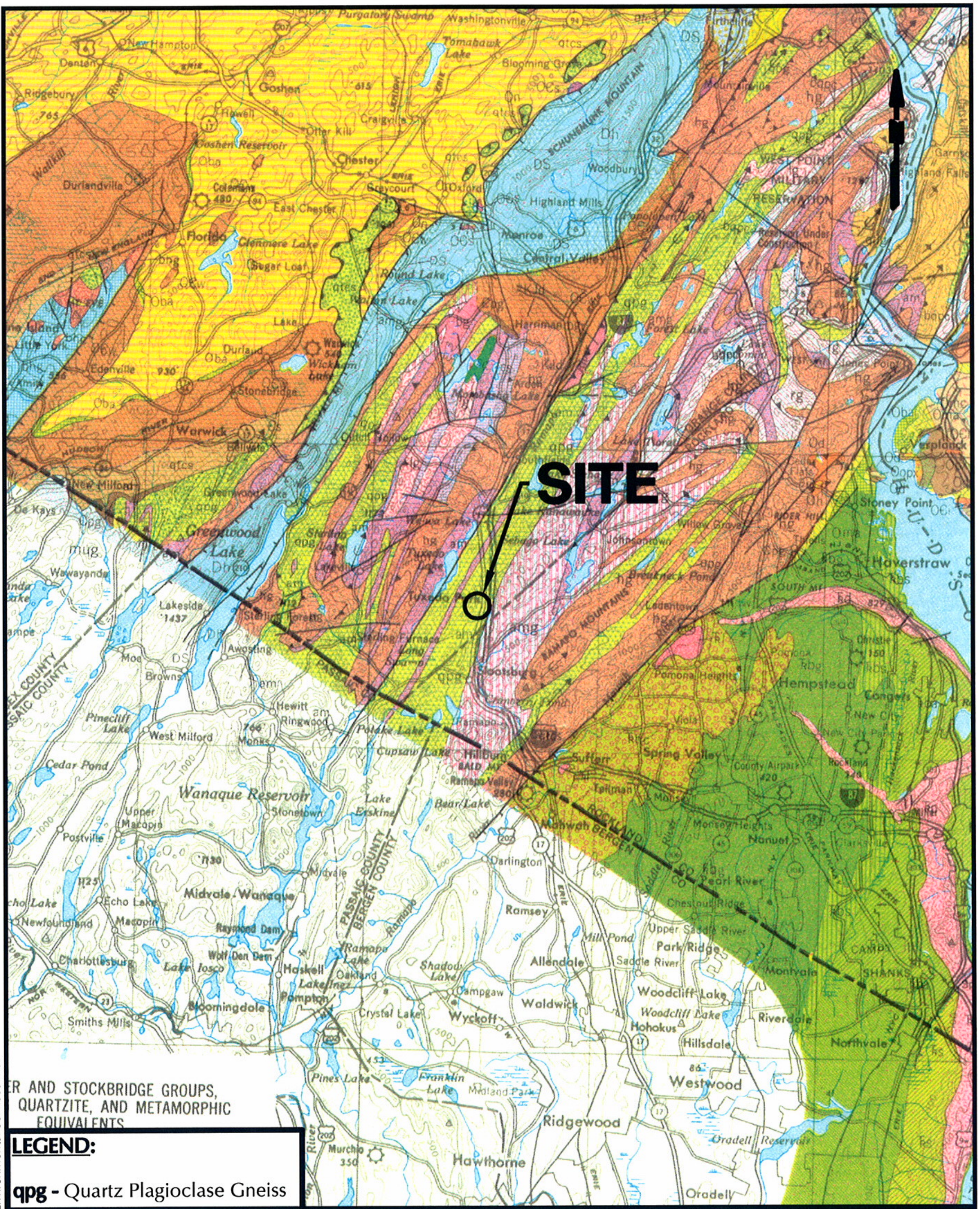

REFERENCE: USGS, GEOLOGIC MAP OF NEW YORK – LOWER HUDSON SHEET, 1995

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NJ Certificate of Authorization No: 24GA27996400

Project	TUXEDO RESERVE		
BEDROCK GEOLOGIC MAP			
TUXEDO			NEW YORK
Project No. 9108601	Date 10/16/09	Scale 1: 250,000	Fig. No. 2

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APPENDIX A

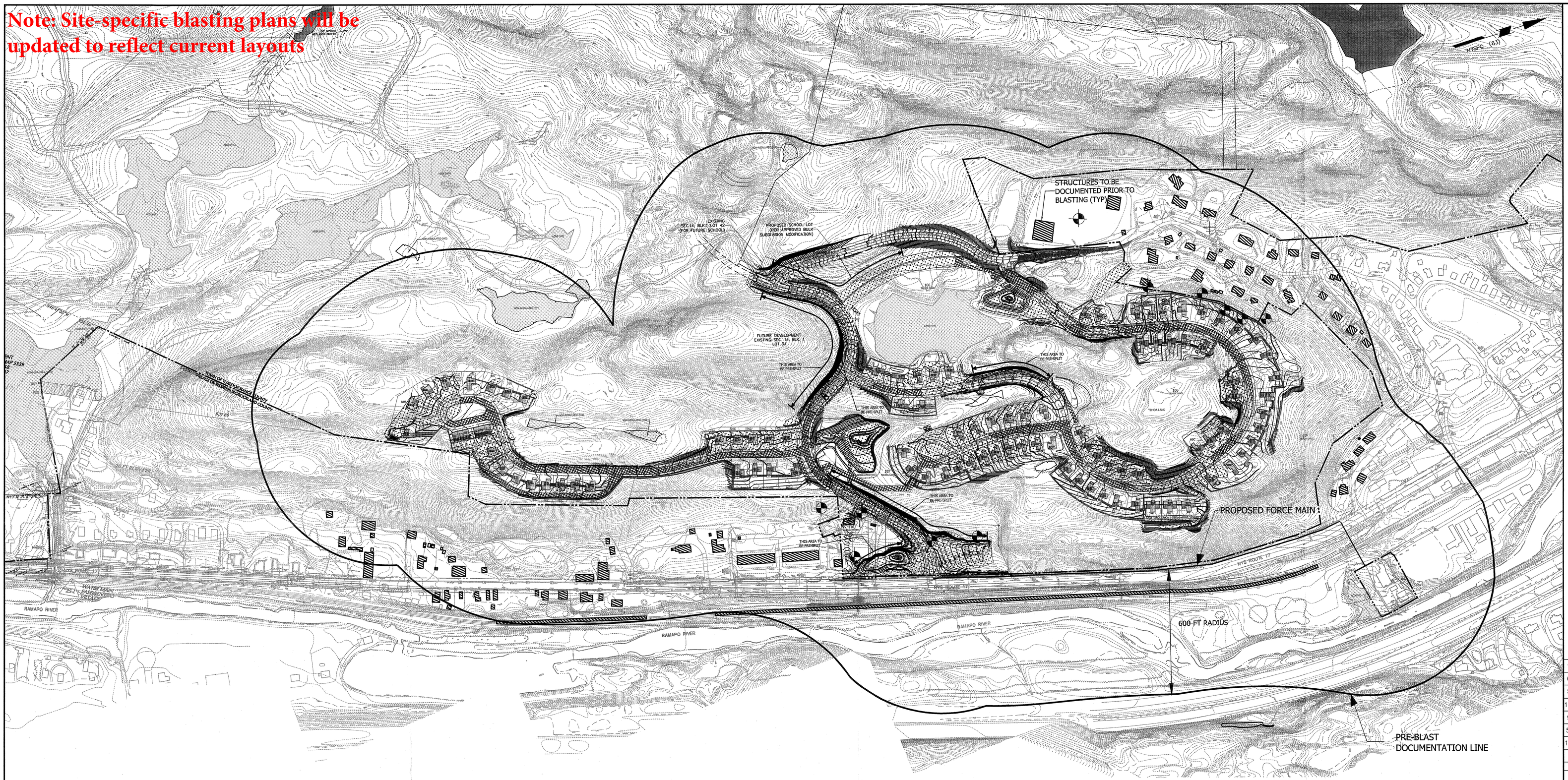
Roadway Blasting Plan & Pre-Blasting Documentation Plan; Drawing BP-1

General Blasting Procedure

"MSDS" Sheets for Explosives

OSM Alternative Blasting Level Criteria

Note: Site-specific blasting plans will be updated to reflect current layouts



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ROADWAY BLASTING NOTES:

1) Blasting Operation Submittals:
The following documents shall be prepared and submitted to the Town of Tuxedo for the blasting operation:

1. Rock Blasting Methodology - The methodology shall be prepared by a licensed engineer to provide the sequence of blasting operation, establish the design and monitoring standards for the production blasting. The design shall include the number, location, diameter and depth of drilled holes; the type and grade of explosive, size of cartridge and weight of explosive in each hole; the amount of explosive in the blast and maximum pounds of explosive per delay/interval; and the delay arrangement scheme. Product information sheets will be provided by the retained blaster. The monitoring standards shall establish the monitoring control points, the maximum particle velocity, and the noise level during blasting. The majority of the rock will be excavated using conventional blasting techniques. Special blasting techniques and alternative rock removal methods will be implemented where rock must be excavated to form the finished face of the permanent rock slope or excavated in close proximity to adjacent sensitive residential structures. These special blasting techniques and alternative methods include pre-splitting, line drilling, and hydraulic splitting. A Pre-split shot has sufficient load to produce sufficient pressure to cause the splitting action to occur without damaging the rock wall to remain. Stemming will be used at a depth to insure proper rock fragmentation and to confine explosive energy to prevent flyrock. Stemming materials are likely to consist of 1/4" stone. Up to three feet of overburden may remain on rock to help control flyrock and increase explosive efficiency where needed.

2. Test Blasting Program - A test blast program shall be performed prior to the production blasting at points of the closest property line or structure. The test blasts are performed to confirm that the blasting method will achieve the required rock cut, and to verify the vibration from future production blasting will not affect any adjacent structures. The test blasts can also verify that the peak particle velocity will not to exceed the pre-established limits and that the debris and dust protection measures are adequate. The limiting criteria from the test blast program shall be used to revise the Roadway Blasting Plan, where necessary. A blasting shcedule shall be submitted to the Town of Tuxedo a minimum of two weeks prior to the test blast.
The blaster's design will be provided to the town of tuxedo a minimum of two weeks prior to any blasting. Design information will include

Preliminary Burden and Spacing

Drill Diameter	Burden X Spacing min.	max.
3.5"	6' x 6'	10' x10'
4.0"	7' x 7'	12' x 12'
5.0"	8' x 8'	14' x 14'
5.25"	8' x 8'	15' x 15'
5.5"	9' x 9'	16' x 16'
6.0"	10' x 10'	18' x 18'

Drill diameter selection to be based on but not limited to: Rock depth to grade, Pounds per delay in consideration to nearest protected structure, field measured ground vibration levels of previous blasts, and maintaining agreed upon particle size of blasted rock. Staggered blasthole patterns may provide more efficient breakage through rock movement and more uniform distribution of explosive energy througout the rock bed; this is to be determined by a licensed blaster. Delay timing patterns will be designed to provide optimum breakage and desired rock movement. Whenever possible, one hole per delay sequence will be utilized to ease any effects on nearby structures. Blasts will be designed whenever possible to allow rock movement into a free face away from any protected structures. Blasting mats or covers shall be used to help contain flyrock.

3. Blast Monitoring Reports - The report shall document the location of the elevation control points, to monitor the vibration (i.e. peak particle velocity) and noise levels generated from the blasting operation, and charge per delay.

4. Daily Blasting Logs - The daily log shall document each blast detonated including the date, time of firing, number and depth of holes, total pounds of explosive used, the distribution of instantaneous and delay caps, pounds per delay, and location and spacing of drill holes.

2) Vibrations and Air Blast Standards
It is recommended that an initial threshold peak particle velocity of 2 inches per second (ips) for frequencies greater than 40Hz and 0.75 ips for frequencies less than 40 Hz be utilized during blasting and excavation. The initial data will be evaluated to determine if a lower criteria is more appropriate; this typically is based on the vibration frequency of various sources of vibration and the behavior of sensitive structures or equipment during performance of the work. The criteria will be modified, as appropriate, in accordance with published US Office of Surface Mining frequency-based velocity criteria. Air pressure emanating from the blast should not exceed the standards set forth in the Town of Tuxedo Blasting code. Charge per delay should conform to the scaled distance to actual distance ratios provided in the Town of Tuxedo Blasting Code.

3) Site Control
Written notice will be issued prior to the start of the blasting operation to property owners within 600 feet from the blast site in accordance with the Town of Tuxedo ordinances and code.
All Metro North Railroad's requirements shall be satisfied a minimum of 2 weeks before commencement of blasting. The contractor will maintain control of the blast area once loading operations commence. All other site access must be controlled by others. Blast notification and blasting times will be given to site personnel 30 minutes prior to blast. Blast warnings will consist of three(3) horn blasts two(2) to five(5) seconds each two(2) minutes prior to blast.
Post blast "all clear" will consist of one horn blast of fifteen seconds.

4) Pre-Blast conditions Survey
Homeowners within 600 feet of the blasting site will be offered the option of having a pre-blast condition survey of their homes performed. This survey will include a visual inspection of their home with existing conditions documented via photographs and/or videotaping. Monitoring points will be established on these structures if conditions warrant. See preblasting documentation notes below.

5) Blasting Operation
All blasting operations, including the use and storage of explosive, shall conform with the requirements of Federal and State laws, local ordinances and Town of Tuxedo Fire Marshall regulations, and Metro North Railroad's specifications & regulations. No explosives shall be stored on-site during non-working hours.

6) Hours of Operation
All blasting will be performed between the hours of 9:00 AM and 5:00 PM, excluding Saturdays, Sundays and public holidays observed by the Town of Tuxedo when no blasting shall be permitted.

7) Blast Monitoring
Blast monitoring shall be accomplished using at least 2 seismographs, monitoring both vibrations and air blasts. At least one of these shall be placed adjacent to the closest residential/commercial structure. Results of the blast monitoring should be provided on a daily basis to the Towhship representative.

The contractor shall monitor the movement of the train rails of the Metro North Railroad according to the Metro North Railroad's blast monitoring specifications. A Report shall be issued to Metro North Railroad's office at the end of each work day.

8) Road Closure and Traffic Control
Road closure criteria and traffic control requirements along NYS Route 17 shall be determined by NYSDOT during permitting of this work. All NYSDOT requirements shall be provided to the Town of Tuxedo a minimum of four weeks prior to blasting.

