KEYSPAN ENERGY

FORMER CLIFTON MGP SITE
CLIFTON OPERABLE UNIT No.1, STATEN ISLAND, NY
Town of Clifton
Richmond County, Staten Island, NY

PROPOSED NOISE/VIBRATION MITIGATION PLAN
For
Pile Driving Related Noise and Vibration

April 26, 2006

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Prepared by:

Paulus, Sokolowski and Sartor Engineering, PC
67A Mountain Boulevard Extension
Warren (Somerset County), New Jersey 07059

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1.0 INTRODUCTION

KeySpan Corporation (KeySpan) owns a property (Site) at 40 Willow Avenue near the intersection of Bay Street and Willow Avenue in the Clifton section of Staten Island. The Site is a former Manufactured Gas Plant (MGP) with underground residue from the MGP operations which ceased operations 50 years ago. The New York State Department of Environmental Conservation (NYSDEC) selected an approach to remediate the Site described in the March 2004 Record of Decision (ROD) for the Operable Unit No. 1 (Clifton OU-1) portion of the Site. The selected remedy to stabilize the Site includes the construction of an underground vertical barrier around the perimeter of the Site to a depth of approximately 130 feet below the ground surface (bgs). The upper part of the barrier will be made of Waterloo Barrier® steel sheet piling. The lower part of the barrier will be made of jet grout columns (a kind of concrete) to a depth of approximately 130 feet.

The rear yards of eight residences that front on Lynhurst Avenue border the Site along the southern boundary. A commercial building at 66 Willow Avenue borders the Site to the west. Driving steel sheet piles into the ground can create noise and vibration at and near the Site. This Noise and Vibration Mitigation Plan (Plan) describes various mitigation measures to reduce noise and vibration impacts to adjacent residential properties from steel sheet pile driving at the Site.

This Plan. prepared by KeySpan, represents the collective comments, suggestions, and requirements from the NYSDEC, the New York City Department of Environmental Protection (NYCDEP) and the NYCDEP's acoustical consultant. The April 26, 2006 version of this Plan was approved by the NYSDEC. On November 22, 2006, NYSDEC issued a proposal to update the approved plan and this current Plan represents an update to the April 26, 2006 Plan.

A number of possible noise and vibration mitigation measures suggested by the various involved parties as well as available reports and studies have been reviewed. Also, discussions with other contractors and consultants, as well input from the NYSDEC, the NYCDEP and the NYCDEP's acoustic consultant, have been considered in development of this Plan.

The steel sheet piling is being installed approximately one foot from the fence/property line. A vibratory hammer has been used to drive the steel sheets into the ground. At the south boundary nearest to the residential properties, the sheets hit an unanticipated underground gravel/cobble layer at a depth of 30 to 35 feet below the ground surface. In addition, during the start of driving a sheet pile there tends to be a momentary peak in the noise level and then the noise is reduced as the sheet is driven further into the ground.

Community complaints of noise and vibration at the Site have resulted in the involvement of the Staten Island Borough President's Office, the New York City Mayor's Office, the New York City Department of Environmental Protection (NYCDEP), New York City Department of Buildings and NYSDEC. NYCDEP has been requested by the Mayor's Office to evaluate noise/vibration mitigation options for consideration by NYSDEC and KeySpan.

1.1 Current Status

Steel sheets have been installed along one half of the distance of the western site boundary. Along the southern site boundary, adjacent to the residential properties, only about one third of the steel sheets have been installed. Pile driving work at the Site has been suspended and will continue only after approval of this Plan by the NYSDEC.

1.2 Summary of the Plan

This Plan incorporates the most practical and effective measures offering potential to mitigate noise and vibration from the pile driving activities at the Site. This Plan includes the following elements:

- Continue noise and vibration monitoring.

- Provide for additional monitors in the residential area (requires access agreements for these properties)
- Improve reporting and availability of monitoring data.
- Use action levels to evaluate noise and vibration from operations and take action as prescribed.
- Attach acoustical insulation to the fence around the perimeter of the Site.
- Use high frequency vibratory hammer (to replace low frequency hammer), with support of the steel sheets during their installation.
- Use movable acoustic curtain to shield the pile driving hammer and pile from the residences (requires access agreements for these properties).
- Install steel sheets only to a depth of first refusal or 35 feet or to the depth of the gravel cobble layer.
- Provide schedule of pile driving with restricted times.
- Provide a screening barrier for the southern boundary.

The following measures were also considered but are considered impractical for the following reasons:

- Pre-drilling
  Pre-drilling would pose problems with contamination issues, creating spoils and possible vapor releases.
- Jetting
  Jetting would pose similar problems as pre-drilling related to subsurface contamination releases, spoils, vapors, and contaminated water. In addition, the water injected could serve to mobilize subsurface contamination.

1.3 Access Agreements

Full implementation of this Plan will require access to the adjacent residential properties along the southern boundary of the site. Access is needed:

1. To monitor noise and vibration in the residential area to assess effectiveness of the mitigation. Monitoring equipment will be placed at the residential backyards as depicted on Figure 4-1.

2. To accommodate the moveable sound control curtain which will overhang the fence when pile driving along the southern site boundary.

