US Army Corps
of Engineers®
New York District

NEW YORK AND NEW JERSEY HARBOR DEEPENING CHANNEL IMPROVEMENTS

NAVIGATION STUDY

DRAFT INTEGRATED FEASIBILITY REPORT & ENVIRONMENTAL ASSESSMENT

APPENDIX B3:

Structural

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Executive Summary

The United States Army Corps of Engineers (USACE) as part of a broader feasibility assessment has evaluated the New York and New Jersey Harbor system for areas that may have a condition that presents a structural concern based upon either the deepening or the anticipated activities to perform the deepening. For the feasibility evaluation USACE has relied upon significant amounts of historical information that had been gathered and generated in prior efforts. Some of this information will need to be confirmed in the future Preconstruction Engineering Deign (PED) phase of the project.

The USACE anticipates the following structural-related impacts:

1.) Some regions of the channels may need to have the blasting performed under less than ideal production to minimize the Peak Particle Velocities to maintain compliance with the appropriate regulatory blasting limits and to minimize damage (Section 2.1).
2.) A few waterfront structures including bulkheads and/or piers may need to undergo structural modifications or replacements dependent upon the results of a site-specific investigation or communication with the property owner (Section 2.2.1).
3.) For inland structures, a pair of chimneys will need to be demolished unless further information is obtained due to changes in support conditions or document falling of brick during past activities (Section 2.2.2).
4.) The harbor deepening effort will also impact utility lines running throughout the harbor. Several utilities will need to be either removed or relocated (Section 3)

The USACE had provided the following recommendations to mitigate these impacts:

1.) Part of the Kill Van Kull Channel will be blasted using non-production blasting.
2.) Structures on the waterfront and inland need further investigation to determine potential reinforcements or demolitions.
3.) About fifteen channel utilities will need to be removed and restored in different locations.

For further recommendation refer to Section 4 Recommendations. Ultimately, USACE believes the structural challenges associated with deepening the harbor to be manageable.

1. Structural Background

The deepening of the New York and New Jersey harbor may involve several different types of interactions with structures along the channels. It has been the experience of the USACE that the structures near the channels need to be evaluated to prevent possible unsafe conditions and damage from occurring. The USACE is evaluating the various regions to ensure that there is no "new" condition that is present or would be created from the further deepening of the channels. This is being undertaken by utilizing the vast amount of information that is available to the USACE from the prior activities. With necessary additional information to be gathered during the project engineering and design phase, which will occur at a later date.

1.1 Summary of the Historical Information

This report was compiled based upon the available information for the channels of the New York harbor with emphasis on the Ambrose, Anchorage, Kill Van Kull, and Newark Bay channels. A portion of the information utilized is historical and introduces some risk into the evaluation. This risk is partially mitigated by the comparison of satellite images from the approximate time of the writing of the prior reports with those of the region now. USACE has performed or commissioned several studies of the channel's characteristics that are being utilized in the evaluation of further deepening without commissioning new studies to duplicate past efforts. To accomplish this the USACE is leveraging the available information from the reports described within this section as well as the as-built information that USACE has previously obtained.

The earliest report "Update of Blasting Analysis: New Jersey –New York Harbor" was created by URS Greiner Woodward Clyde Federal Services. It is dated July 7, 1999. This report provides extensive information regarding the anticipated Peak Particle Velocities (PPV) and various methods of mitigation.

The next report that is being utilized is the "Feasibility Report for New York and New Jersey Harbor Navigation Study Final Environmental Impact Statement (FEIS) Appendix – G." from December of 1999. This report provides historical as-built conditions for several buildings that have been present for the past few decades as well as information regarding some of the subsurface characteristics.

The latest of the reports that is being utilized is the "Structural Investigation / Blasting Analysis NYNJ Harbor 50' Channel Project." This report was prepared for the USACE in July 2003 by the Master Harbor Partnership. This partnership included URS which was a member of the group that developed the report "Update of Blasting Analysis: New Jersey –New York Harbor." This report updates some of the peak particle velocities as more attenuation was documented than expected in some of the rock types from the earlier report. This report also evaluates several structures that were of concern to the USACE for possible effects from blasting.

1.2 General Conditions

The Kill Van Kull channel is the shipping channel between Staten Island, NY and Bayonne, NJ. The Kill Van Kull channel is currently maintained at a navigable depth of 50' below MLLW. This is captured on the current controlling depth report as well as the bathymetry sheets 1-9 contained in section 1.3 Bathymetry Information. This file also indicates that the channel is deeper than the reported navigable depth in several locations due to over blasting and over dredging of prior efforts.