PRE-BLASTING DOCUMENTATION NOTES:

A pre-blasting conditions survey of accessible structures within 600 feet the site will be performed. Exterior and the interior facades facing the blast area will be documented. Vibration monitoring will bedone to establish ambient baseline vibration and sound levels on-site these levels can be compared to blasting vibration and sound levels.
Our work would consist of the following tasks:

1. The adjacent exterior and interior facades of buildings where we are permitted access would be included in our work. In addition, we would document conditions in adjoining sidewalks, streets, and parking lots. The conditions at the time of our work would be documented using a digital videotape camera. Digital photographs would also be taken. The exterior survey would be performed from the adjacent grade. The interior survey would include the accessible portions of the buildings facing the blast area.
2. Measure ambient vibration and sound levels at four (4) locations around the site. These measurements would be made using our seismograph to establish a documented level of existing vibration and sound levels for comparison if adjacent site occupants express concern about vibrations and noise that occur during construction.
3. With approval by the Owner, establish crack monitoring reference lines over selected observed cracks on the above described neighboring structures. These reference lines provide a means for measuring and documenting the selected cracks for changes (if any) during construction.
4. With approval by the Owner, establish vertical elevation control points at selected locations on the sidewalks in front of buildings, and at selected façade locations, that adjoin the site. The Contractor's Professional Land Surveyor would be expected to establish the initial elevations and monitor the elevations of these control points for movement (if any) during construction.
5. The results of this work would be summarized in a report giving a brief description of the documented areas. The report would also include a plan showing the locations where elevation control points and crack monitoring reference lines were established, and ambient vibration/sound level measurements were made. The report would include a tabulated listing of areas inspected along with referenced corresponding videotape and photographs of the respective areas. Copies of the Digital Video Disks (DVDs), would be included with the report. Digital photographs taken would be provided on a CD ROM which would be included with the report.

GENERAL NOTES:

1. Southern tract boundary and topographic information have been taken from a survey titled "Topographic Survey Southern Tract" prepared by Langan Engineering, last revised September 11, 2007.
2. The specification provided on this drawing shall be used for all blasting including lots, roadways, utility trenches, and basins.
3. The blasting contractor shall be licensed in the state of New York.
4. The contractor is specifically cautioned that the location and/or elevation of existing utilities as shown in the plans is based on records of various utility companies and, where possible, measurements taken in the field. The information is not to be relied on as being exact or complete. The contractor must call the appropriate utility company at least 72 hours before any excavation to request exact field location of utilities. It shall be the responsibility of the contractor to relocate all existing utilities which conflict with the proposed improvements shown on the plans.
5. The area and limit of blasting is approximate and will be adjusted per actual rock subsurface conditions.
6. In addition, blasting is expected on house lots, but the extent of blasting required in these areas is approximate and will be refined as house designs are completed.
7. Blasting on individual lots shall conform to the same blasting specification and performance standards.
8. The contractor shall conduct his rock blasting/excavation work to generate material which conforms to sizes of rock required for fill. Some additional on-site rock crushing may be required to produce the three separate rock-derived fill materials (large rock fill, small rock fill and choke stone). The rock fills and choke stone shall be placed in upward succession. Refer to the specifications and procedures outlined in the Geotechnical Engineering Study for Tuxedo Reserve- North Ridge Section as prepared by Langan Engineering, revised 25 May 2007.
9. Any necessary corrections to Metro North Railroad's tracks deemed caused by on-site blasting operations will be paid for by the contractor responsible for said damage.

SHEET USED BY OCHD FOR REFERENCE ONLY. NOT REVIEWED OR APPROVED BY OCHD.

OWNER:
TUXEDO RESERVE OWNER LLC
C/O RELATED COMPANIES
60 COLUMBUS AVENUE
NEW YORK, NEW YORK 10023

CONSULTING ENGINEERS:
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RIVER DRIVE CENTER 1
619 RIVER DRIVE
ELMWOOD PARK, NEW JERSEY 07407
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ROBERT A.M. STERN ARCHITECTS
460 WEST 34th STREET
NEW YORK, NEW YORK 10001
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ENVIRONMENTAL CONSULTANTS:
ECOLSCIENCES, INC.
75 FLEETWOOD DRIVE, SUITE 250
ROCKAWAY, NEW JERSEY 07866
TEL: (973) 366-9500 FAX: (973) 366-9593

LAND USE ATTORNEY:
SIVE PAGET & RIESEL, P.C.
460 PARK AVENUE
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555 HUDSON VALLEY AVENUE
NEW WINDSOR, NEW YORK 12553
TEL: (845) 458-7316 FAX: (845) 458-7317

Date	Description	No.
9-09-08	PER TOWN ENGINEER'S COMMENTS	13.
6-10-08	H&A COMMENTS REVISIONS	12.
5-30-08	SUBMITTAL TO OCHD, NYSDOH, & NYSDEC	11.
10-26-07	SUBDIVISION SUBMISSION TO PLANNING BOARD	4.
9-11-07	SUBDIVISION SUBMISSION TO PLANNING BOARD	3.
5-25-07	SUBDIVISION SUBMISSION TO PLANNING BOARD	2.
11-29-06	SUBDIVISION SUBMISSION TO PLANNING BOARD	1.

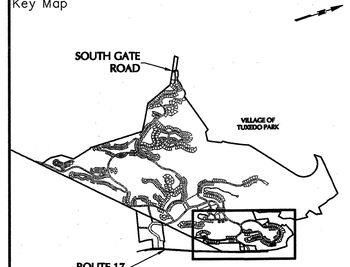
Revisions

NAME GEORGE DERRICK DATE
PROFESSIONAL ENGINEER NY Lic. No. 48930-1

Project
TUXEDO RESERVE
(PHASE 1 - SECTION 1)
TOWN OF TUXEDO
ORANGE COUNTY NEW YORK

Drawing Title
PHASE 1-SECTION 1 ROADWAY BLASTING PLAN & PREBLASTING DOCUMENTATION PLAN

Key Map



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Drn. By JO	
Last Revised 9-09-08	X

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EXPLOSIVES SPECIALISTS

BLASTING CONTRACTORS
CONCRETE DEMOLITION
EXPLOSIVE FORMING & SIZING OF METALS

JOHN JOSEPH, Inc.

695 WESTBROOK ROAD Phone 973-839-0669
RINGWOOD, NJ. 07456 Fax 973-839-7837

August 13, 2008

Related Companies
199 Orange Turnpike
Sloatsburg, NY 10974

Attn: Paul Roggeman

Ref: Blasting Operations for Tuxedo Reserve

Dear Paul,

To address the concerns of the anfo in free flowing form.

1. Ammonium nitrate is a material that is used to fertilize all lawns.
2. When using anfo in blast holes, we are detonating over 99% in the confined blast hole. After the detonation takes place, all the blasted rock is now surface rock which will be of no further danger than fertilizing the lawn if any residue is left.
3. When there is water in the blast hole, there will be sealed & packaged explosives or it will be dewatered prior to loading WR/anfo (water resistant).
4. Blasting Procedures enclosed.
   A. Blast patterns will vary from 4x4 to possibly 5x6 depending on the diameter of the drill hole and the depth..
   B. All drilling will be done with hydraulic drills with dust collectors to keep the dust at a minimum.
   C. There will be hydraulic truck excavators at each blast location to relieve the shot after blast occurs to minimize ground vibration and improve rock breakage and prepare for the next round of holes. Also to place blasting mats when necessary.
5. There will be no overnight storage on sight. All explosives to be used will be brought in on a State approved truck mounted magazine and removed at the end of each day.
6. The blaster will have one (1) seismograph at the nearest structure. Langan may want to place another seismograph at another location.

I will be glad to attend the meeting to address any questions that they might have.

Very truly yours,

JOHN JOSEPH, INC.

John E. Joseph
President

EXPLOSIVES SPECIALISTS

BLASTING CONTRACTORS
CONCRETE DEMOLITION
EXPLOSIVE FORMING & SIZING OF METALS

JOHN JOSEPH, Inc.

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RINGWOOD, N.J. 07456

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BLASTING PROCEDURES

THE DRILLING & BLASTING OF ROCK IN THE STATE OF NEW JERSEY IS MORE RESTRICTIVE THAN ANY OTHER STATE. BLASTING CRITERIA IS APPROXIMATELY 50% OF OTHERS.

THEREFORE, MANY FACTORS HAVE TO BE TAKEN INTO CONSIDERATION PRIOR TO STARTING.

TO ASSIST PEOPLE WHO WOULD LIKE TO KNOW MORE ABOUT A TYPICAL BLASTING OPERATION, WE WOULD LIKE TO EXPLAIN SOME TERMINOLOGY, DESCRIPTIVE DIAGRAMS, SOME PRODUCTS, HOW THEY FUNCTION AND ARE USED.

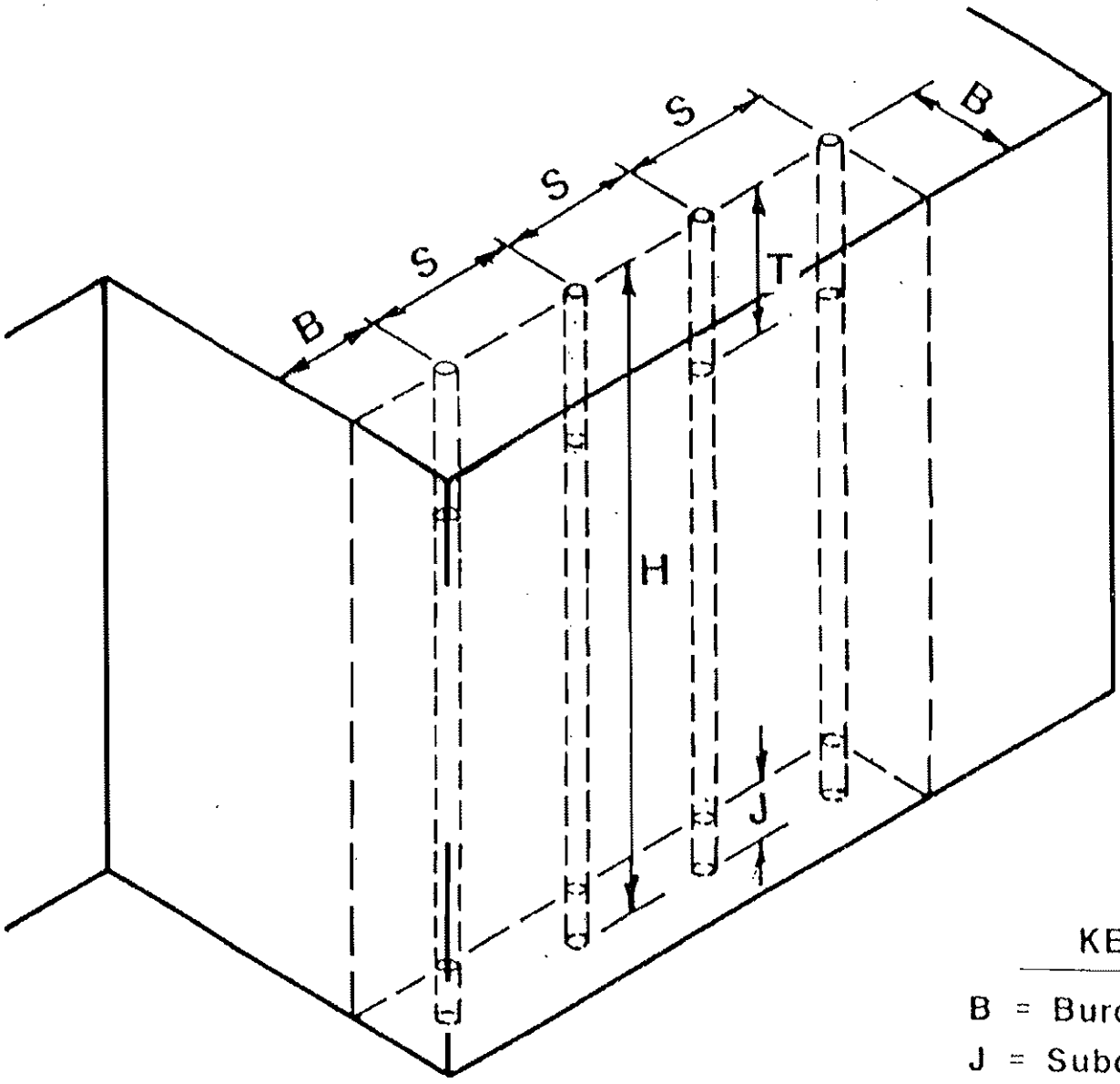
REMEMBER THAT EXPLOSIVE, AT THIS TIME, IS A SUBSTANCE WHEN INITIATED WILL DETONATE AT A RATE BETWEEN 8,000 FEET PER SECOND TO 22,000 FEET PER SECOND. SOME SUBSTANCES WILL DETONATE FASTER BUT FOR THE PURPOSE OF BLASTING ROCK, IT IS NOT EFFECTIVE (RATES OF 3,000 FEET PER SECOND AND LOWER ARE CONSIDERED DEFLAGRATION TO BURNING.

THE PURPOSE OF USING EXPLOSIVES IS TO DRILL HOLES IN THE ROCK IN SUCH A MANNER AS TO CONFINE THE ENERGY THAT IS BEING EXPELLED WHEN DETONATED (WHICH THEN CHANGES TO GASES OF TEMPERATURES 3,000 DEGREES TO 7,000 DEGREES F AND PRESSURES UP TO 1.5 MILLION PSI). AT THIS TIME, THE ROCK SHOULD START TO YIELD, FRAGMENT, & BREAK APART PROVIDING THAT IT HAS NOT BEEN TOO CONFINED.

TO DETERMINE CONFINEMENT OF THIS ENERGY OR FORCE, THERE IS STANDARD TERMINOLOGY USED IN THE INDUSTRY.

(ALWAYS REMEMBER ANY FORCE OR ENERGY EXPELLED WHEN EQUAL IN ALL DIRECTIONS WILL TRAVEL IN THE DIRECTION IN THE PATH OF LEAST RESISTANCE).

DIAGRAM OF TERMINOLOGY:



KEY

B = Burden
J = Subdrilling
T = Stemming
S = Spacing
H = Hole Depth

BORE HOLES ARE DRILLED IN A ROCK AT LOCATIONS SO THAT THE BURDEN (DISTANCE FROM THE NEAREST FREE FACE) AND THE HOLE IS OF SUFFICIENT SIZE TO HOLD THE AMOUNT OF ENERGY PRODUCED FROM THE EXPLOSIVE CHARGE.

THE HOLE DIAMETER WILL DETERMINE THE SIZE AND AMOUNT OF CHARGE THAT CAN BE PLACED IN THE HOLE AND WILL ALSO HAVE TO BE TAKEN INTO CONSIDERATION PRIOR TO DETERMINING THE DRILL PATTERN.