In the event that access to these properties is refused, some provisions of this plan may be modified or suspended during any period where access to the adjacent properties is denied. Specifically, with respect to the two items noted above:

1) An alternate strategy for monitoring noise may be implemented. Rather than placing noise monitoring equipment in the locations shown on Figure 4-1, temporary noise monitoring locations will be established on either side of the homes. The first will be in the public access area of Lynhurst Avenue on the south side of the residential properties, and the second will be attached to or placed near the temporary sound barrier along the site's southern property line, immediately adjacent to the boundary with the residential properties.

   Readings from the two locations will be used to project estimates of noise levels at the homes. Although this is less desirable than direct measurement at the homes, it is the only workable monitoring strategy when installing sheets along the western, northern and eastern boundaries of the site (away from the homes) if access for monitoring is not granted.

2) When driving sheets along the southern site boundary, the temporary sound barrier must be removed to provide adequate access for the operation of the crane. It is intended that the moveable acoustical curtain, suspended from the crane, would provide the most reasonable protection to the homes in the present circumstance. As noted above, however, because of the close proximity of the barrier wall to the property line, this curtain will overhang the property line by a few feet.

   If access for use of this curtain is denied, the sheets along the southern boundary will be driven without use of the temporary sound barrier and the moveable acoustic curtain. This will mean that the only effective mitigation measure in place for this portion of the work (approximately 25 to 30 sheets) will be the use of the high frequency vibratory hammer. The effect of using this hammer is not certain, and it is possible that noise levels at the homes could approach the levels experienced prior to the implementation of this plan.

   The temporary noise monitoring locations on Lynhurst Avenue would remain in place. However, with little or no noise abatement in place between the neighboring homes and the pile driver, the action levels described in Section 6.1 would no longer be relevant for these homes.

1.4 Zoning

The Site is located within an (M-3) manufacturing zone. However, the Site also abuts a low-density residential area. The line delineating the two zones runs along the southern boundary of the Site and the northern boundaries of the rear yards of the eight adjacent residential properties. This zoning situation and the relative small size of the site make

certain construction activities difficult and limit potential noise and vibration mitigation measures that can be used.

1.5 Noise Basics

1.5.1 Noise Descriptors

There are a number of noise descriptors used to characterize various aspects of noise that take into account the variability of noise levels over time which most environments experience. Various criteria and guidelines are used to characterize noise. Commonly used descriptors are discussed below.

A-Weighting (dBA) - Noise measurements are most often taken using the "A-weighted" frequency response function. The A-weighted frequency or dBA scale simulates the response of the human ear to sound levels (particularly low-level sound) and has been given prominence as a means for estimating annoyance caused by noise, for estimating the magnitude of noise-induced hearing damage, in hearing conservation criteria, for speech interference measurements, and in procedures for estimating community reaction to (general broad band) noise (Clayton, et al. 1978; Cheremisinoff, et al. 1977). Sound measurements are often made using the “A” frequency weighting when assessing environmental noise. The Leq or the LAeq (the A-weighted equivalent continuous sound level) is an important parameter.

Equivalent Sound Level (Leq) - The equivalent sound level (Leq) is the value of a steady-state sound which has the same A-weighted sound energy as that contained in the time-varying sound. The Leq is a single sound level value for a desired duration, which includes all of the time-varying sound energy during the measurement period. The U.S. Environmental Protection Agency (EPA) has selected Leq as the best environmental noise descriptor for several reasons, but primarily because it correlates reasonably well with the effects of noise on people,

even for wide variations of environmental sound levels and different time exposure patterns. Also, it is easily measurable with available equipment.

Statistical Descriptors - Statistical sound level descriptors such as L_{10}, L_{50}, and L_{90} are used to represent noise levels that are exceeded, 10, 50, and 90 percent of the time, respectively. L_{50}, the Sound Pressure Level (SPL) exceeded 50 percent of the time, provides an indication of the median sound level. L_{90} represents the residual level, or the background noise level without intrusive noises. The L10 is the sound level that is exceeded 10 percent of the time for a specified monitoring period. The Lmax is the maximum measured sound level at any instant in time.

1.6 Vibration Basics

A source (such as pile driving or blasting) can excite the adjacent ground, creating vibration waves that propagate (or move) through the various soil and rock strata potentially reaching the foundations of nearby buildings and then throughout the parts of the building structure. The effects of ground-borne vibration can include perceptible movement of the building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. In extreme cases, such vibration can cause damage to buildings and other structures.

Differences in these vibration outcomes is related to the magnitude of the vibration that propagates to nearby structures. Vibrations of greater magnitude may cause building damage but vibrations at much lower levels may be felt by humans but be to low to cause building damage.

Evaluation criteria for determining vibration impacts due to construction activities include thresholds for (1) human perception, annoyance, and interference and (2) damage to fragile and historical buildings (FTA Table 4.23). Although no standardized vibration criteria for construction activities have been established, exceedances of certain vibration levels may typically cause community reactions.

The Peak Particle Velocity (PPV) is appropriate for evaluating impulsive vibration associated with such vibration sources as blasting or pile driving, and the resulting stresses that potentially are damaging to buildings. PPV represents the maximum instantaneous positive or negative peak motion of a vibrating surface. The US Bureau of Mines (USBM) criteria and methodology is applicable to this measurement of vibration.

Excessive vibration levels from construction activities, although temporary in duration, may create a nuisance condition at nearby sensitive receptors. Ground vibrations from construction activities very rarely reach the levels that can damage structures, but can achieve the audible and perceptible ranges in buildings that are very close to the active work area (DOT-T-95-16; April, 1995). The types of construction activities that typically generate the greatest vibrations are blasting and impact pile driving. The sheet pile driving at Clifton is being done with a vibratory hammer which, typically, is not as loud as pile driving using an impact hammer.