Table 1.2 lists the current Authorized Depth of the various channels that are under evaluation as part of this study.

Table 1.2-1 Authorized Depth of the Channels Under Evaluation.

Channel Name	Authorized Depth (feet) bellow MLLW
Ambrose Channel	53'
Anchorage Channel South	50'
Anchorage Channel North	45'
Port Jersey	50'
Kill Van Kull	50'
Newark Bay South	50'
Newark Bay Central	50'
Newark Bay North	45'
South Elizabeth	50'
Port Elizabeth	50'
Arthur Kill	50'

Currently, the feasibility of deepening the New York and New Jersey Harbor system is under investigation by the USACE New York District. This portion of the report determines the likely impacts to the structures that may be affected by deepening the channel. The report evaluates if structures are to be affected either by the activities to remove the earth or the removal of the earth itself. These efforts are mainly necessary along the Kill Van Kull channel as the distance between the channel and the shoreline is significantly less than other regions of the harbor system.

1.3 Bathymetry Information

This section documents the most recent bathymetry information that was available at the time of the evaluation of the Kill Van Kull channel. This information was utilized to make assumptions regarding the characteristics of the waterfront structures when as-built information was not available. This information is routinely collected by the USACE as part of the harbor mission and was not specifically commissioned for this report. For this reason, the information represented in the data does not fully capture conditions completely between the channel and the various waterfront structures.