TO CONFINE THE ENERGY IN THE ROCK, A STEMMING MATERIAL IS USED AT THE TOP SECTION OF THE HOLE WHICH IS USUALLY 3/8" CRUSHED STONE FOR 2-1/2" HOLES.
IT IS OBVIOUS THAT THERE HAS TO BE MORE STEMMING IN DEPTH THAN BURDEN ON THE HOLE , OTHERWISE, THE ENERGY WILL COME OUT THE TOP WHICH WOULD BE DIFFICULT TO CONTROL.

SPACING IS THE DISTANCE BETWEEN ADJACENT BLAST HOLES, MEASURED PERPENDICULAR TO THE BURDEN. THIS IS DETERMINED BY THE SIZE OF CHARGE, ROCK FORMATION (STRATA) AND AMOUNT OF ROCK BEING FRAGMENTED AND DISPLACED BY EACH CHARGED HOLE.

HOLE DEPTH IS DETERMINED BY MANY FACTORS. FIRST RULE OF THUMB COVERS ONLY THE RECOMMENDED MINIMUM

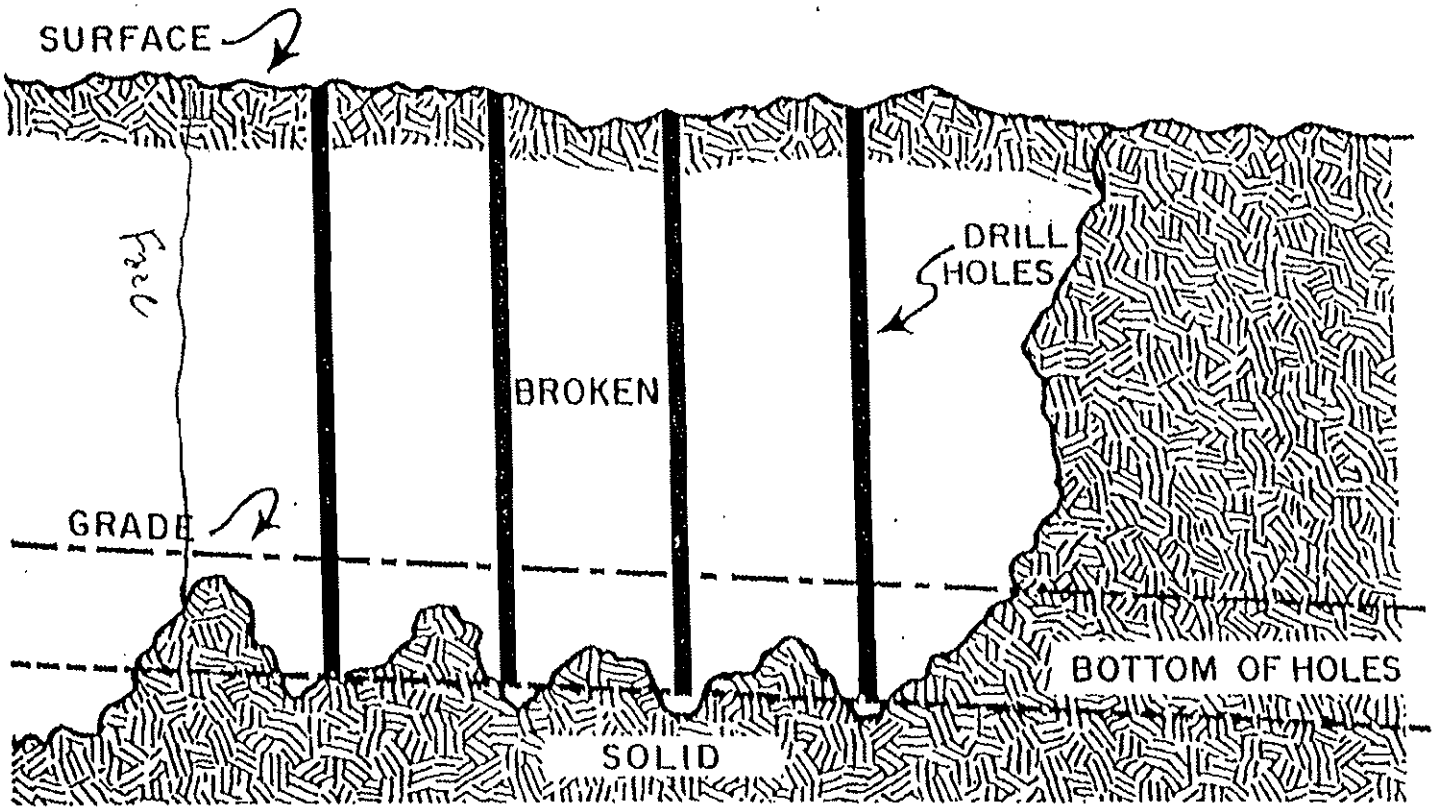
$$H\text{-}D = 2X\ (B)$$

WHERE H-D = HOLE DEPTH IN FEET
B = BURDEN IN FEET

WHICH MEANS IF YOU HAVE 4' OF BURDEN ON THE HOLE THE MINIMUM DEPTH OF HOLE WOULD HAVE TO BE 8' DEEP AND SUBDRILLING BECAUSE OF PEAKS OF ROCK BETWEEN DRILL HOLES.

SECOND RULE OF THUMB FOR SUBDRILLING IS TO DRILL 20% TO 50% OF THE BURDEN ON THE HOLE IF THERE IS A NATURAL SEAM 2' BELOW THE BOTTOM OF THE HOLE, THERE IS A POSSIBILITY THAT THE ROCK COULD POSSIBLY FRACTURE TO THAT DEPTH BUT CANNOT BE DETERMINED UNTIL EXCAVATION TAKES PLACE.

A TYPICAL SHOT WOULD FRAGMENT AS SHOWN IN THIS ILLUSTRATION:



Drilling below the grade to insure breaking the entire bottom to the grade.

ALL STATE & LOCAL REGULATIONS ARE ADHERED TO ANDA SEISMIC RECORDING OF EACH BLAST SHOT IS TAKEN AT THE NEAREST STRUCTURE.

THE STATE AND LOCAL GOVERNING BODIES ARE NOTIFIED EACH DAY PRIOR TO BLASTING.

AFTER EACH SHOT THE MUCK (BLASTED ROCK) IS EXCAVATED TO DETERMINE IF THE GRADE HAS BEEN ATTAINED WITH THE PROCEDURE USED, SOME OF THE MUCK IS PLACED BACK AGAINST THE FREE FACE TO HELP CONTROL ANY FRAGMENTS OF ROCK FROM ESCAPING FROM THE NEXT BLAST AND TO LOWER THE DB'S (AIRBLAST) WHICH IS ALSO MONITORED BY THE SEISMOGRAPH.

WHEN WE ASSESS AN AREA THAT NEEDS BLASTING ALL THESE FACTORS AND OTHERS ARE TAKEN INTO CONSIDERATION.

THE TYPE OF ROCK THAT HAS TO BE BLASTED, WHICH DICTATES WHAT TYPE AND AMOUNT OF ENERGY WILL BE NEEDED TO ACHIEVE THE RESULTS THAT ARE DESIRED, AS WELL AS THE PUBLIC RELATIONS WITH NEIGHBORS, OTHER STRUCTURES OR UTILITIES ADJACENT OR NEARBY.

WE USUALLY START BY SHOOTING THREE TO SIX HOLES ON THE FIRST SHOT AND DELAYING EACH HOLE BY 25 MILLISECONDS USING DIRT IF AVAILABLE WITH CABLE BLASTING MATS BEING STRATEGICALLY PLACED TO ATTEMPT TO CONTROL THE FRAGMENTED PIECES TO AN AREA THAT IS SATISFACTORY.

THIS METHOD IS REPEATED TO ACCOMPLISH WHAT NEEDS TO BE BLASTED.

WHAT MOST PEOPLE ASK IS, HOW DO YOU KNOW HOW MUCH EXPLOSIVES DO YOU HAVE TO PLACE IN THE HOLE?

THERE IS A RULE OF THUMB IN THIS CALCULATION WHICH IS WHEN FIGURING THE CUBIC YARDS OF ROCK THAT THE HOLE WILL FRAGMENT AND DISPLACE. IT WILL TAKE FROM 1.2 LBS. TO 3.5 LBS. PER CUBIC YARD TO ACCOMPLISH THIS TASK DEPENDENT ON THE GEOLOGICAL FORMATION AND TYPE OF ROCK THAT HAS TO BE BLASTED.

WE USUALLY START WITH 1.4 LBS. IF THE ROCK IS HARD AND DENSE WITH SUFFICIENT BLAST MATS TO CONFINE THE FIRST TRIAL BLAST, THEN CHANGE OR ADJUST WHAT IS NEEDED AS YOU PROGRESS.

Material Safety Data Sheet

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MSDS # 1122
Date 05/13/05

Supersedes
MSDS # 1122 01/24/08

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s):
NONEL® MS
NONEL® LP
NONEL® SL
NONEL® TD
NONEL® MS CONNECTOR
NONEL® TWINPLEX™
NONEL® STARTER
NONEL® EZ DET®
NONEL® EZTL™
NONEL® EZ DRIFTER ®
OPTIMIZER® OPTISLIDE®
OPTIMIZER® OPTISURFACE®
OPTIMIZER® OPTI-TL®

Product Class: NONEL® Non-electric Delay Detonators

Product Appearance & Odor: Aluminum cylindrical shell with varying length and diameter of attached colored plastic tubing. The detonator may be enclosed in a plastic housing, and an assembly may contain two detonators. Odorless.

DOT Hazard Shipping Description: Detonators, non-electric 1.1B UN0029 II
-or- Detonator assemblies, non-electric 1.1B UN0360 II
-or- Detonator assemblies, non-electric 1.4B UN0361 II

NFPA Hazard Classification: Not Applicable (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

Ingredients	CAS#	Occupational Exposure Limits OSHA PEL-TWA	ACGIH TLV-TWA
Pentaerythritol Tetranitrate (PETN)	78-11-5	None[1]	None[2]
Lead Azide	13424-46-9	0.05 mg (Pb)/m^3	0.05 mg (Pb)/m^3
Lead	7439-92-1	0.05 mg (Pb)/m^3	0.05 mg (Pb)/m^3
Silicon	7440-21-3	15 mg / m^3 (total dust) 5 mg / m^3 (respirable fraction)	10 mg / m^3
Selenium	7782-49-2	0.2 mg/m^3	0.2 mg/m^3
Red Lead (Lead tetroxide)	1314-41-6	0.05 mg (Pb)/m^3	0.05 mg (Pb)/m^3
Titanium dioxide	13463-67-7	15 mg/m^3	10 mg/m^3
Barium Chromate	10294-40-3	1 mg (CrO_3)/10m^3 (ceiling) 0.5 mg (Ba)/m^3	0.01 mg (Cr)/m^3 0.5 mg (Ba)/m^3
Lead Chromate	7758-97-6	0.05 mg (Pb)/m^3 1 mg (CrO_3)/10m^3 (ceiling)	0.15 mg (Pb)/m^3 0.012 mg (Cr)/m^3
Barium Sulfate	7727-43-7	0.5 mg (Ba)/m^3	10 mg/m^3
Potassium Perchlorate[3]	7778-74-7	None[1]	None[2]
Silica (crystalline)	61790-53-2	See Note Below	0.05 mg/m^3 (resp frac)
Molybdenum	7439-98-7	None[1]	None[2]

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Tungsten	7440-33-7	None[1]	5 mg/m³ (TWA) 10 mg/m³ (STEL)
Aluminum	7429-90-5	15 mg/m³ (total dust) 5 mg/m³ (respirable fraction)	5 mg/m³
Antimony	7440-36-0	0.5 mg/m³	0.5 mg/m³
Cyclotetramethylene Tetranitramine (HMX)	2691-41-0	None[1]	None[2]

[1] Use limit for particulates not otherwise regulated (PNOR): Total dust, 15 mg/m³ ; respirable fraction, 5 mg/m³ .
[2] Use limit for particulates not otherwise classified (PNOC): Inhalable particulate, 10 mg/m³ ; respirable part., 3 mg/m³ .
Note: The OSHA PEL for crystalline silica is calculated as follows:
Quartz, respirable: 10 mg/m³ [2] / % SiO_2 + 2 Quartz, total dust: 30 mg/m³ / % SiO_2 + 2
[3] Not all delay periods contain perchlorate. Those that do contain between from about 4 to a maximum of about 60 mg perchlorate per detonator.

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

SECTION III - PHYSICAL DATA

Boiling Point: Not Applicable
Vapor Density: Not Applicable
Percent Volatile by Volume: Not Applicable
Evaporation Rate (Butyl Acetate = 1): Not Applicable
Vapor Pressure: Not Applicable
Density: Not Applicable
Solubility in Water: Not Applicable

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not Applicable
Flammable Limits: Not Applicable
Extinguishing Media: (See Special Fire Fighting Procedures section.)
Special Fire Fighting Procedures: Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe, distant location. Allow fire to burn unless it can be fought remotely or with fixed extinguishing systems (sprinklers).
Unusual Fire and Explosion Hazards: Can explode or detonate under fire conditions. Burning material may produce toxic vapors.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

This is a packaged product that will not result in exposure to the explosive material under normal conditions of use. Exposure concerns are primarily with post-detonation reaction products, particularly heavy metal compounds.

Eyes: No exposure to chemical hazards anticipated with normal handling procedures. Particulates in the eye may cause irritation, redness, swelling, itching, pain and tearing.
Skin: No exposure to chemical hazards anticipated with normal handling procedures. Exposure to post-detonation reaction products may cause irritation.
Ingestion: No exposure to chemical hazards anticipated with normal handling procedures. Post-detonation reaction product residue is toxic by ingestion. Symptoms may include gastroenteritis with abdominal pain, nausea, vomiting and diarrhea. See systemic effects below.

Material Safety Data Sheet

Inhalation: Not a likely route of exposure. See systemic effects below.
Systemic or Other Effects: None anticipated with normal handling procedures. Repeated inhalation or ingestion of post-detonation reaction products may lead to systemic effects such as respiratory tract irritation, ringing of the ears, dizziness, elevated blood pressure, blurred vision and tremors. Heavy metal (lead) poisoning can occur.
Carcinogenically: ACGIH classifies Lead as a "Suspected Human Carcinogen" and Insoluble Chromium VI as "Confirmed Human Carcinogen". NTP, OSHA, and IARC consider components contained in this detonator carcinogenic.