Annoyance from vibration often occurs when vibration levels exceed the thresholds of human perception. These criteria are an order of magnitude below the damage threshold for normal buildings and are well below vibration levels (0.50 PPV) at which damage might be expected to occur. In other words a person may be able to feel vibrations at levels that are much lower than levels that could cause damage. Vibration levels as low as in the range of 0.017 to 0.035 PPV (at the receptor location) may often be felt by humans and can be unsettling or annoying, but are well below levels that would result in physical damage.

It is important to note that the term “damage” when used in the context of acceptable levels of ground vibrations refers to threshold damage as defined by the US Bureau of Mines as “the occurrence of cosmetic damage; that is, the most superficial interior cracking of the type that develops in all homes independent of blasting.” It also should be noted that the occurrence of PPV values greater than the USBM values (0.50 PPV) does not imply that cosmetic cracking will occur. Unless the initial monitoring indicates

that cosmetic/hairline cracking occurs at PPV values lower than the USBM criteria, these criteria can be considered applicable to typical residential structures. For “fragile buildings” and “extremely fragile historic buildings,” PPV values of 0.20 in/sec and 0.12 in/sec (at the building), respectively, have been suggested.

2.0 SITE MOBILIZATION

2.1 Pile Driving

The installation of piles is fairly common for modern construction projects. Piles are used to support parking structures, bridges, overpasses, many types of buildings and also are used as retaining structures or barriers. Piles often form the backbone of structures that can serve as framework to support great weight and pressure of concrete loads. They can be used as barriers that confine ground pressures and prevent unwanted movement. Getting the piles into the ground, as with other construction activities, cannot be done without causing some noise and vibration. This can create concern when these activities take place near residences. Pile driving is, however, a necessary construction activity.

Sheet pile driving consists of inserting a long, usually steel, sheet into the ground. A common approach to accomplish this is with a vibratory hammer. This method makes less noise than using an impact hammer. An impact hammer is a heavy weight hammer that pounds on the pile creating sharp bang noises from the impact of the hammer on the pile. The vibratory hammer does away with the sharp bang noise, since the vibratory hammer "shakes" the pile into the ground. As such, it is considered to be quieter than an impact hammer.

A high frequency vibratory hammer will be used in place of the low frequency vibratory hammer which has been used at the Site thus far. It is anticipated that using the high frequency vibratory hammer may result in some reduction in noise generated and cause less vibration. The amount of improvement is uncertain. Monitoring will be performed.

2.2 Other Equipment

Noise associated with the installation of the vertical barrier containment will be generated primarily by construction equipment and various construction activities. Equipment utilized for pile driving will include a crane, front-end loaders, backhoe, and other construction-related vehicles and equipment. The equipment generates noise from diesel

engines, high-pressure air compressors, and mechanical equipment movement in general. The most widespread source of noise from typical construction equipment is generally due to internal combustion engines, usually diesel, which provide operating power. Engine-powered construction equipment includes earthmoving equipment that is highly mobile, handling equipment that is partly mobile, and stationary equipment. Earthmoving equipment includes machinery such as drill rigs, dump trucks, and jet grout drills. Their internal combustion engines are used both for propulsion and for powering working mechanisms. Engine sound typically predominates, with exhaust noise normally being the major source, and inlet sound level and structural sound level being of secondary importance. Other sources of noise associated with the equipment include the mechanical and hydraulic transmission actuation systems and cooling fans that can sometimes produce relatively high sound levels. The typical operating cycle of this equipment involves several minutes of full-power operation followed by several minutes at lower power.

Stationary equipment such as air compressors, cranes, and generators generally run continuously at relatively constant power and speed, although sound levels may vary according to the work cycle (e.g., loading). Because construction activities are carried out at various locations on the site and because these activities change as work progresses, the construction site would have both spatial and temporal noise dimensions. Construction related noises are usually of a temporary duration and can be, relatively intermittent.

3.0 SITE PREPARATION OF NOISE AND VIBRATION MITIGATION MEASURES

A combination of mitigation methods will be utilized. No single mitigative measure would be the most effective at reducing noise levels. The following mitigation measures together are considered to offer the most potential for application to this project and have been incorporated into this plan as described below. The implementation details, feasibility, and the expected effectiveness of these measures to reduce noise and vibration from the pile driving at the Site are discussed below.

Four primary new measures will be undertaken at the Site to mitigate pile driving noise and vibration. The four primary mitigation measures to be used at the Site are:

- High Frequency Vibratory Hammer
- Fence – Acoustic Insulation
- Moveable Sound Barrier Curtain
- Temporary Sound Barrier

These are discussed below.

3.1 High Frequency Vibratory Hammer

A high frequency vibratory hammer will be used. This hammer replaces the low frequency vibratory hammer which has been used at the Site thus far. It is anticipated that using the high frequency vibratory hammer may result in some reduction in noise generated and cause less vibration. The amount of improvement is uncertain. Monitoring will be performed to evaluate the effect on noise and vibration and pile driving effectiveness. Driving the sheets with this hammer may be slower and may extend the sheet pile installation period.