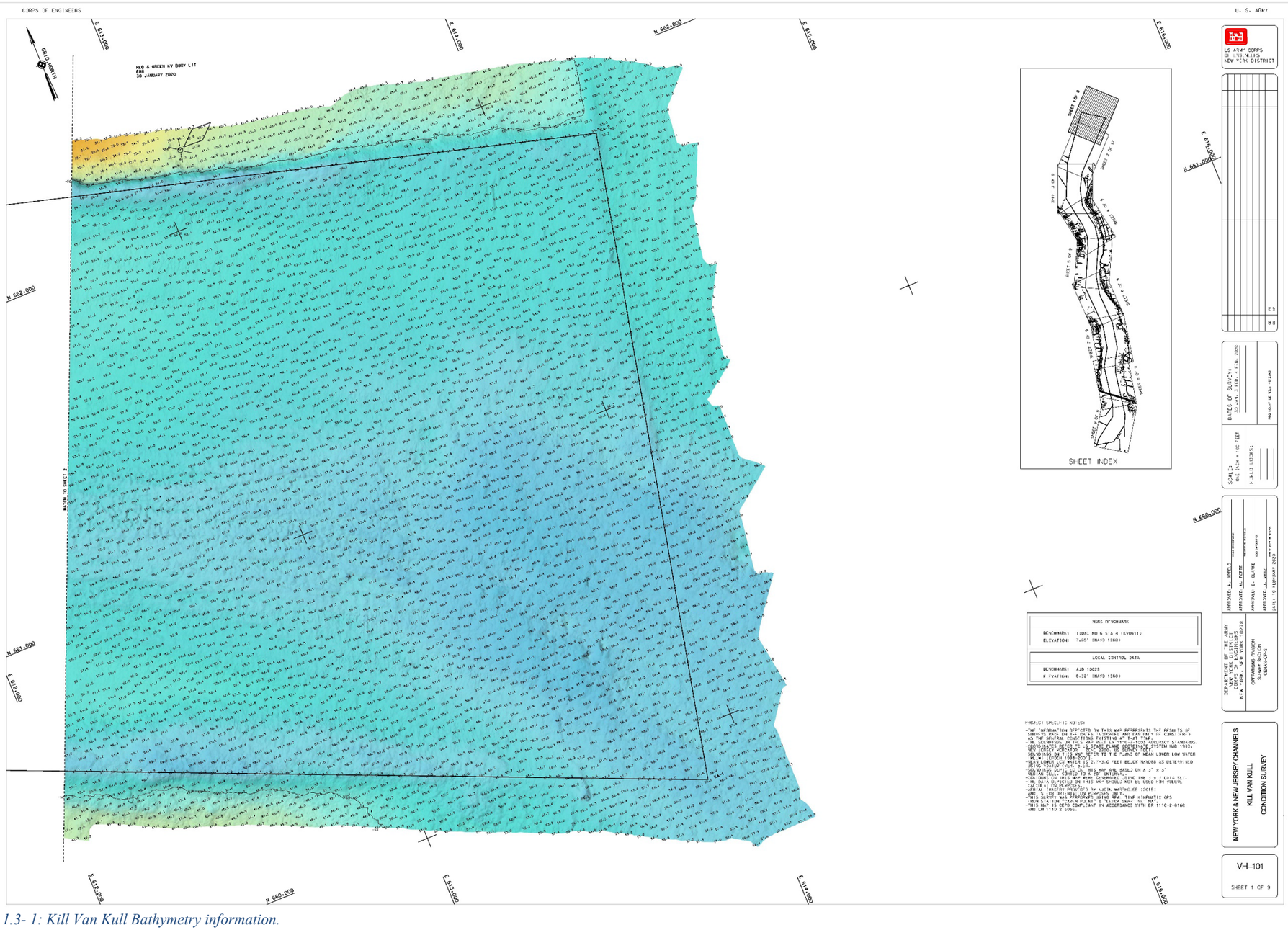

Figure 1.3- 1: Kill Van Kull Bathymetry information.