Perchlorate: Perchlorate can potentially inhibit iodide uptake by the thyroid and result in a decrease in thyroid hormone. The National Academy of Sciences (NAS) has reviewed the toxicity of perchlorate and has concluded that even the most sensitive populations could ingest up to 0.7 microgram perchlorate per kilogram of body weight per day without adversely affecting health. The USEPA must establish a maximum contaminant level (MCL) for perchlorate in drinking water by 2007, and this study by NAS may result in a recommendation of about 20 ppb for the MCL.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.
Skin: Wash with soap and water.
Ingestion: Seek medical attention.
Inhalation: Not applicable.
Special Considerations: None

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions, may explode when subjected to fire, supersonic shock or high-energy projectile impact.
Conditions to Avoid: Keep away from heat, flame, ignition sources, impact, friction, electrostatic discharge and strong shock. Do not attempt to disassemble.
Materials to Avoid (Incompatibility): Corrosives (acids and bases or alkalis).
Hazardous Decomposition Products: Carbon Monoxide (CO), Nitrous Oxides (NO_x), Sulfides, Chromates, Lead (Pb), Antimony (Sb) and various oxides and complex oxides of metals.
Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Protect from all ignition sources. In case of fire evacuate all personnel to a safe distant area and allow to burn or fight fire remotely. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. If loose explosive powder is spilled, such as from a broken detonator, only properly qualified and authorized personnel should be involved with handling and clean-up activities. Spilled explosive powder is extremely sensitive to initiation and may detonate. Follow applicable Federal, State, and local spill reporting requirements.

Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

Material Safety Data Sheet

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: None required for normal handling. Provide enhanced ventilation after use if in underground mines or other enclosed areas.

Respiratory Protection: None required for normal handling.

Protective Clothing: Cotton gloves are recommended.

Eye Protection: Safety glasses are recommended.

Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry, well-ventilated location. Store in compliance with Federal, State, and local regulations. Only properly qualified and authorized personnel should handle and use explosives. Keep away from heat, flame, ignition sources, impact, friction, electrostatic discharge and strong shock.

Precautions to be taken during use: Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death. Avoid breathing the fumes or gases from detonation of explosives. Detonation in confined or unventilated areas may result in exposure to hazardous fumes or oxygen deficiency.

Other Precautions: It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

Material Safety Data Sheet

SECTION X - SPECIAL INFORMATION

These products contain the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Chemical Name	CAS Number	Max. lbs/1000 units
Lead	7439-92-1	39.4
	(Use Toxic Chemical Category Code)	
Lead Compounds	N420	2.0
Barium Compounds	N040	1.8
Chromium Compounds	N090	1.9

Range* of Section 313 Chemicals in each product

Product	lb Pb per 1000 detonators	lb Pb compounds per 1000 detonators	lb Ba compounds per 1000 detonators	lb Cr compounds per 1000 detonators
NONEL® MS	0 - 27	0.3 – 1.5	0 – 0.9	0 – 0.9
NONEL® LP	0 - 30	0.3 – 2.0	0 - 1.8	0 - 1.9
NONEL® SL	7 - 27	0.3 – 1.5	0	0
NONEL® TD	0 - 18	0.3 – 0.7	0	0
NONEL® MS Connector	5 - 16	0.3 – 0.4	0	0
NONEL® TWINPLEX™	5 - 15	0.3 – 0.7	0	0
NONEL® STARTER	0	0.3	0	0
NONEL® EZ DET®	22 - 36	2.0	0	0
NONEL® EZTL™	5 - 16	0.5 – 0.7	0	0
NONEL® EZ DRIFTER	39.4	1.3	1.2	1.3
NONEL® OPTISLIDE®	0	0	0	0
NONEL® OPTISURFACE®	0	0	0	0
NONEL® OPTI-TL®	0	0	0	0

* The exact quantity and weight percent of Section 313 Chemicals in each delay period and tubing length for each product is available upon request.

Disclaimer

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MSDS # 1124
Date 01/24/05

Supercedes
MSDS # 1124 10/20/04

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): NONEL® LEAD LINE

Product Class: Shock Tube

Product Appearance & Odor: Hollow plastic tubing (normally yellow) with dusty inner coating of HMX and aluminum. No detectable odor.

DOT Hazard Shipping Description: Articles, explosive, n.o.s. (HMX) 1.4S UN0349 II.
For 10,000 ft spools with Wire Lock Terminations only, Not regulated as an explosive, 0000

NFPA Hazard Classification: Not Applicable (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

			Occupational Exposure Limits	
Ingredients:	**CAS#**	**% (Range)**	**OSHA PEL-TWA**	**ACGIH TLV-TWA**
Cyclotetramethylene Tetranitramine (HMX)	2691-41-0	0.35	None[1]	None[2]
Aluminum (dust)	7429-90-5	0.04	15 mg/m³ (total) 5 mg/m³ (respirable)	10 mg/m³

[1] Use limit for particulates not otherwise regulated (PNOR): Total dust, 15 mg/m³ ; respirable fraction, 5 mg/m³.
[2] Use limit for particulates not otherwise classified (PNOC): Inhalable particulate, 10 mg/m³ ; respirable part., 3 mg/m³.
Note: The above hazardous dust mixture is present at approximately 15 mg per meter of tubing.

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in daminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

SECTION III - PHYSICAL DATA

Boiling Point: Not Applicable
Vapor Density: Not Applicable
Melting Point: HMX decomposes violently at melting pt., about 278°C
Evaporation Rate (Butyl Acetate = 1): Not Applicable
Vapor Pressure: Not Applicable
Density: Not Applicable
Solubility in Water: Not Soluble
Percent Volatile by Volume: Not Applicable

Material Safety Data Sheet

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not Applicable
Flammable Limits: Not Applicable
Extinguishing Media: Water, inert powder, CO_2
Special Fire Fighting Procedures: For shock tube only, consider initial isolation of at least 15 meters (50 feet) in all directions. Fight fire with normal precautions and methods used for plastic fires from a reasonable distance. IF DETONATORS OR OTHER EXPLOSIVES ARE PRESENT, DO NOT FIGHT FIRE.
Unusual Fire and Explosion Hazards: May burn vigorously with localized detonations and projection of fragments, with effects usually confined to the immediate vicinity of packages. Toxic smoke from combustion of the plastic material may be emitted. If product functions, high heat and pressure are released from the end of the tube if not covered or enclosed, typically by a metal device.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

This is a packaged product that will not result in exposure to hazardous ingredients (inner coating materials) under normal conditions of use.
Eyes: Not a likely route of exposure. Dust particles may be irritating.
Skin: Not a likely route of exposure. Dust particles may cause skin irritation.
Ingestion: Not a likely route of exposure. Ingestion of large amounts of the reactive powder (HMX) is poisonous and may cause cardiovascular collapse.
Inhalation: Not a likely route of exposure. Breathing dust can cause respiratory irritation. During manufacture and at processing temperatures, irritating fumes may evolve.
Systemic or Other Effects: None known.
Carcinogenicity: No constituents are listed by NTP, IARC or OSHA.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.
Skin: Wash with soap and water.
Ingestion: Not Applicable
Inhalation: Not Applicable
Special Considerations: None.

SECTION VI - REACTIVITY DATA

Stability: Stable
Conditions to Avoid: Keep away from heat, flame, impact, friction, ignition sources and strong shocks. Also avoid stretching to failure.
Materials to Avoid (Incompatibility): Incompatible with strong oxidizers and acids.
Hazardous Decomposition or Combustion Products: Hazardous carbon monoxide (CO), nitrogen oxide (NO_x) gases and products of plastic decomposition produced.
Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Protect from all ignition sources. In case of fire evacuate area not less than 50 feet in all directions. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, repackage undamaged devices in original packaging, accounting for every device. If the ends or tube wall have been opened such that powder may have

Material Safety Data Sheet

been released from the tube, isolate the spill area. Contamination of the HMX/Aluminum powder with sand, grit or dirt will render the material more sensitive to detonation. Carefully wet down and clean "loose" powder spills using a damp sponge or rag, avoid applying friction or pressure to the explosive, and place in a (Velostat) electrically conductive bag. Follow applicable Federal, State, and local spill reporting requirements.
Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: None normally required. Provide enhanced ventilation if used in underground mines, indoors or other enclosed areas.
Respiratory Protection: None normally required. Extended testing of the product indoors or in enclosed areas may necessitate respiratory protection.
Protective Clothing: None normally required. Wear chemical-resistant gloves during post-detonation cleanup or spill cleanup operations.
Eye Protection: Safety glasses or goggles are recommended for handling, testing or cleanup.
Other Precautions Required: None

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry, well-ventilated location. Store in compliance with Federal, State, and local regulations. Keep away from heat, flame, ignition sources and strong shock. Only properly qualified and authorized personnel should handle and use Shock Tube.
Precautions to be taken during use: Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death. Avoid breathing the fumes or gases from detonation of explosives. Detonation in confined or unventilated areas may result in exposure to hazardous fumes or oxygen deficiency.
Other Precautions: It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

SECTION X - SPECIAL INFORMATION

This product contains the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Chemical Name	CAS Number	% By Weight
None		

Disclaimer

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MSDS # 1076
Date 10/25/07

Superceded
MSDS # 1076 01/24/05

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): ELECTRIC SUPER™ COAL
ELECTRIC SUPER™ LP
ELECTRIC SUPER™ SP
ELECTRIC SUPER™ SEISMIC
ELECTRIC SUPER™ INSTANT
DIPED™

Product Class: Detonators, Electric

Product Appearance & Odor: Metal cylinder with varying length of attached plastic coated wires.

DOT Hazard Shipping Description: Detonators, Electric 1.1B UN0030 II
Or
Detonators, Electric 1.4B UN0255 II
Or
Detonators, Electric 1.4S UN0456 II

NFPA Hazard Classification: Not Applicable (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

Ingredients	CAS#	EXPOSURE LIMITS OSHA PEL-TWA	ACGIH TLV-TWA
Tungsten	7440-33-7	None[1]	5 mg/m³ (TWA) 10 mg/m³ (STEL)
Barium Chromate	10294-40-3	1 mg (CrO_3)/10m³ (ceiling) 0.5 mg (Ba)/m³ 0.5 mg (Pb)/m³	0.01 mg (Cr)/m³ 0.5 mg (Ba)/m³ 0.5 mg (Pb)/m³
Lead Compounds	---	None[1]	None[1]
Pentaerythritol Tetranitrate (PETN)	78-11-5	No Value Established	No Value Established
Boron	7440-42-8	None[1]	None[1]
Potassium Perchlorate[2]	7778-74-7	No Value Established	No Value Established
Diazodinitrophenol (DDNP)	4682-03-5	No Value Established	No Value Established
Nitrocellulose	9004-70-0		

[1] Use limit for particulates not otherwise regulated (PNOR): Total dust, 15 mg/m³ ; respirable fraction, 5 mg/m³ .
[2] Use limit for particulates not otherwise classified (PNOC): Inhalable particulate, 10 mg/m³ ; respirable part., 3 mg/m³ .
[3] Not all delay periods contain perchlorate. Those that do contain between from about 4 to a maximum of about 25 mg perchlorate per detonator.

Material Safety Data Sheet

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

SECTION III - PHYSICAL DATA

Boiling Point: Not Applicable
Vapor Density: Not Applicable
Percent Volatile by Volume: Not Applicable
Vapor Pressure: Not Applicable
Density: Not Applicable
Solubility in Water: Not Applicable

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not Applicable
Flammable Limits: Not Applicable
Extinguishing Media: None
Special Fire Fighting Procedures: Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe location, no less than 2,500 feet in all directions.
Unusual Fire and Explosion Hazards: Can explode or detonate under fire conditions. Burning material may produce toxic vapors.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

This is a packaged product that will not result in exposure to the explosive material under normal conditions of use. Exposure concerns are primarily with post-detonation reaction products, particularly heavy metal compounds.

Eyes: No exposure to chemical hazards anticipated with normal handling procedures. Particulates in the eye may cause irritation, redness and tearing.
Skin: No exposure to chemical hazards anticipated with normal handling procedures.
Ingestion: No exposure to chemical hazards anticipated with normal handling procedures.
Inhalation: Not a likely route of exposure.
Systemic or Other Effects: None anticipated with normal handling procedures. Repeated inhalation or ingestion of post-detonation reaction products may lead to systemic effects such as respiratory tract irritation, ringing of the ears, dizziness, elevated blood pressure, blurred vision and tremors. Heavy metal (lead) poisoning can occur.
Carcinogenicity: ACGIH classifies Lead as a "Suspected Human Carcinogen" and Insoluble Chromium VI as "Confirmed Human Carcinogen". NTP, OSHA, and IARC consider components contained in this detonator carcinogenic.
Perchlorate: Perchlorate can potentially inhibit iodide uptake by the thyroid and result in a decrease in thyroid hormone. The National Academy of Sciences (NAS) has reviewed the toxicity of perchlorate and has concluded that even the most sensitive populations could ingest up to 0.7 microgram perchlorate per kilogram of body weight per day without adversely affecting health. The USEPA must establish a maximum contaminant level (MCL) for perchlorate in drinking water by 2007, and this study by NAS may result in a recommendation of about 20 ppb for the MCL.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.
Skin: Wash with soap and water.
Ingestion: Seek medical attention.
Inhalation: Not applicable.
Special Considerations: None

Material Safety Data Sheet

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions, may explode when subjected to fire, supersonic shock or high-energy projectile impact, especially when confined or in large quantities.
Conditions to Avoid: Keep away from heat, flame, ignition sources, strong shock and electrical impulse. Do not attempt to disassemble.
Materials to Avoid (Incompatibility): Corrosives (acids and bases)
Hazardous Decomposition Products: Carbon Monoxide (CO), Nitrous Oxides (NO_x), Lead (Pb) and various oxides and complex oxides of metals.
Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Protect from all ignition sources. In case of fire evacuate area not less than 2,500 feet in all directions. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. Follow applicable Federal, State, and local spill reporting requirements.
Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Not required for normal handling.
Respiratory Protection: None normally required.
Protective Clothing: Cotton clothing is suggested.
Eye Protection: Safety glasses are recommended.
Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry, well-ventilated location. Store in compliance with Federal, State, and local regulations. Keep away from heat, flame, ignition sources, strong shock, and electrical impulses.
Precautions to be taken during use: Avoid breathing the fumes or gases from detonation of explosives. Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death.
Other Precautions: It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

Material Safety Data Sheet

SECTION X - SPECIAL INFORMATION

This product contains the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Chemical Name	CAS Number (Use Toxic Chemical Category Code)	% By Weight
Barium Compounds	N040	1.2
Lead Compounds	N420	0 – 0.59
Chromium Compounds	N090	1.2

Amount of Lead in Detonator Product Line *				
Product	Pb compounds in detonator [grams]	Pb compounds in detonator [Wt.%]	Pb in detonator [grams]	Pb in detonator [Wt. %]
Electric Super SP	0.0412	0.588%	0.0357	0.5093%
Electric Super LP	0.0412	0.588%	0.0357	0.5093%
Electric Super Coal	0.0412	0.588%	0.0357	0.5093%
Electric Super Seismic	0.0000	0.0000%	0.0000	0.0000%
Electric Super Instant	0.0000	0.0000%	0.0000	0.0000%

*Applies to only the detonator (source of lead). Do not use case weight or weight of any other component.