3.2 Fence – Acoustic Insulation

An acoustical insulation material has been attached to the inside of the chain link fence that runs along the perimeter of the Site. The insulation is BBC-13-2" Acoustical material that consists of a combination of 2" thick vinyl-faced Quilted Fiberglass Sound Absorber

and reinforced loaded vinyl noise barrier (1 pound per square foot) that are bonded together. The installed insulation extends from the top of the fence (which is 8 ft high) to the ground. Seams and joints overlap approximately 2 inches and self seal with Velcro strips. The insulation material has grommets installed which have been used to fasten the curtain material to the fence. This material has a Sound Transmission Class of STC-32. This measure will primarily provide mitigation of noise from construction equipment and activities at the Site close to the ground. This type of curtain material has been used at many sections of the massive "Big Dig" construction project in Boston with reported results showing noise reductions of 12 dBA.

3.3 Moveable Sound Barrier Curtain

The major source of noise at the Site has been from the vibratory hammer and the steel sheet piles during pile driving. A moveable acoustical curtain will be used to shield the residential area from noise produced by the hammer and the steel sheets during pile driving. The curtain is designed to completely block the line of sight between the residences and the hammer and steel sheets during pile driving.

The curtain is of a size and shape that will surround the hammer and steel sheet on three sides when properly placed. The curtain is constructed of a steel frame with acoustic material fastened to the steel framework.

The moveable curtain is long enough to cover the pile driver and steel sheet when they are at the highest point at the beginning of a drive. The steel frame is constructed in sections that can be attached or unattached as needed to adjust the length of the curtain.

The moveable curtain will use the same BBC-13-2" acoustical material as the fence installation. It is anticipated that when properly placed the curtain will provide noise control in the 10 to 15 dBA range.

The curtain must be moveable so that it can be moved as the active pile driving point progresses along the perimeter of the Site. It will be hung on the crane's second cable or attached to another crane (such as boom crane) for proper placement.

3.4 Access Agreement

Use of this moveable curtain during pile driving along the southern Site boundary will require an access agreement for the residential properties. When properly placed, the moveable curtain will overhang the fence line. Proper placement of the curtain is extremely critical for it to effectively reduce pile driving noise at the residential properties.

The amount of noise mitigation that can be expected from use of the moveable curtain requires that all neighbors grant access to a portion of their yards. Refusal of access by some of the neighbors will result in uncontrolled noise impacts on all the neighbors when pile driving along the properties where access is not granted.

If the moveable curtain can not be used because access is not granted to all eight residential properties then mitigation will primarily consist of the high frequency hammer and the 8 ft fence insulation. It can ***not*** reasonably be expected that the action levels described in this plan will necessarily be achieved if this access is ***not*** granted.

3.5 Temporary Sound Barrier

A non-retractable temporary sound barrier wall that will screen the site from the residential properties will be installed and will be used during pile driving activities on the western, northern and eastern boundaries. After pile driving is completed in these areas, it will be removed. This barrier will screen the view of construction activities occurring at the northern site boundary and most of the western and eastern site boundaries. The double wall construction will provide sound reduction of activities occurring north of the barrier. The details of this are being worked out and will be provided as a supplement to this Plan. It is anticipated that access to the residential

properties will not be needed for this barrier, but it cannot be used when pile driving activity is near or along the southern site boundary.

3.6 Other Considerations

We have also considered numerous other suggested measures for inclusion into the Plan. These suggestions were the result of review by KeySpan, *NYCDEP*, and NYSDEC. Two significant measures that were reviewed include a retractable barrier along the southerly boundary and the use of a hydraulic pile driver with an integral auger. These two suggested measures are not practical or feasible. In addition, jetting and pre drilling have been thoroughly evaluated; they are not practical or feasible and would result in possible mobilization of subsurface contamination.

4.0 NOISE AND VIBRATION MONITORING (DURING CONSTRUCTION)

Monitoring activities are an important part of the Plan. Monitoring data are needed to assess the effectiveness of the implemented mitigation measures and to assess action levels.

KeySpan operated six continuous monitors for noise and vibrations during pile driving activities. These monitors were located on the Site and near the western Site boundary on the commercial property at 66 Willow Avenue. Monitoring was not performed on the eight residential properties during pile driving activities because the owners of these properties would not consent to access agreements for monitoring purposes with KeySpan.

Noise and vibration data have proved useful and will be continued as part of the mitigation plan. Though previous noise and vibration monitoring was not performed at the residential properties the addition of monitors within the residential area would provide necessary noise and vibration data in the area closest to the residents and would provide data for evaluating the noise level with the action levels.

4.1 Noise Monitoring Plan

The noise monitoring procedures to be used during construction are described below.

- The monitoring locations where noise and vibration monitoring will be performed are shown on Figure 4-1. Contingent temporary monitoring locations as stated in section 1.3 are shown on Figure 4-1.
- The responses and action levels are discussed in Section 6.0.

Noise Measurements will be performed using the A-weighting network and the "slow" response of the sound level meter.

- The measurement microphone will be fitted with a windscreen.
- The Noise Monitoring will be located approximately 5 feet above the ground.

Noise monitoring will not be performed during inclement weather i.e., downpours or when wind speeds are greater than 15 mph. Pile driving would be suspended during such conditions.

Construction Noise Monitoring

- Noise level measurements will be taken at each monitoring location during ongoing construction activities continually during the daytime.
- Leq, L10, and Lmax noise measurements will be computed.
- Construction noise measurements will be performed during the construction activity that has the greatest noise potential.
- Noise measurements data will be summarized i.e., tables, plotted graphically, etc.
- Construction activities observed during noise monitoring will be noted.