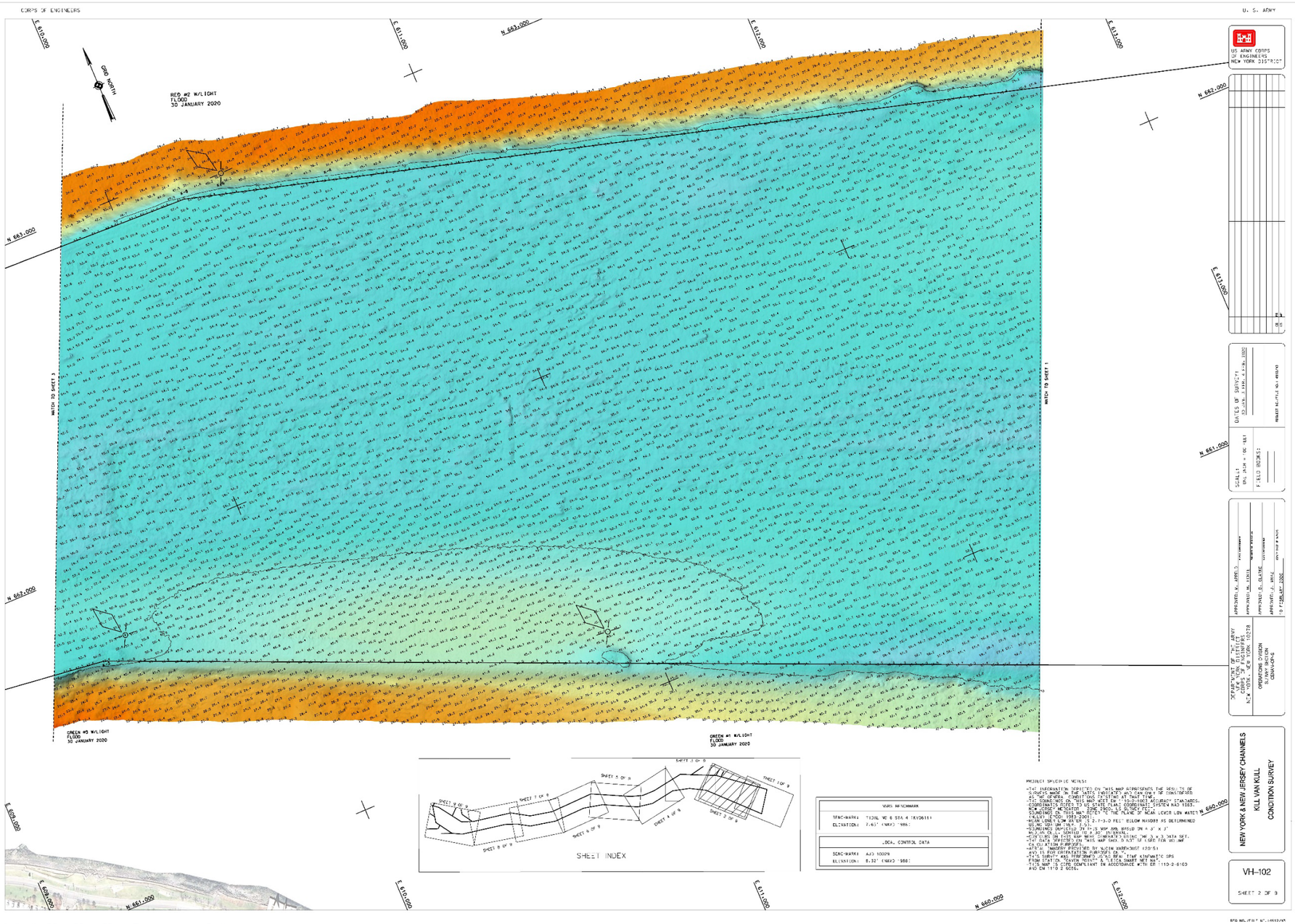

Figure 1.3- 2: Kill Van Kull Bathymetry Information (continued).

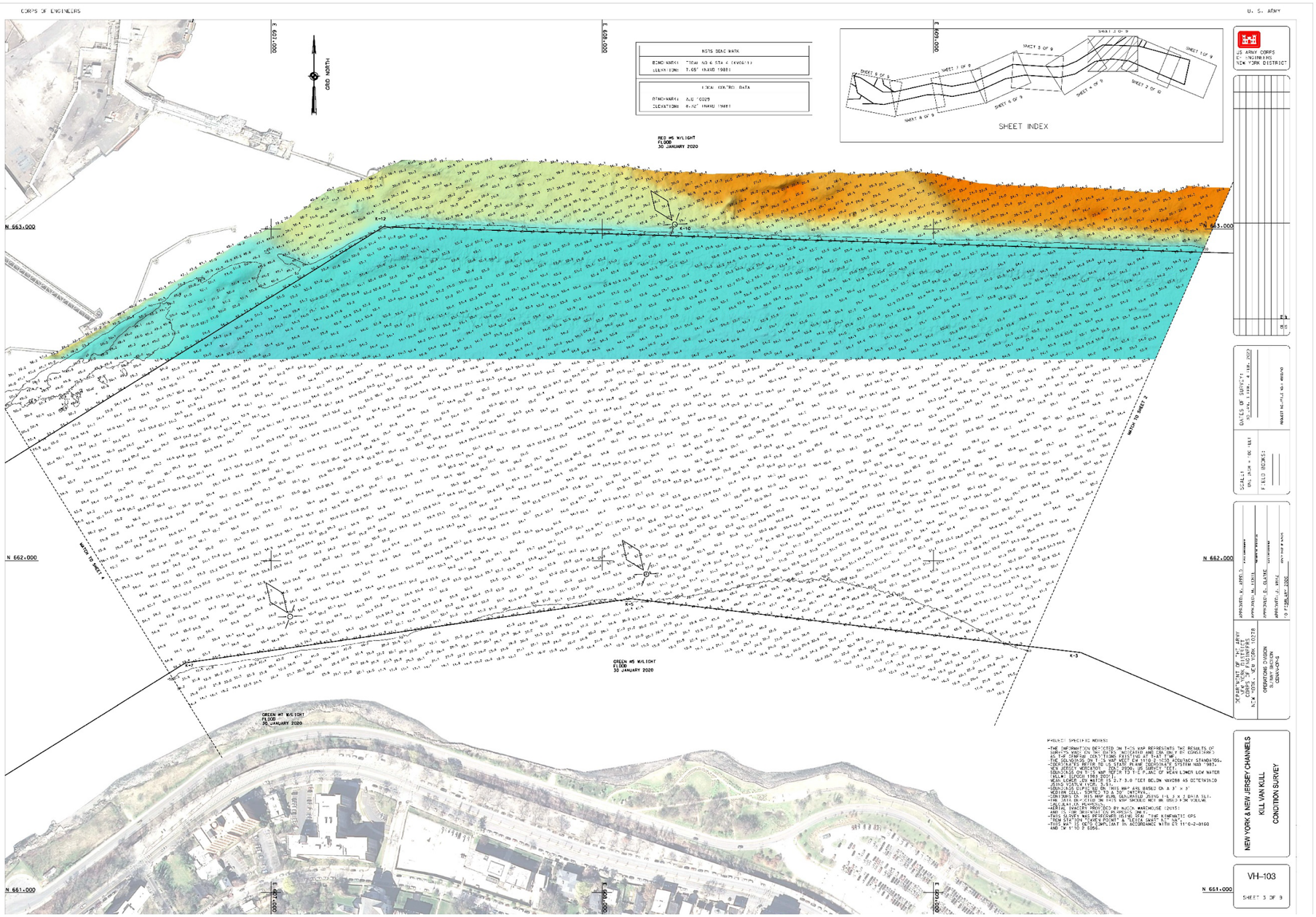

Figure 1.3- 3: Kill Van Kull Bathymetry Information (continued).