Disclaimer

Dyno Nobel Inc. and its subsidiaries disclaim any warranties with respect to this product, the safety or suitability thereof, the information contained herein, or the results to be obtained, whether express or implied, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND/OR OTHER WARRANTY. The information contained herein is provided for reference purposes only and is intended only for persons having relevant technical skills. Because conditions and manner of use are outside of our control, the user is responsible for determining the conditions of safe use of the product. Buyers and users assume all risk, responsibility and liability whatsoever from any and all injuries (including death), losses, or damages to persons or property arising from the use of this product or information. Under no circumstances shall either Dyno Nobel Inc. or any of its subsidiaries be liable for special, consequential or incidental damages or for anticipated loss of profits.

Material Safety Data Sheet

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CANUTEC (CANADA) 613-996-6666

MSDS # 1030
Date 09/05/07

Supercedes
MSDS # 1030 03/27/07

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s):

DYNO® AP
DYNO® AP PLUS
DYNO® AP PLUS LD
DYNO® E5
DYNO® MC
DYNO® MC PLUS
DYNO® SL
DYNO® SL PLUS
DYNO® TX
DYNO® XTRA
DYNOSPLIT® AP
POWERMITE®
POWERMITE® AP
POWERMITE® Canadian
POWERMITE® LD
POWERMITE® LD PLUS
POWERMITE® PLUS
POWERMITE® RAISE BOMB™
POWERMITE® SL
POWERMITE® SL PLUS

Product Class: Emulsion Explosives, Packaged

Product Appearance & Odor: White or pink opaque semi-solid, which will appear gray if product contains aluminum. Little or no odor. Typically paper or plastic chub packaging.

DOT Hazard Shipping Description: Explosive, Blasting, Type E 1.1D UN0241 II

NFPA Hazard Classification: Not Available (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

Ingredients:	CAS#	% (Range)	Occupational Exposure Limits ACGIH TLV-TWA	OSHA PEL-TWA
Ammonium Nitrate	6484-52-2	60-80	None	None
Sodium Nitrate	7631-99-4	10-18	None	None
Aluminum	7429-90-5	0-15	10 mg/m^3 (dust)	15 mg/m^3 (total)
Mineral Oil	64742-35-4	0-3	5 mg/m^3 (mist)	None

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

Material Safety Data Sheet

SECTION III - PHYSICAL DATA

Boiling Point: Not Applicable

Vapor Density: (Air = 1) Not Applicable

Percent Volatile by Volume: <20 (water)

Evaporation Rate (Butyl Acetate = 1): <1

Vapor Pressure: Not Applicable

Density: 0.95-1.25 g/cc

Solubility in Water: Product partially dissolves very slowly in water.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: >100°C

Flammable Limits: Not Applicable

Extinguishing Media: (See Special Fire Fighting Procedures section.)
Special Fire Fighting Procedures: Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe location, no less than 2,500 feet in all directions.
Unusual Fire and Explosion Hazards: Can explode or detonate under fire conditions. Burning material may produce toxic vapors.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

Eyes: May cause irritation, redness and tearing.
Skin: Prolonged contact may cause irritation.
Ingestion: Large amounts may be harmful if swallowed.
Inhalation: Not a likely route of exposure.
Systemic or Other Effects: None known.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least fifteen minutes. If irritation persists seek medical attention.
Skin: Remove contaminated clothing. Wash with soap and water.
Ingestion: Seek medical attention.
Inhalation: If irritation occurs, remove to fresh air.
Special Considerations: None.

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions, may explode when subjected to fire, supersonic shock or high-energy projectile impact, especially when confined or in large quantity.
Conditions to Avoid: Keep away from heat, flame, ignition sources and strong shock.
Materials to Avoid (Incompatibility): Corrosives (strong acids and strong bases or alkalis).
Hazardous Decomposition Products: Nitrogen Oxides (NO_x),Carbon Monoxide (CO)
Hazardous Polymerization: Will not occur.

Material Safety Data Sheet

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Protect from all ignition sources. In case of fire evacuate area not less than 2,500 feet in all directions. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. Follow applicable Federal, State, and local spill reporting requirements.
Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Not required for normal handling.
Respiratory Protection: None normally required.
Protective Clothing: Gloves and work clothing that reduce skin contact are suggested.
Eye Protection: Safety glasses are recommended.
Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry, well-ventilated location. Store in compliance with Federal, State and local regulations. Keep away from heat, flame, ignition sources and strong shock.
Precautions to be taken during use: Avoid breathing the fumes or gases from detonation of explosives. Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death.
Other Precautions: It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

SECTION X - SPECIAL INFORMATION

The reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372 may become applicable if the physical state of this product is changed to an aqueous solution. If an aqueous solution of this product is manufactured, processed, or otherwise used, the nitrate compounds category and ammonia listing of the previously referenced regulation should be reviewed.

Material Safety Data Sheet

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FOR 24 HOUR EMERGENCY, CALL CHEMTREC (USA) 800-424-9300
CANUTEC (CANADA) 613-996-6666

MSDS # 1063
Date 07/02/07

Supersedes
MSDS # 1063 03/27/07

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s):

BLASTEX®
BLASTEX® PLUS
BLASTEX® PLUS HD
BLASTEX® TX
BLASTEX® TX PLUS
BLASTGEL® 1000
BLASTGEL® 1070
SUPER BLASTEX®
SUPER BLASTEX® TX
SUPER BLASTEX® TX
DYNO® 1.6 SB
DYNO® 1.5 SBC
DYNO® 1.6 SB30
DYNO® 900
DYNO® 1300
DYNO® 1500
DYNO® 1520
DYNO® 1540
DYNOTEX
DX-2011
DX-2012

Product Class: Emulsion Explosives, Packaged

Product Appearance & Odor: White or pink opaque semi-solid, which will appear gray if product contains aluminum. Little or no odor. Packaged in cylindrical cartridges of paper or plastic film.

DOT Hazard Shipping Description: Explosive, blasting, type E 1.5D UN0332 II

NFPA Hazard Classification: Not Applicable (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

Ingredients:	CAS#	% (Range)	Occupational Exposure Limits ACGIH TLV-TWA	OSHA PEL-TWA
Ammonium Nitrate	6484-52-2	60-85	None	None
Sodium Nitrate	7631-99-4	0-12	None	None
Aluminum	7429-90-5	0-10	10 mg/m³ (dust)	15 mg/m³ (total)
Mineral Oil	64742-35-4	0-6	5 mg/m³ (mist)	None
Kerosene	8008-20-6	0-6	None	None

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

Material Safety Data Sheet

SECTION III - PHYSICAL DATA

Boiling Point: Not Applicable
Vapor Density: (Air = 1) Not Applicable
Percent Volatile by Volume: <20 (water)

Evaporation Rate (Butyl Acetate = 1): <1

Vapor Pressure: Not Applicable
Density: 1.15-1.35 g/cc
Solubility in Water: Product partially dissolves very slowly in water.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: >100°C
Flammable Limits: Not Applicable
Extinguishing Media: (See Special Fire Fighting Procedures section.)
Special Fire Fighting Procedures: Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe location, no less than 2,600 feet in all directions.
Unusual Fire and Explosion Hazards: Can explode or detonate under fire conditions. Burning material may produce toxic vapors.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

Eyes: May cause irritation, redness and tearing.
Skin: Prolonged contact may cause irritation.
Ingestion: Large amounts may be harmful if swallowed.
Inhalation: Not a likely route of exposure.
Systemic or Other Effects: None known.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least 15 minutes. If irritation persists seek medical attention.
Skin: Remove contaminated clothing. Wash with soap and water.
Ingestion: Seek medical attention.
Inhalation: If irritation occurs, remove to fresh air.
Special Considerations: None.

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions, may explode when subjected to fire, supersonic shock or high-energy projectile impact, especially when confined or in large quantities.
Conditions to Avoid: Keep away from heat, flame, ignition sources and strong shock.
Materials to Avoid (Incompatibility): Corrosives (strong acids and strong bases or alkalis).
Hazardous Decomposition Products: Nitrogen Oxides (NO_x), Carbon Monoxide (CO)
Hazardous Polymerization: Will not occur

Material Safety Data Sheet

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Protect from all ignition sources. In case of fire evacuate area not less than 2,500 feet in all directions. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. Follow applicable Federal, State, and local spill reporting requirements.
Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Not required for normal handling.
Respiratory Protection: None normally required.
Protective Clothing: Gloves and work clothing that reduce skin contact are suggested.
Eye Protection: Safety glasses are recommended.
Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry, well-ventilated location. Store in compliance with Federal, State and local regulations. Keep away from heat, flame, ignition sources and strong shock.
Precautions to be taken during use: Avoid breathing the fumes or gases from detonation of explosives. Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death.
Other Precautions: It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

SECTION X - SPECIAL INFORMATION

The reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372 may become applicable if the physical state of this product is changed to an aqueous solution. If an aqueous solution of this product is manufactured, processed, or otherwise used, the nitrate compounds category and ammonia listing of the previously referenced regulation should be reviewed.

Material Safety Data Sheet

Dyno Nobel Inc.
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CANUTEC (CANADA) 613-996-6666

MSDS #1009
Date 04/26/07

Supercedes
MSDS # 1009 01/01/05

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): ANFO
DYNOMIX™, DYNOMIX™ (U.G.)
DYNOMIX™ WR
DYNOMIX™ HD
FRAGMAX™

Product Class: ANFO, Bulk or Packaged

Product Appearance & Odor: White, free-flowing solid prills with fuel oil odor. May be tinged pink or other color to distinguish from solid prills without fuel.

Hazard Shipping Description (U.S. DOT and Canada TDGR)
For ANFO, DYNOMIX™, DYNOMIX™ (U.G.), FRAGMAX™ : Ammonium nitrate-fuel oil mixture 1.5D NA0331 II
Or Explosive, blasting, type B 1.5D UN0331 II

Note: Either description is acceptable, but if already packaged, refer to packaging for which description to use.

For DYNOMIX™ WR: Explosive blasting, type B 1.5D UN0331 II
For DYNOMIX™ HD (Canada only): Explosive blasting, type B 1.1D UN0082 II

NFPA Hazard Classification: Not Available (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

Ingredients:	CAS#	% (Range)	Occupational Exposure Limits ACGIH TLV-TWA	OSHA PEL-TWA
Ammonium Nitrate	6484-52-2	92-95	None[1]	None[2]
Fuel Oil	68476-34-6	4-7	100 ppm	None
Guar Gum*	9000-30-0	0-3	None[1]	None[2]

[1] Use limit for particulates not otherwise regulated (PNOR): Total dust, 15 mg/m³ ; respirable fraction, 5 mg/m³ .
[2] Use limit for particulates not otherwise classified (PNOC): Inhalable particulate, 10 mg/m³ ; respirable part., 3 mg/m³ .

* DYNOMIX™ WR is the only product containing guar gum.

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

Material Safety Data Sheet

SECTION III - PHYSICAL DATA

Boiling Point: Not Applicable
Vapor Density: > 1
Percent Volatile by Volume: < 8 (Fuel oil)

Vapor Pressure: <5 mm Hg @ 75° F
Density: 0.8 to 1.1 g/cc bulk density
Solubility in Water: Ammonium Nitrate component completely soluble

Evaporation Rate (Butyl Acetate = 1): < 1

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: >120° F (49°C)
Flammable Limits: Not Available
Extinguishing Media: (See Special Fire Fighting Procedures section.)
Special Fire Fighting Procedures: Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe location, no less than 2,500 feet in all directions.
Unusual Fire and Explosion Hazards: Can explode or detonate under fire conditions. Burning material may produce toxic vapors.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

Eyes: May cause irritation, redness and tearing.
Skin: Prolonged contact may cause irritation.
Ingestion: Large amounts may be harmful if swallowed.
Inhalation: May cause dizziness, nausea or intestinal upset.
Systemic or Other Effects: None known.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least 15 minutes. If irritation persists, seek medical attention.
Skin: Wash with soap and water.
Ingestion: Seek medical attention.
Inhalation: Remove to fresh air.
Special Considerations: None.

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions. May explode when subjected to fire, supersonic shock or high-energy projectile impact, especially when confined or in large quantities.
Conditions to Avoid: Keep away from heat, flame, ignition sources and strong shock.
Materials to Avoid (Incompatibility): Corrosives (strong acids and strong bases or alkalis).
Hazardous Decomposition Products: Carbon Monoxide (CO) and Nitrogen Oxides (NO_x)
Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: In case of fire evacuate area not less than 2,500 feet in all directions. Protect from all ignition sources. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a

Material Safety Data Sheet

complete account of product has been made and is verified. If possible, plug drains or dike channels to prevent either material or water runoff from entering storm drains or surface waters. Follow applicable Federal; State and local spill reporting requirements.

Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Not required for normal handling. Forced ventilation may be necessary where natural ventilation is limited.
Respiratory Protection: None normally required. In a dusty environment, or in hot, enclosed areas, respiratory protection may be needed.
Protective Clothing: Gloves and work clothing that reduce skin contact are suggested.
Eye Protection: Safety glasses are recommended.
Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry, well-ventilated locations. Store in compliance with Federal, State, and local regulations. Keep away from heat, flame, ignition sources and strong shock.
Precautions to be taken during use: Avoid breathing the fumes from detonation of explosives. Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death.
Other Precautions: It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library publications.

SECTION X - SPECIAL INFORMATION

The reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372 may become applicable if the physical state of this product is changed to an aqueous solution. If an aqueous solution of this product is manufactured, processed, or otherwise used, the nitrate compounds category and ammonia listing of the previously referenced regulation should be reviewed.