During initial driving of a full sheet pile, the uncontrolled noise levels were approximately 90 dBA for a few minutes after the sheet gets imbedded into the ground ; before reduction to approximately 80 dBA for a few more minutes as the sheet is further advanced into the ground. Monitoring will be performed continuously during pile driving and the measured sound levels will be computed as 1 minute Leq values.

4.2 Existing Noise (Pre-Construction)

A summary of the background (pre-construction) noise monitoring data collected at the Site is presented in Table 4-1. This table lists the monitored Leq values for NM-1 through NM-4 and presents the average daytime Leq as Ld (L daytime) of 58.5 dBA. Monitoring of the existing ambient sound level was only performed on-site. The on-site location is in close proximity to the residential property boundaries and is representative of ambient (existing) sound levels for the area. Background noise in the vicinity of the site area of this Clifton community is predominantly from vehicular traffic (heavy vehicular traffic, cars, trucks and buses idling at the nearby traffic light and intersections, automobile acceleration, loud mufflers, car horns, loud car stereos, car alarms, brakes squealing, and

ambulance/police sirens). Noise influences from off-site construction work, people talking, local shops, airplanes high overhead and low-flying planes, trains, boat horns in distance and other general "sounds of the city" are also present at the Site. The presence of local and major highways results in relatively high ambient (existing) levels due to the generation of noise from surface transportation vehicles (trucks and autos). The intersection of Willow Avenue and Bay Street is in close proximity to the Project Site and contributes to vehicle generated noise from cars, trucks and buses braking, idling and accelerating at the traffic light.

4.3 Monitoring Locations

Noise and vibration monitoring has been performed at three locations on the south eastern (SE) boundary, near the north eastern (NE) boundary and just to the west of the western(Western) site boundary on the adjacent, 66 Willow Ave, property during sheet pile driving. The noise monitoring locations are shown on Figure 4-1.

Additional monitoring for Noise and Vibration *on* the residential properties is planned, and locations are dependent on for which properties access for monitoring is granted. An additional three (3) monitoring locations are planned. If access to the residential properties is not allowed for monitoring, three (3) additional monitoring locations in the public access areas nearby the residences would be utilized.

Table 4-1 Pre-construction (existing) A-Weighted Noise Levels			
Phase I - October 27-28, 2004			
Noise Monitoring Location	**Leq (dBA)**	**L10 (dBA)**	**Remarks**
NM-1 (a) Ld (7am - 10pm)	58.5	62.8	Q-500 dosimeter is located inside the Clifton Remediation **Site**, approximately 11 ft North of the Southern property boundary fence, and near center of site in an east/west direction, 65' to the west of an open paved lot. Local noise influences include veh
NM-3 (b)	61.9	66.6	SLM is located outside the Clifton Remediation **Site**, on the adjacent paved lot to the East, approximately 24 ft off the eastern site fence-line and 25 ft off the Southern property boundary fence. Local noise influences include vehicular traffic such as c
NM-4 (b)	69.3	72.9	SLM is located outside the Clifton Remediation **Site**, on the adjacent paved lot to the East, approximately 24 ft from the fence bordering WIllow St and 25 ft off the fence bordering Bay St. Local noise influences include vehicular traffic such as cars, tr

Notes:
(a) L10 values were calculated from a second sound level meter at location NM-1 that ran for approximately 4-hours
(b) NM-3 and NM-4 were calculated from two 20-minute measurement periods

5.0 WORKPLAN

NYSDEC has requested that pile driving move to the northwest corner of the Site, farthest away from the residences, when activities resume. When pile driving resumes, it will continue along the western property boundary moving north away from the residences. Pile driving during high wind conditions will be avoided to prevent the wind from causing the curtain to sway and create unsafe conditions in the work area.

6.0 ACTION / DECISION FLOWCHARTS

This Section describes the action levels and actions to be taken if these threshold levels are exceeded. Also included are decision flowcharts identifying thresholds and prescribed actions.

6.1 Noise

Action levels have been established and are based upon the implementation of the noise abatement measures described in this Plan including granting of access to the adjacent properties. The following three "action" noise threshold values will be used to assess the effectiveness of mitigation during pile driving at the Site:

- "warning" noise threshold value of 75 dBA Leq,
- "temporary halt" noise threshold value of 80 dBA Leq
- "stop work" noise threshold value of 85 dBA Leq,

These noise action levels are described below.

The "warning" noise level is 75 dBA Leq.

If this action level is exceeded during active pile driving, then the cause will be investigated. Work itself would not necessarily be stopped. KeySpan will verify the placement and integrity of the 'moveable sound curtain' and that it is optimized for noise mitigation. The placement would immediately be corrected.

The "temporary halt" noise threshold value is 80 dBA Leq.

If this action level is exceeded then work will be temporarily halted, if necessary, while the apparent cause is investigated and corrections made. If the cause is related to placement of the curtain then this would be corrected and work would resume. If the cause is due to other reasons, such as equipment or operation factors, then these would be corrected, and work resumed. If this level is exceeded due to obstructions in the ground which cause refusal, the drive will continue at the next sheet position.

The "stop work" noise level is 85 dBA Leq for the pile driving.