Disclaimer

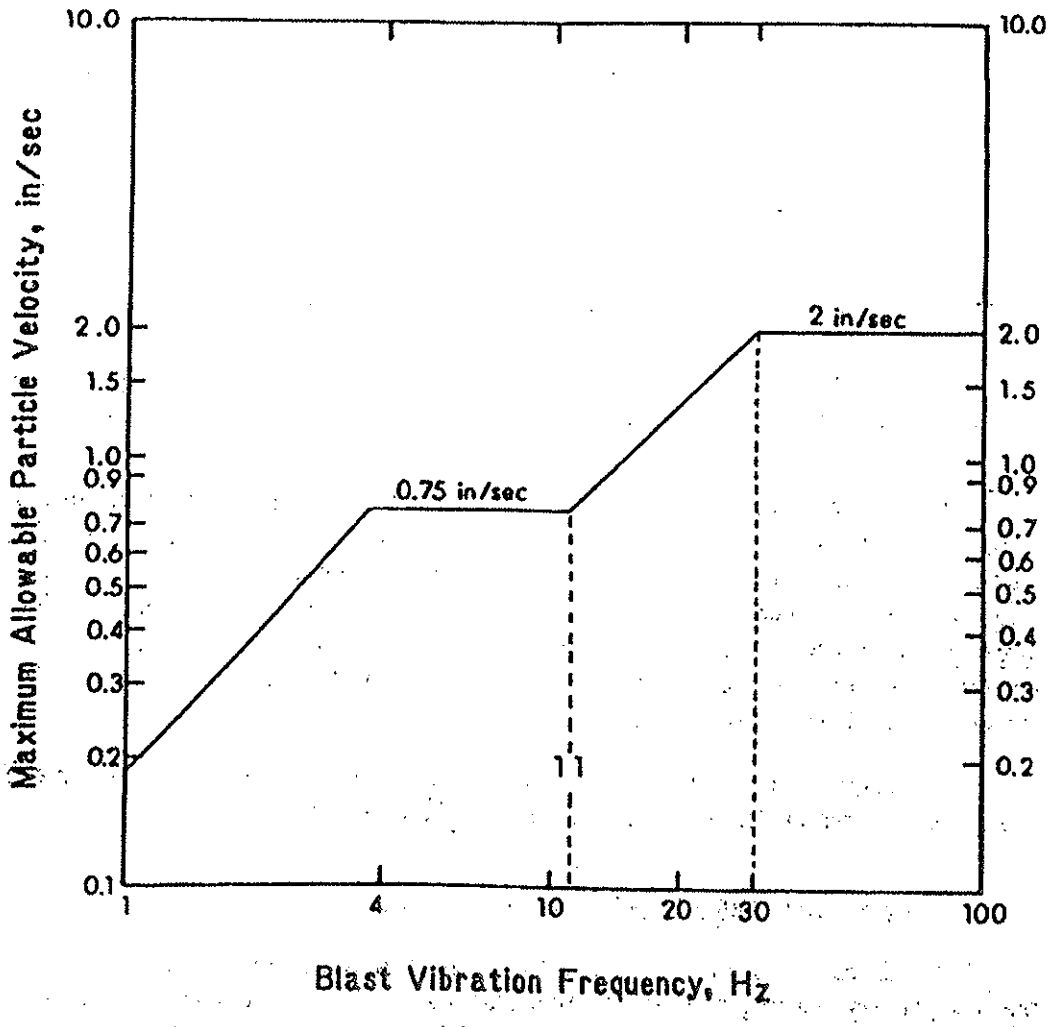
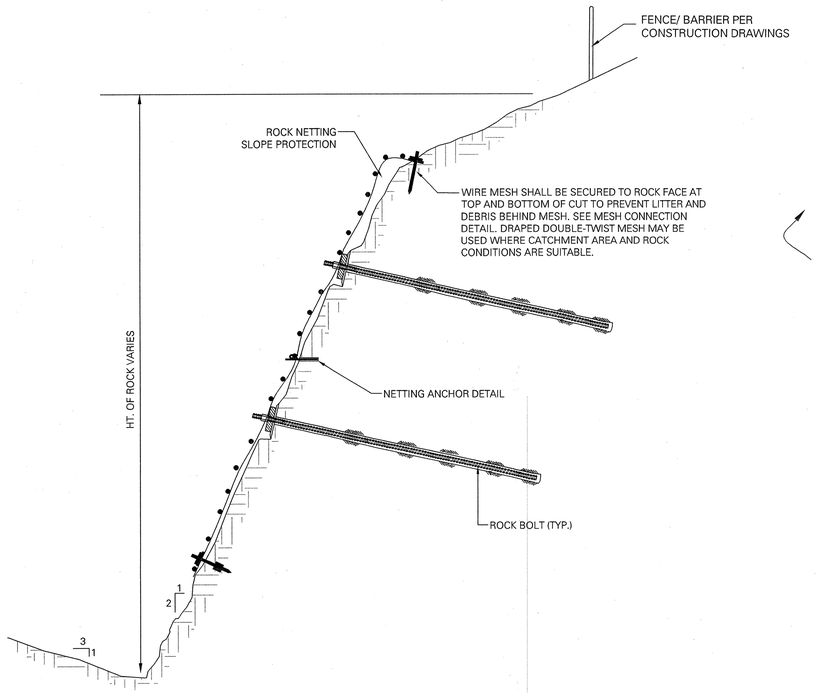


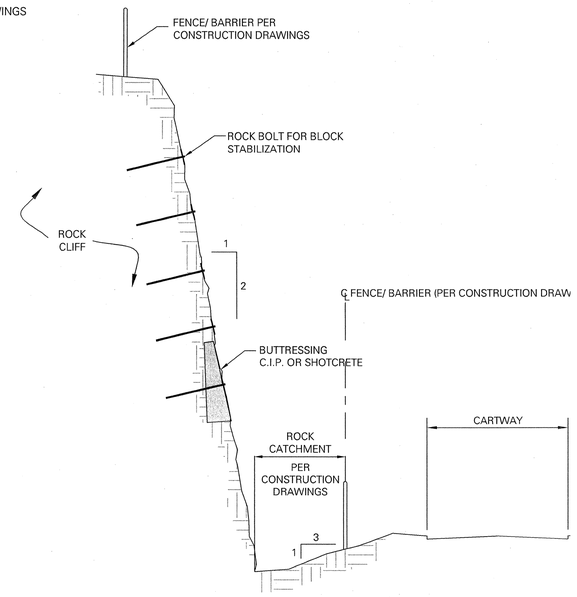
Figure 10.20 OSM Alternative Blasting Level Criteria (Modified from Figure B 1, RI 8507 U.S. Bureau of Mines)

APPENDIX B

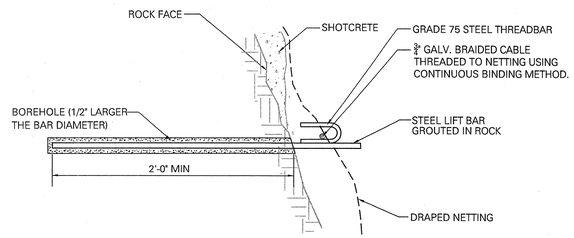
Typical Rock Fall Protection & Stabilization Methods; Drawing ST-1



1 ROCK NETTING
NOT TO SCALE



2 CROSS SECTIONS
NOT TO SCALE

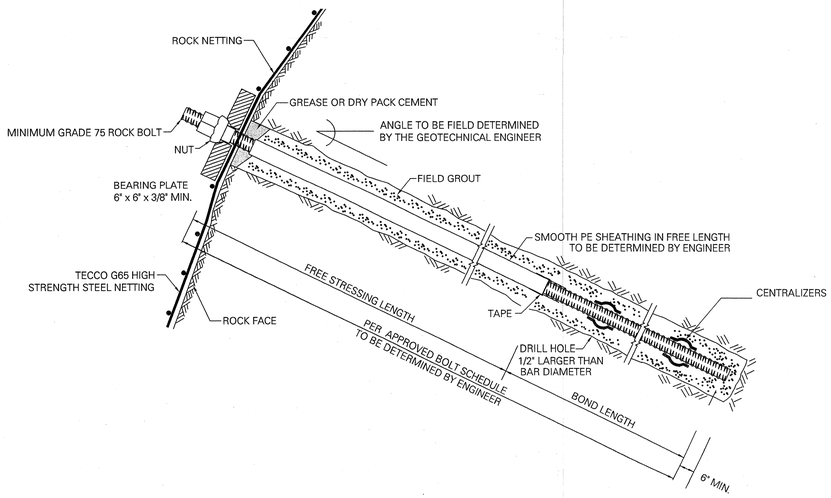


CROSS SECTION

NOTE:

FOR MID-SLOPE SUPPORT, USE GRADE 75 (MIN.) EPOXY-COATED OR GALVANIZED STEEL WITH BEARING PLATE AND NUT, SPACED 15 FT, CENTER-TO-CENTER, EMBEDMENT INTO ROCK TO BE FIELD DETERMINED.

3 NETTING ANCHOR DETAIL
NOT TO SCALE



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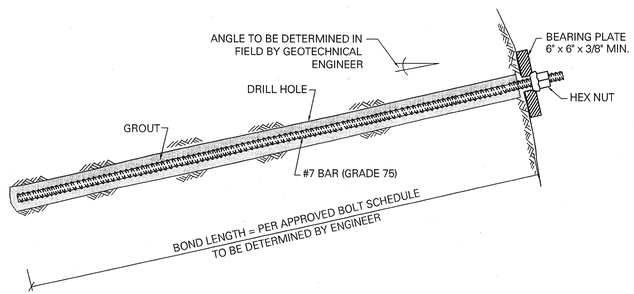

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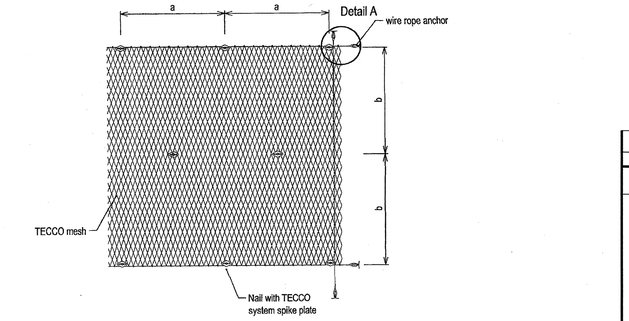

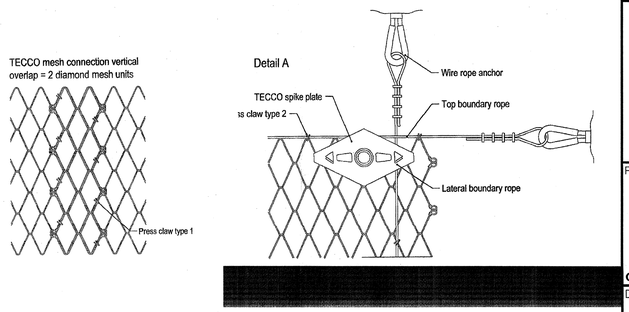

6 TECCO MESH DETAIL
NOT TO SCALE

GENERAL NOTES

1. METHODS OF STABILIZATION MAY INCLUDE SCALING AND RECONTOURING OF THE CUT. OTHER STABILIZATION AND ROCKFALL PROTECTION MEASURES MAY INCLUDE SHOTCRETE, ROCK BOLTS, DRAPED OR SECURED DOUBLE -TWIST GALVANIZED STEEL MESH, CONCRETE BUTTRESSING, DOWELLING, CATCHMENT DITCHES AND TRIMMING. THE INTENT OF STABILIZATION IS TO MINIMIZE THE USE OF EXTERNAL SUPPORT SO AS TO MAINTAIN THE NATURAL BEAUTY OF THE SITE. THUS, TO THE EXTENT POSSIBLE, RECONTOURING, SCALING AND TRIMMING SHALL BE CONSIDERED INITIALLY. DECORATIVE SHOTCRETE, SCULPTED TO PROVIDE A NATURAL APPEARANCE MAY BE USED SOLELY OR IN CONNECTION WITH ANY OF THE OTHER METHODS.
2. THIS PLAN PROVIDES TYPICAL DETAILS FOR THE METHODS THAT MAY BE ANTICIPATED TO BE USED TO STABILIZE ROCK CUTS ON THE SITE, IF NECESSARY. THE CONSTRUCTION DRAWINGS AND SPECIFICATIONS WILL BE PREPARED BY THE GEOTECHNICAL ENGINEER TO PROVIDE SITE INFORMATION. THE GEOTECHNICAL ENGINEER WILL SELECT AN APPROPRIATE METHOD OR COMBINATION OF METHODS MOST APPROPRIATE FOR AS-EXCAVATED SITE CONDITIONS.
3. EACH LOCATION REQUIRING STABILIZATION SHALL BE VERIFIED AND APPROVED BY THE ENGINEER. MATERIAL QUANTITIES, LOCATIONS AND THE ORIENTATION MAY BE MODIFIED BY THE ENGINEER BASED ON JOINT PATTERNS AND ROCK CONDITIONS ENCOUNTERED.

Date	Description	No.
Revisions		
9/9/08	AS PER TOWN ENGINEER'S COMMENTS	1

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NJ Certificate of Authorization No: 24GA27996400

Project

TUXEDO RESERVE
(PHASE 1 - SECTION 1)
TOWN OF TUXEDO
ORANGE COUNTY **NEW JERSEY**

Drawing Title

TYPICAL ROCK FALL PROTECTION & STABILIZATION METHODS

Project No. 9108601	Drawing No. ST-1
Date 10-16-09	
Scale NTS	
Drn. By AC	
Last Revised 9-9-08	

ISSUED FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

APPENDIX C

Wetlands Monitoring and Maintenance Plan

WETLAND MONITORING AND MAINTENANCE PLAN
FOR
TUXEDO RESERVE PLANNED INTEGRATED DEVELOPMENT
PHASE 1 SECTION 1 (NORTH RIDGE)
WETLAND AREA "WT"
TOWN OF TUXEDO
ORANGE COUNTY, NEW YORK

Prepared for:

Tuxedo Reserve Owner LLC
60 Columbus Circle
New York, New York 10023

Attn: Andrew Dance

Prepared by:

EcolSciences, Inc.
75 Fleetwood Drive, Suite 250
Rockaway, New Jersey 07866

May 22, 2008
Revised October 12, 2009

Overview

A concern has been raised regarding wetland area "WT" located in the Northridge section of the in the Tuxedo Reserve Planned Integrated Development. Development of the site will require that blasting occur within 25 feet of the wetland. In order to ensure that no impacts occur in the wetland a maintenance and monitoring plan has been prepared for the wetland. The maintenance plan is to protect the existing qualities of the wetland. The monitoring plan consists of two components, monitoring the water levels in the wetlands and monitoring the vegetation within the wetlands to determine if reduced water levels have allowed the encroachment into the wetlands of upland vegetation. In the unlikely event that disturbance to the hydrology of the wetland is identified during the maintenance and monitoring period, steps are outlined to mitigate for these disturbances.