If this action level is exceeded, then a review into the cause will immediately be investigated. Work would stop and the effectiveness of the implemented mitigation measures would be reviewed and additional mitigation measures implemented. If this level is exceeded because of obstructions in the ground which cause refusal, the drive will be stopped and the next sheet position will be attempted.

Monitoring to assess the actions levels will be the Leq (minimum one minute interval), measured near the back side of the houses facing the Site. These threshold noise levels would be evaluated outdoors near the back side of the houses facing the Site.

Evaluation - Noise

Placement of monitors beyond the southern fence line on the residential properties (see Section 1.3) will provide data on noise and vibration in this area. This monitoring is needed to compare measured levels to the action levels. Figure 6-1 shows a flowchart of noise action levels and prescribed actions.

6.2 Vibration

The following two vibration "action level" threshold values will be used to assess the effectiveness of mitigation during pile driving at the Site:

- "warning" vibration threshold value of 0.2 inches per second PPV,
- "stop work" vibration threshold value of 0.5 inches per second PPV,

These are described below.

- The vibration "warning" threshold level is 0.2 inches per second PPV. If this level is exceeded then the situation will be reviewed to identify the potential cause.

- The vibration "stop work" threshold is 0.5 inches per second PPV. This threshold level is the U.S. Bureau of Mines vibration criteria to avoid possible cosmetic damage to structures with concrete foundations, timber framing. The potential causes of such vibration will be reviewed and possible mitigation methods investigated.

Evaluation - Vibration

These levels would be evaluated on the ground in the vertical direction outside near the foundations of adjacent houses. Figure 6-2 shows a flowchart of vibration action levels.

6.3 Additional Monitors

Previous noise and vibration monitoring was not performed at the residential properties due to denial of access. The addition of monitors within the residential area would provide necessary data on noise and vibration in the area closest to the residences. This monitoring is needed to compare measured levels to the proposed actions levels. Use of the high frequency hammer will be evaluated with measured noise vibration data.

The success of this plan to mitigate pile driving noise depends to a great degree that access to the residential properties be granted.

Figure 6-1 Noise Mitigation Action Flow Chart

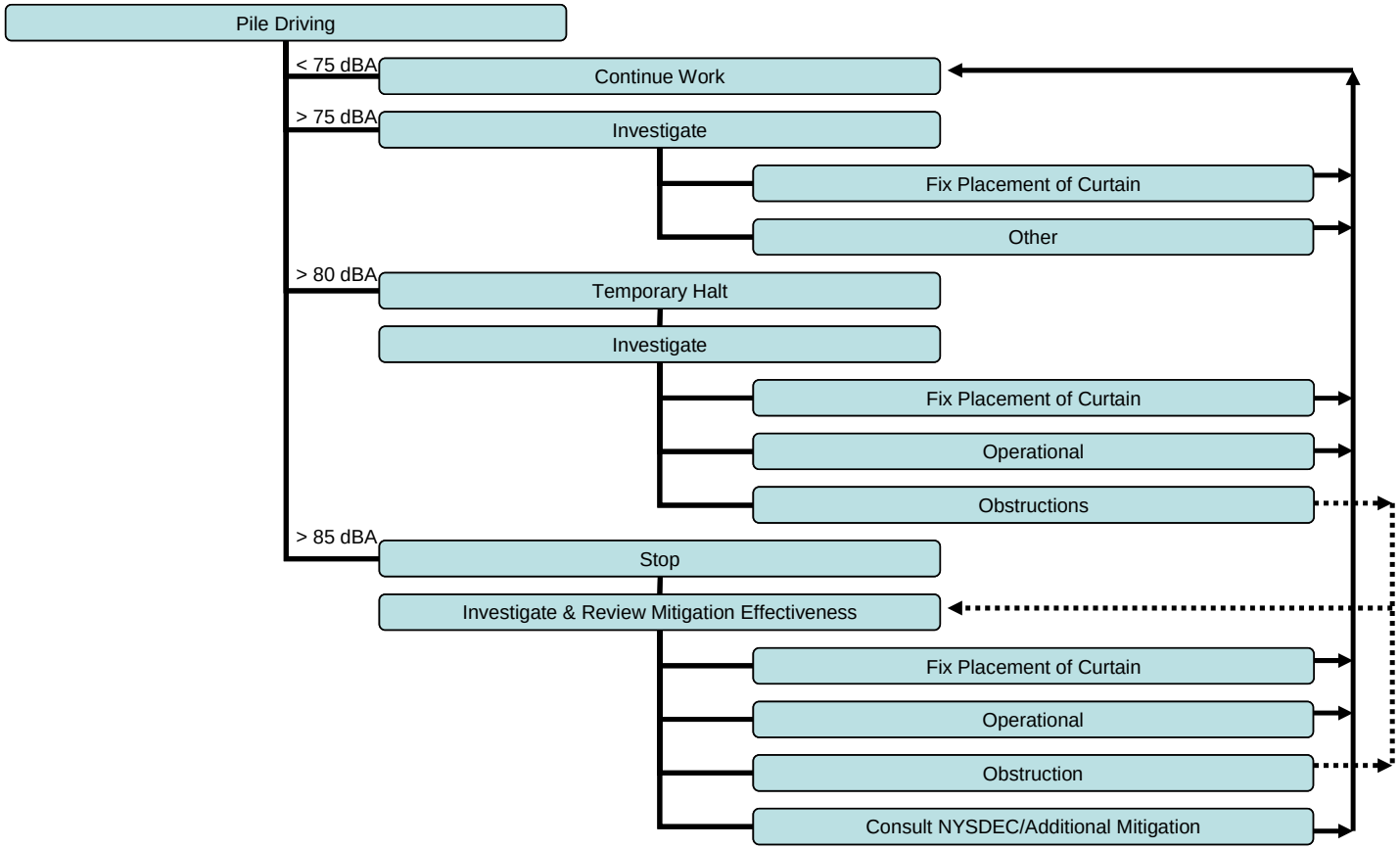
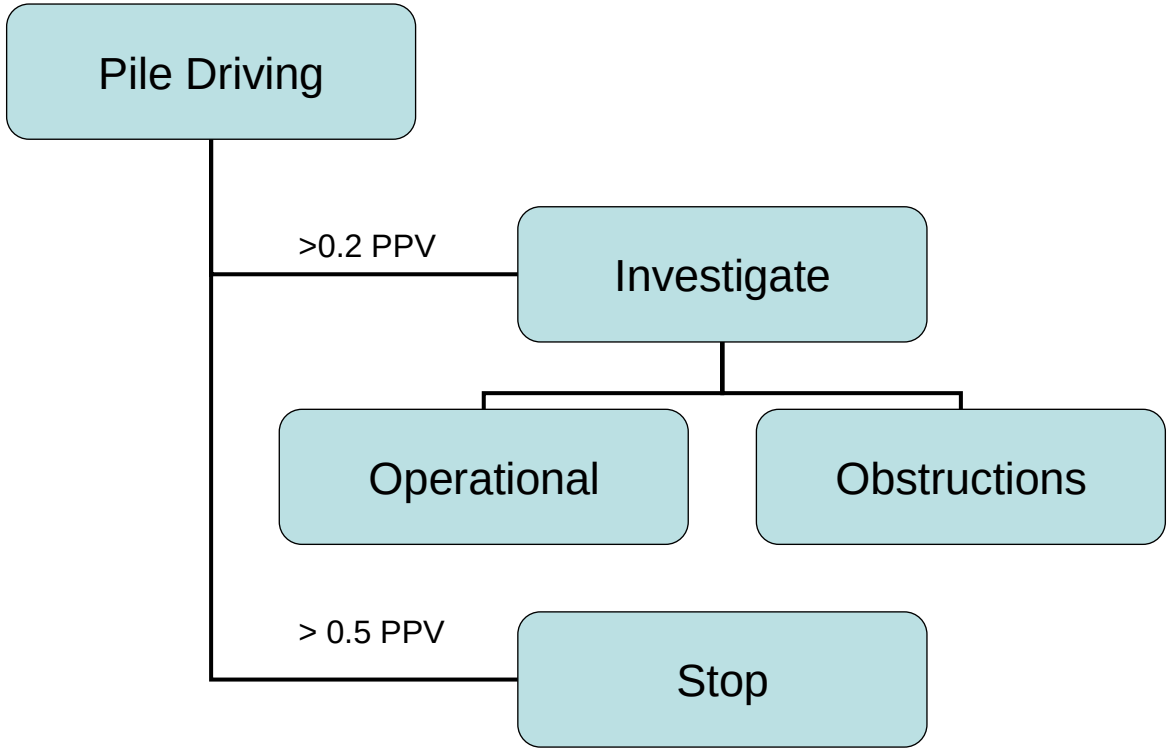


Figure 6-2 Vibration Mitigation Action Flow Chart



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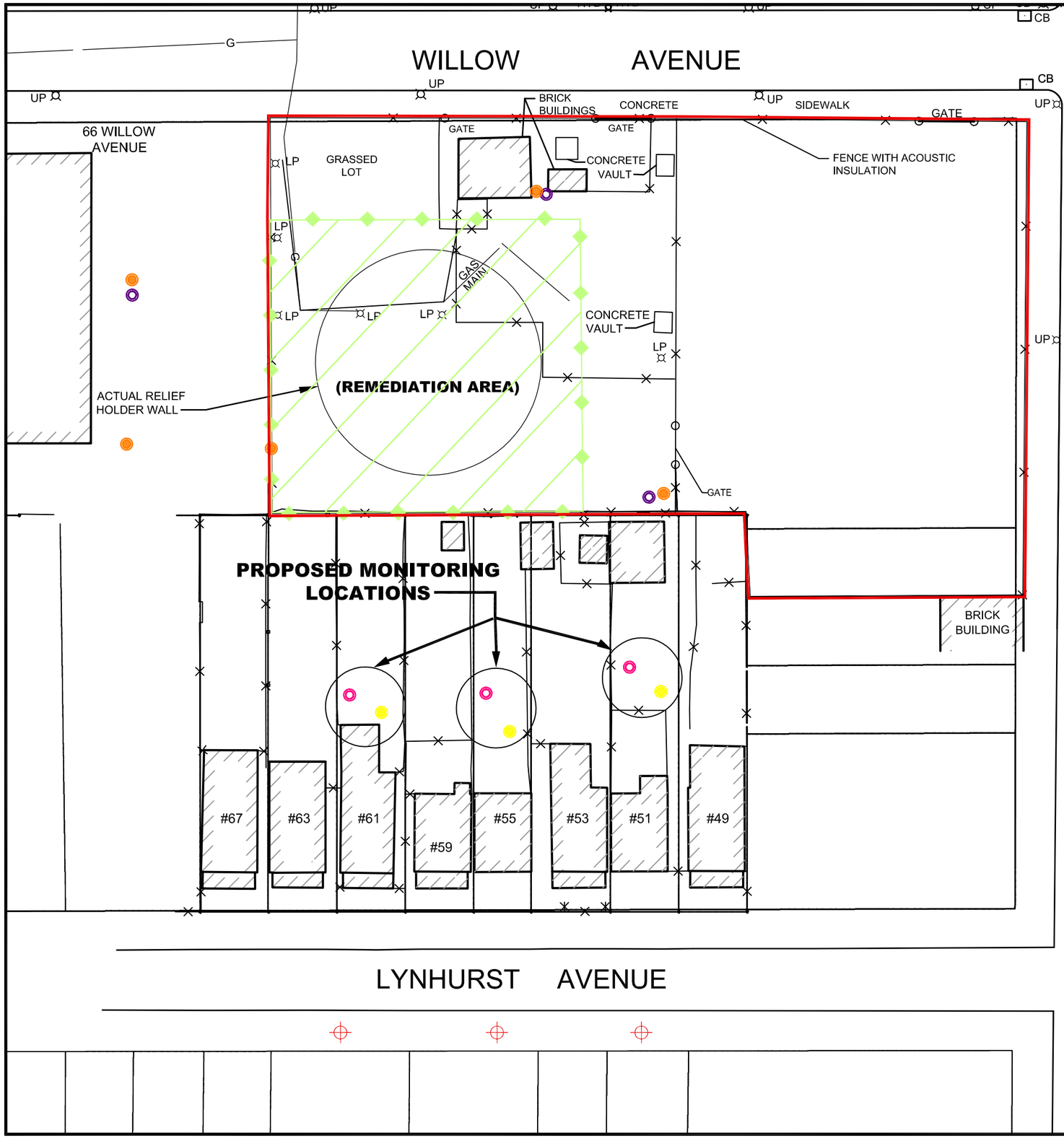