The developer of this site, Tuxedo Reserve Owner, LLC, is dedicated to protecting, managing, and studying the on-site wetland and providing for their long-term maintenance. Management will be conducted by Tuxedo Reserve Owner, LLC during project construction. Following, construction, monitoring will be continued by the property owner, which may be Tuxedo Reserve Owner, LLC or its successor, including a homeowner association. The monitoring and maintenance plan is proposed as follows:

Monitoring and Maintenance Plan

1. *Baseline Monitoring*

The major concern for the long-term viability of wetland "WT" is to maintain the current water quantity reaching the wetland system to maintain the existing floral and faunal community and to prevent the invasion of the wetlands by extensive upland vegetation indicating a possible change in the wetland hydrology. Therefore, prior to construction baseline data will be collected to determine current conditions in wetland "WT" and provide a standard reference for the following years. Since the baseline data will provide the supporting documentation of what existing site conditions were like prior to construction, baseline monitoring proposes a more intensive monitoring schedule. It is anticipated that baseline monitoring will be representative of all four seasons prior to initiation of blasting. These tasks include:

- Prior to construction, to restrict any disturbance to the wetlands, a double-barrier silt fence or super fence will be established upgradient of the boundaries of the proposed limit of disturbance around the wetland. During construction these fences will be maintained on a regular basis to ensure proper installation and function. A permanent split rail fence with appropriate signage indicating the function and values of wetlands will be established prior to the completion of construction. Where the fence is located within individual properties, the owners may upgrade or replace but under no circumstances remove the fence.

- Establish 5 permanent 1 x 1 meter quadrats that will be used to monitor the status of the vegetative communities in the wetlands. Quadrat locations will be chosen randomly in the various vegetative communities documented in the wetland. The quadrat locations will be marked by rebar, surveyed (or GPS) and plotted on a topographic map.

- Sample the permanent quadrats to obtain baseline vegetative community diversity. Sampling of the quadrats will take place twice a year in the spring and fall. Photographs of the quadrats and surrounding wetlands and undeveloped upland buffers areas will be obtained during both sampling periods.

- Establish three shallow piezometers in the wetlands. The piezometers will be monitored to verify that blasting activities proposed during construction of Quail Road and the nearby detention basin do not impact groundwater/surface water levels within the wetlands. The piezometers will be located downgradient of the proposed development areas and basin and upgradient of Quail Road. The piezometers will be installed approximately 3-feet deep into the surface soils. The piezometers will be studied to review ground water fluctuations in the top two feet of the soil, the active root growth zone for most vegetative species. The locations of the proposed piezometers will be shown on the final construction plans prepared for the Northridge project. The piezometers will be monitored manually on a monthly basis for one year following installation.

- Establish three rain gauges on-site to record recharge on-site. The rain gauges will be monitored weekly.

- Collect monthly weather data, specifically precipitation totals from the Tuxedo area to provide a baseline of potential seasonal precipitation levels. If available, monthly data from the previous five-years will also be obtained to account for seasonal and yearly fluctuations in precipitation amounts. Compare weather data to 30 year Normal climatic data.

- Prepare annual report and submit to Town of Tuxedo Engineering Department for Review. The annual report will include the results for all sampling data, precipitation data, color photographs of the wetlands and uplands, and comments regarding site conditions, as necessary.

2. *Five-Year Monitoring and Maintenance Plan*

The major concern for long-term viability of the wetland is to maintain the current water quantity to the wetlands and to review the floral community to ensure no changes to the current wetland vegetative community. The primary indication that a change in the underlying hydrologic regime has occurred is the invasion of the wetland with upland

species. Careful monitoring following construction is required to maintain the system in its current condition. It is anticipated that monitoring will continue on a monthly basis during construction, specifically during blasting. Immediately following the completion of blasting, monitoring of the wetland will continue for five years following construction. Monitoring and maintenance for this five year period is as follows:

Year One through Five

- Sample the vegetation in spring and fall in the permanent quadrats to monitor and document any vegetational change.

- Take photographs during spring and fall site visits.

- Monitor piezometers. Monitoring will continue twice a year in the spring and fall. Results will be tabulated with information collected from the baseline sampling.

- Monitor rain gauges. Monitoring will be conducted weekly.

- Determine whether any measures are needed to supplement the hydrology of the wetland. These measures may include manual removal of invasive upland species, redirection of surface water from the proposed stormwater basin to recharge the wetlands, and/or constructing upland diversion berms to redirect surface flows into the wetland. However, no remedial action is proposed until it is determined if the water level changes observed are a direct result of on-site construction activities as opposed to normal seasonal or yearly fluctuations in precipitation. Therefore evaluation of the current years information will be compared with the baseline data to determine if any mitigation steps are necessary.

- Prepare annual report and submit to Town of Tuxedo Engineering Department. The report will include recommendations of steps to be taken, if necessary, to improve the hydrologic regime of the wetlands. Upon receiving comments from the Town, the recommended enhancement measures will be implemented by the applicant.

- The monitoring plan report will also include recommendations by the applicant's consultant to improve the health of the wetland if necessary, including but not limited to the hand removal of non-native vegetation, girdling of trees to create snag habitat, supplemental native planting to encourage wildlife use, and inclusion of wildlife habitat nesting boxes/structures. Upon receiving comments from the Town, these recommendations will be implemented by the applicant.

3. *Mitigation Plan*

The applicant does not anticipate that on-site construction techniques, specifically blasting, will cause any impact to the hydrology of the wetland. The blasting

methods proposed by the project engineer are anticipated to prevent any disturbance to the wetland. In the unlikely event that blasting causes a fracture that allows drainage from the wetland, the applicant will not destroy the wetland system by removing the stable wetland flora and underlying nutrient rich muck/silt substrate in order to place a clay or other impervious liner beneath the wetland system. This type of mitigation will cause more destruction to the functional wetland system then the potential impacts that may occur from the alteration of the wetland hydrology. In order to seal the wetland, all the stable vegetation including trees, shrubs, and emergent plants will need to be removed. Removal of the vegetation will displace any wildlife species that may utilize the wetland for foraging, nesting, or feeding. Once the soils are replaced, the wetland will need to be replanted. A revegetated system will likely take years to restore to the same high-level functioning system as currently exists.

As outlined in the monitoring steps above, other reasonable measures will be evaluated to supplement the hydrology of the wetland. These measures may include manual removal of invasive upland species, redirection of surface water from the proposed stormwater basin to recharge the wetlands, and/or constructing upland diversion berms to redirect surface flows into the wetland..

APPENDIX D

Well and Hydrogeologic Monitoring Protocol

LANGAN

WELL AND HYDROGEOLOGIC MONITORING PROTOCOL
FOR PROPOSED BLASTING PROGTRAM AT
THE NORTH RIDGE PHASE OF THE TUXEDO RESERVE
TOWN TUXEDO, NEW YORK
SEPTEMBER 2009
(ORIGINALLY ISSUED AUGUST 2008)

1.0 PURPOSE

On behalf of The Related Companies (TRC), Leggette, Brashears & Graham, Inc. (LBG) has prepared this protocol (the Protocol) for assessing the potential impacts on local (on-site and off-site) water-supply wells from proposed bedrock blasting associated with construction of the North Ridge Phase of the development of the Tuxedo Reserve property (the proposed Development) in the Town of Tuxedo, New York (the Site). This Protocol has been prepared to address the requirements of the Town of Tuxedo (the Town) in connection with its approval of The Related Companies' application for construction of the proposed Development. The subject wells are located throughout the Site and on properties bordering the southwestern and eastern Site boundaries [Figure 1; Table 1(see below)].

This Protocol has been developed using geologic and hydrogeologic information and data gathered by LBG as part of its previously completed assessments associated with water-supply development and recharge management efforts for the proposed Development, as well as subsurface information provided by Langan in connection with its engineering and design efforts associated with the proposed site development. The respective information has been developed through the completion of extensive field investigations, and the collection of site-specific measurements and observations. As such, the establishment of site-specific geologic and hydrogeologic conditions has occurred prior to initiation of any blasting activities at the Site. However, this Protocol does anticipate the future visitation and inspection of the subject wells prior to blasting, in order to establish as current as possible the appropriate "baseline" conditions for use in the future (post-blasting) comparisons.

2.0 Background/Hydrogeology

Since bedrock commonly occurs at shallow depths [generally less than 7 feet below grade (ft bg)] throughout the Site, construction of the proposed Development may necessitate controlled blasting in certain areas. In particular, those portions of the Site selected for the construction of roads, subgrade utility line installations, stormwater management facilities, and building foundations may require adequate removal of shallow bedrock. The areas and amount of blasting will depend upon the extent and competency of the encountered shallow bedrock, and most likely will be determined on a locale-specific basis by how readily excavation to the target depth can be accomplished with typical construction equipment. Where considered necessary, the blasting of bedrock at the Site will typically involve below grade detonations, as determined by the blasting contractor.

On-site and local off-site wells tap the "crystalline" bedrock (igneous and metamorphic rocks) aquifer underlying the Property and surrounding area. The crystalline bedrock aquifer is used as a water supply source for several residences in the area and can locally be hydraulically connected with shallow overburden formations (overlying soil and glacial till) and surface-water bodies (e.g., wetlands). This bedrock is characteristically massive, with localized mineralogical banding (e.g., gneissic foliations), and locally penetrated by naturally occurring fractures (i.e., "cracks") and fracture zones and systems. These fractures can occur individually, or as network of roughly parallel and intersecting planar and curve-linear features. Weathering of the upper surface of the bedrock can be laterally and vertically extensive especially where fracture zones are exposed at shallow depths. Under such circumstances, the bedrock is potentially rendered easier to blast and/or excavate with machinery.

Groundwater movement and storage in the bedrock is primarily controlled by the extent and orientation of the fractures that penetrate the comprising rock units. Consequently, the yield of water-supply wells tapping the bedrock are dependent upon the number, aperture (opening) size, and extent of the fractures penetrated by the intake zone of the well (e.g., open borehole). The depth of on-site and local off-site water supply wells typically exceeds 100 ft bg and may locally exceed 500 ft bg, while the corresponding static groundwater level can range from about 20 ft bg to over 100 ft bg. Generally, the groundwater and well yields associated with the crystalline bedrock in the Site area are adequate for meeting individual residential demands. Locally, this aquifer is also capable of yields that can support public community supplies such as that being developed for use by the Development (e.g., Wells LBG-1, LBG-6, TW-F, TW-2B, and LBG-2).

Based on available records for the on-site and off-site wells, along with the results of rock-coring programs completed by Langan and LBG, respectively, the local depth to the perennial (e.g., non-perched) groundwater surface in the immediate vicinity of the North Ridge Phase of the proposed Development is generally in excess of 20 ft bg in topographically lower areas, and in excess of 50 ft bg in topographically higher areas. These depths are typically below the contact between the bedrock and overlying soil ("overburden").

The natural quality of groundwater occurring within the bedrock is generally reflective of the mineral constituents that form the comprising rock units, and is generally considered naturally potable. In particular, the groundwater associated with wells developed in the bedrock aquifer may naturally exhibit slightly elevated iron and manganese concentrations, and a slight reddish-brown tint in color and/or turbidity. The concentrations of these parameters may naturally change over time in response to indigenous microbiological conditions, especially where influenced by well pumpage.

The potential for adverse impacts on the local bedrock aquifer and wells from blasting is primarily dependent on the detonation location relative to the local groundwater surface and respective well location. Typically, blasting that occurs in the portion of a rock mass located above the perennial groundwater surface has minimal to no potential of adversely influencing local supply wells. The available information indicates that: the typical depth to groundwater in

the neighboring residential wells is over 50 ft bg; the separation distance between these wells and the proposed blasting locations in the North Ridge Phase area is generally greater than 200 feet; and the anticipated potential use of explosives is to be limited to at most bedrock within the upper 48 feet of ground surface at locations several hundred feet away from the nearest off-site residence. As such, the potential for the proposed blasting to adversely influence the bedrock aquifer and nearby supply wells is considered minimal.

At most, the effects of the proposed blasting may results in a localized short-term fluctuation of several feet in the existing groundwater surface at the point of detonation, with the degree of impact rapidly decreasing outwards (on the order of feet). As a result, the nearby residential water-supply wells are not anticipated to be adversely impacted. However, as per the Town, any proposed blasting activities associated with the Development require the incorporation of a blasting impact assessment with respect to nearby existing residences. Such an assessment is to include monitoring activities associated with addressing the potential for impacts on water supply wells located in the area targeted for blasting activities.

In the event that the collected background information and blast-monitoring information indicate the interruption of potable water supply from a residential well has occurred due to ongoing blasting, a tanker of potable water will be provided for the impacted residence until a the associated impact is addressed. Prior to implementing blasting, a local bulk water services provider (e.g., Troncillito Brothers Water Services of Marlboro, NY) will be retained "on call" to provide for the rapid provision of potable water in the event of an impact. The water-services supplier will conduct a survey of the existing well setup at the respective residences prior to initiation of blasting in order to pre-determine the appropriate hook-up measures that may be required and associated access logistics. The associated water supply will be connected directly to the respective residential plumbing system, upstream of the existing pressure tank.

In addressing the Town's blast monitoring program requirements regarding supply wells, we have developed this protocol to be potentially implemented for all of those accessible private wells within 1,500 feet of a respective blast site (Figure 1). Based on the blasting locations currently identified by Langan for the North Ridge phase, a list of all of those properties where private wells are known or believed to exist and that are intended to be monitored as per this protocol is provided as Table 1. The proposed protocol is intended to monitor the identified homeowner wells during and following the blasting activities.

3.0 MONITORING EQUIPMENT

3.1 Water-Level Measurement Depth to water measurements will be obtained using a manually-operated electric water-level indicator and tape measure, and, if existent access conditions allow, a dedicated electronic data logger and pressure transducer.

3.2 Water-Quality Measurement Water quality will be determined and monitored using applicable field instrumentation and methodologies employed near the wellhead. Selected parameters will also be analyzed by a New York State certified laboratory.

4.0 RESIDENTIAL-WELL MONITORING PROCEDURE

The following efforts will be undertaken as part of the proposed blasting monitoring area:

4.1 Water-Level and Yield Baseline Establishment

1) Obtain access permission from the respective homeowners and reconnoiter each well with respect to water-level and water-sampling access logistics at least one week prior to implementation of the program. At this time, the water-services supplier will conduct a survey of the existing well setup in order to determine the appropriate hook-up measures that may be required in the event that an alternative water supply is required due to blasting impacts.

2) Prior to, during and shortly after the blasting, water level measurements will be collected (data loggers will be utilized where access is possible) in the respective residential wells which have previously been determined to be accessible. In the instance where access for water-level measurement is possible, measurements will be made, at a minimum, on a weekly basis during the implementation of the blasting program. In addition, water levels will be monitored at existing TRC Wells LBG-1, LBG-6, TW-F, TW-2B, LBG-2, and E as blasting activities proceed. The reference for groundwater level measurements (generally the top of the well casing) will be clearly marked at each well. All measurements will be taken with reference to these points. Each measurement, along with the corresponding date, time and name of observer will be recorded.