LEGEND

- EXISTING BUILDING/STRUCTURE
- HISTORICAL STRUCTURE/FEATURE
- CHAIN LINK FENCE
- CURRENT/HISTORIC PROPERTY BOUNDARY
- GAS LINE
- LIGHT POLE
- UTILITY POLE
- CATCH BASIN
- PROPOSED AREA TO BE CONTAINED WITHIN LIMITS OF VERTICAL BARRIER CUTOFF WALL
- PROPOSED VERTICAL BARRIER CUTOFF WALL TO BE KEYED INTO UNDERLYING SAPROLITE (TOTAL DEPTH APPROXIMATELY 130' BELOW GROUND SURFACE)
- NOISE MONITORING LOCATION
- PROPOSED NOISE MONITORING LOCATION
- VIBRATION MONITORING LOCATION
- PROPOSED VIBRATION MONITORING LOCATION
- ACOUSTIC INSULATION ATTACHED TO FENCE
- PROPOSED CONTINGENCY NOISE MONITORING LOCATION

0 40 80

SCALE, FEET

SOURCES:

1. "CLIFTON VIBRATION DATA SUMMARY" BY PAULUS SOKOLOWSKI AND SARTOR ENGINEERING, PC, JANUARY 2006.
2. FOLLOW-UP SOIL AND GROUNDWATER INVESTIGATION AT THE BROOKLYN UNION GAS COMPANY CLIFTON STATION FACILITY, 40 WILLOW AVENUE, STATEN ISLAND, NY BY FANNING, PHILLIPS & MOLNAR, AUGUST 29, 1994.
3. "MAP OF PROPERTY, EXIST. BLDG & YARD CONNECTIONS, NEW YORK AND RICHMOND GAS COMPANY - 1921", BY FANNING, PHILLIPS & MOLNAR ENGINEERS, RONKONKOMA, NEW YORK. SCALE 1"=30'. DATED 2/8/94 - REVISED TO 2/13/98.
4. "PROPOSED REMEDIAL APPROACH TEST DEMONSTRATION LOCATION AND COMMUNITY AIR MONITORING PLAN (CAMP) MONITORING STATION LOCATIONS" BY PAULUS SOKOLOWSKI AND SARTOR ENGINEERING, PC, WARREN, NEW JERSEY, SCALE: 1"=20. DATED 07/23/04.

REVISIONS/ISSUES

NO.	DATE	DESCRIPTION

PAULUS SOKOLOWSKI and SARTOR Engineering
Engineers • Architects Environmental Scientists

67A MOUNTAIN BOULEVARD EXTENSION
P.O. BOX 4039
WARREN, NEW JERSEY 07059
PHONE: (732) 560-9700
FAX: (732) 560-9768

PROJECT

KEYSPAN CORPORATION
FORMER CLIFTON MANUFACTURED GAS PLANT SITE
OPERABLE UNIT 1 (OU-1)
STATEN ISLAND, NEW YORK

SHEET TITLE

NOISE AND VIBRATION MONITORING LOCATIONS

DATE 12/04/06	JOB NO. 02522.017.044
SCALE 1" = 40'	
DRAWN MB	SHEET NO. Figure 4-1
CHKD. JB	

PROJECT: FILE NAME:M:\KeySpan_Site_Management_Tool\Clifton\Dwgs\clifton_(OU-1)\Clifton-Air Station Locations 2-06\MB_NOISElocations_120406_02.dwg LAST EDIT: 12/04/2006-02:5