3) Short-term pumping tests of each of the selected residential wells will be completed as part of a "baseline" determination and shortly following completion of all blasting activities within 1,500 feet of the respective wells. Each test will involve the pumping of the respective well continuously for up to 1 hour, contingent upon the resulting trend in water-level decline, and the setting and performance of the existing pump. Where possible, the pumped water will be routed to waste from a point closest to the residential pressure tank such as a hose bib, sink faucet, or pressure tank drain. The utilized pumping rate will be measured with a bucket and stop watch. Water levels will be measured with an electronic indicator and/or dedicated data logger where possible. The recovering water level will be monitored for up to 1 hour following cessation of the 1-hour pumping period.

4.2 Water-Quality Baseline Establishment

1) Water samples will be collected from the selected residential wells as part of a "baseline" determination, and shortly following completion of all blasting activities within 1,500 feet of the respective wells.

2) Water samples will be collected at the port closest to the wellhead and, if possible, from the nearest sink faucet, and analyzed for the following field parameters:

temperature, total iron, hydrogen sulfide, sulfate, chloride, turbidity, pH, conductivity, DO, and BARTS (measure of microbiological activity such as coliform and iron bacteria). In addition, water samples will also be collected and submitted to a New York certified laboratory and analyzed for total coliform, total iron, turbidity, color, sulfate, chloride, sodium, nitrate, nitrite, ammonia, and total petroleum hydrocarbons (TPH).

5.0 EXTERNAL MEASUREMENT MONITORING

5.1 Precipitation Precipitation will be measured with an on-site rain gauge. Accumulated precipitation will be recorded during the monitoring periods of the program. If applicable, precipitation measurements will be recorded on a daily basis at a minimum.

5.2 Surface-Water Bodies, Wetlands and Groundwater

1) Stream gauges and piezometers will be installed along the reaches of on-site streams and wetlands nearest the proposed blasting locations prior to the start of the monitoring program (Figure 1). The stream gauge will consist of either a solid stake with increments or a staff gauge inserted into the water body. The piezometers will consist of "drive points"driven to at least 0.5 feet below the encountered surface-water body bed. In addition, those stream gauges and piezometers that already exist in the nearby streams and wetlands (e.g., Mountain Lake) monitored during the 72-hour combined pumping tests completed in 2007 will also be used for water-level monitoring purposes.

   Water-level monitoring at these locations will commence during the pre-blasting residential-well background monitoring program, and be completed using manually-operated electric water-level indicator and tape measure devices, along with dedicated electronic data loggers and pressure transducers where accessible. The relative elevations of the stream gauges and piezometers will be surveyed with respect to location and elevation, and compared to groundwater elevations measured in the nearby wells. This information will be used to characterize the respective water levels relative to perched and non-perched groundwater conditions. The elevations of those wetlands considered to potentially be part of a perched groundwater system will be compared to the elevations of the closest bedrock targeted for blasting. The distance between the respective wetlands and blast-targeted bedrock will be compared to the corresponding projected blasting zone-of-influence in order to assess the potential for adverse influences. Those wetlands where blasting is anticipated to affect bedrock at depths below the elevation of the geologic feature associated with the perched condition (e.g., clay layer; un-fractured massive bedrock unit; etc.) will be further hydrogeologically characterized relative to recharge and discharge components (e.g., precipitation), with the proposed blasting program and/or subsequent rock excavation activities in the respective area being modified accordingly.

2) Surface-water and groundwater samples will be collected at the respective stream gauge/piezometer locations and from the nearby on-site TRC Wells, located proximal to and downgradient of the proposed blasting locations (i.e., Wells LBG-1 and E for the North Ridge Phase). The piezometers and wells will be purged of three volumes of standing water (actual purge volume contingent upon recharge characteristics) prior to collecting the respective samples. The collected samples will be analyzed, contingent upon adequate sample aliquot, for the following field parameters: temperature, total iron, hydrogen sulfide, sulfate, chloride, turbidity, pH, conductivity, DO, and BARTS. In addition, water samples will also be collected from each location and submitted to a New York certified laboratory and analyzed for total coliform, total iron, turbidity, color, sulfate, chloride, sodium, nitrates, and total petroleum hydrocarbons (TPH). Samples will be collected prior to, at least once during, and following blasting, in order to provide the data necessary to assess the potential of impacts on the respective surface-water and groundwater resources.

5.3 Barometric Pressure Barometric pressure will be recorded via an on-site barometer during the course of the monitoring program.

5.4 Nearby Pumpage Only nearby domestic wells have been identified as the closest groundwater users. As such, we will notify the previously identified well owners of the pending test program and request permission to include them in the monitoring program.

6.0 PERMITS

No permits for the monitoring of wells during the proposed program have been identified. However, the Town will be notified at least one week in advance of implementation of the monitoring program. Access permission from the respective off-site well owners will be pursued, and the results of such efforts provided to the Town prior to the initiation of monitoring.

7.0 REPORTING

The results of the blast monitoring program will be summarized and provided to TRC for its transmittal to the Town and the respective homeowners. The respective homeowners will be directed to contact the following LBG representatives at (201) 818-0700, on behalf of TRC, in the event of their having trouble with their wells as a suspected result of the proposed blasting: Al Smith, PG; Matthew Ayers, PG; Frank Getchell, PG.

MA(FG revised):pw

Attachments

TABLE 1
TUXEDO RESERVE
TOWN OF TUXEDO, NEW YORK

Summary Of Potential Residential Well Owners
Within 1,500 Feet Of Blasting-Targeted Areas In The North Ridge Phase

BLOCK	LOT	OWNER	ADDRESS	MAP IDENTIFIER
1	8	Tuxedo Union Free School District No. 3		A
1	23	Timberwolf Industries, Inc.		B
1	9	George Medynski	Route 17 South, Tuxedo, NY	C
1	10	Michael & Jean Yorke	Route 17 South, Tuxedo, NY	D
1	11	Ralph S. & Jean Rogo	Route 17 South, Tuxedo, NY	E
1	12.2	Tuxedo Manor Apartments Inc.	Route 17 South, Tuxedo, NY	F
1	13.11	Raffaele & Teresa Mazzariello	Route 17 South, Tuxedo, NY	G
1	13.2	Ralph Rugo, Jr.	Route 17 South, Tuxedo, NY	H
1	14	R4 Zone		I
3	5	Richard Miller	54 Mountain Road, Tuxedo, NY	K
3	8, 9, 39	James & Antoinette Matthews	11 Mountain Road, Tuxedo, NY	L,M, and N
3	38	Richard E. & Jeanne Heater	48 Mountain Road, Tuxedo, NY	J
3	11	Daniel Richard Winfield	7 Mountain Road Tuxedo, NY	O
3	13.1	John F. & Elise Smith	Hillside Avenue Tuxedo, NY	P
3	15.1, 15.2	William H. Sahler	54 Hospital Road Tuxedo, NY	Q and R
3	6	Teh-Sung Wang	29 Hillside Avenue Tuxedo, NY	S
3	17	Theodore Kincaid, Jr.	5 Hillside Avenue Tuxedo, NY	T
3	18	Peter & Barbara Barba	21 Hillside Avenue Tuxedo, NY	U

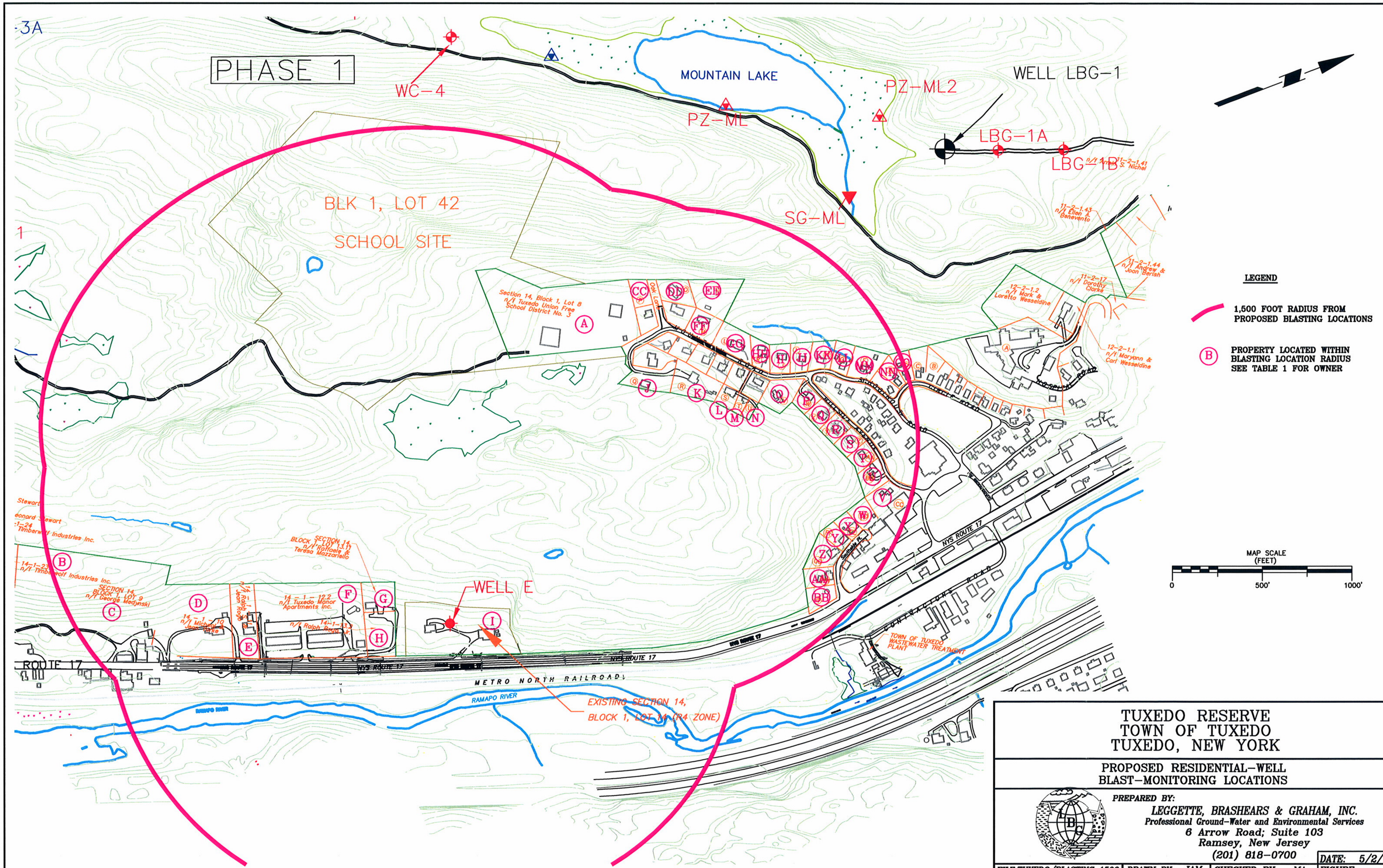
Note: See Figure 1 for locations.

TABLE 1 - CONTINUED
TUXEDO RESERVE
TOWN OF TUXEDO, NEW YORK

Summary Of Potential Residential Well Owners
Within 1,500 Feet Of Blasting-Targeted Areas In The North Ridge Phase

BLOCK	LOT	OWNER	ADDRESS	MAP IDENTIFIER
3	19	Joseph & Martina O'Reilly	15 Hillside Avenue Tuxedo, NY	V
3	30	A. & A. Mammato	20 S Side Place Tuxedo, NY	W
3	31	Jose & Eileen Rivera	S Side Place Tuxedo, NY	X
3	32	Ronald R. Conklin	11 S Side Place Tuxedo, NY	Y
3	33	John P. & Elizabeth Mottola	S Side Place Tuxedo, NY	Z
3	34	John J. Billy	75 S Side Place Tuxedo, NY	AA
3	35.1	John & Mary D. Billy	S Side Place Tuxedo, NY	BB
1	1	Kimberlee Stevens	1 Oak Place Tuxedo, NY	CC
2	2	Dorothy Clarke	23 Hospital Road Tuxedo, NY	DD
2	1,4	William H. & Jean L. Sahler	24 Mountain Road Tuxedo, NY	EE, FF
2	5	Double Gemini Enterprises, Inc.	16 Mountain Road Tuxedo, NY	GG
2	6	Jones Family	10 Mountain Road Tuxedo, NY	HH
2	7	Ralph & Madeline Napolitano	6 Mountain Road Tuxedo, NY	II
2	8	Kevin & Ann Earl	2 Mountain Road Tuxedo, NY	JJ
2	9	John & Debra Ruel	46 Schoolhouse Road Tuxedo, NY	KK
2	10	Donald & Katherine Derbyshire	42 Schoolhouse Road Tuxedo, NY	LL
2	11	Joseph & Marion Mottola	36 Schoolhouse Road Tuxedo, NY	MM
2	8	Richard L. Jones	38 Circle Drive Tuxedo, NY	NN
2	9	Jean S. Dickensen	36 Circle Drive Tuxedo, NY	OO

Note: See Figure 1 for locations.



PHASE 1
WC-4
MOUNTAIN LAKE
PZ-ML
PZ-ML2
WELL LBG-1
LBG-1A
LBG-1B
SG-ML
BLK 1, LOT 42
SCHOOL SITE
Section 14, Block 1, Lot 8 n/f Tuxedo Union Free School District No. 3
WELL E
EXISTING SECTION 14, BLOCK 1, LOT 14 (R4 ZONE)
METRO NORTH RAILROAD
RAMAPO RIVER
ROUTE 17
NYS ROUTE 17
TOWN OF TUXEDO WASTEWATER TREATMENT PLANT
n/f Tuxedo Manor Apartments Inc.
n/f Timberwolf Industries Inc.
LEGEND
1,500 FOOT RADIUS FROM PROPOSED BLASTING LOCATIONS
PROPERTY LOCATED WITHIN BLASTING LOCATION RADIUS SEE TABLE 1 FOR OWNER
MAP SCALE (FEET)
0
500'
1000'

TUXEDO RESERVE
TOWN OF TUXEDO
TUXEDO, NEW YORK

PROPOSED RESIDENTIAL-WELL
BLAST-MONITORING LOCATIONS

PREPARED BY:
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water and Environmental Services
6 Arrow Road; Suite 103
Ramsey, New Jersey
(201) 818-0700

FILE: TUXEDO/BLASTING 1500	DRAWN BY: JAM	CHECKED BY: MA	DATE: 5/2/08
			FIGURE: 1