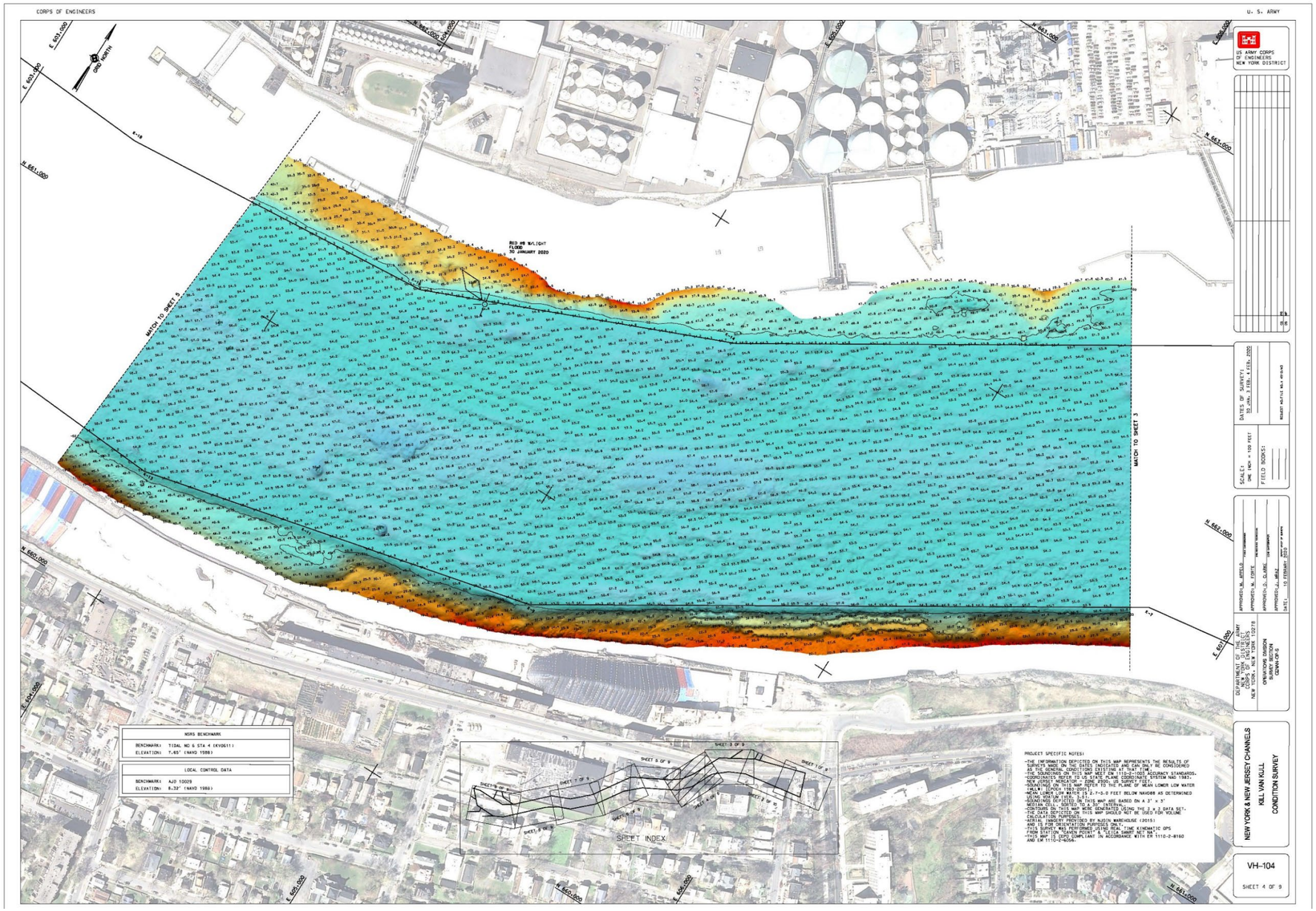

Figure 1.3- 4: Kill Van Kull Bathymetry Information (continued).

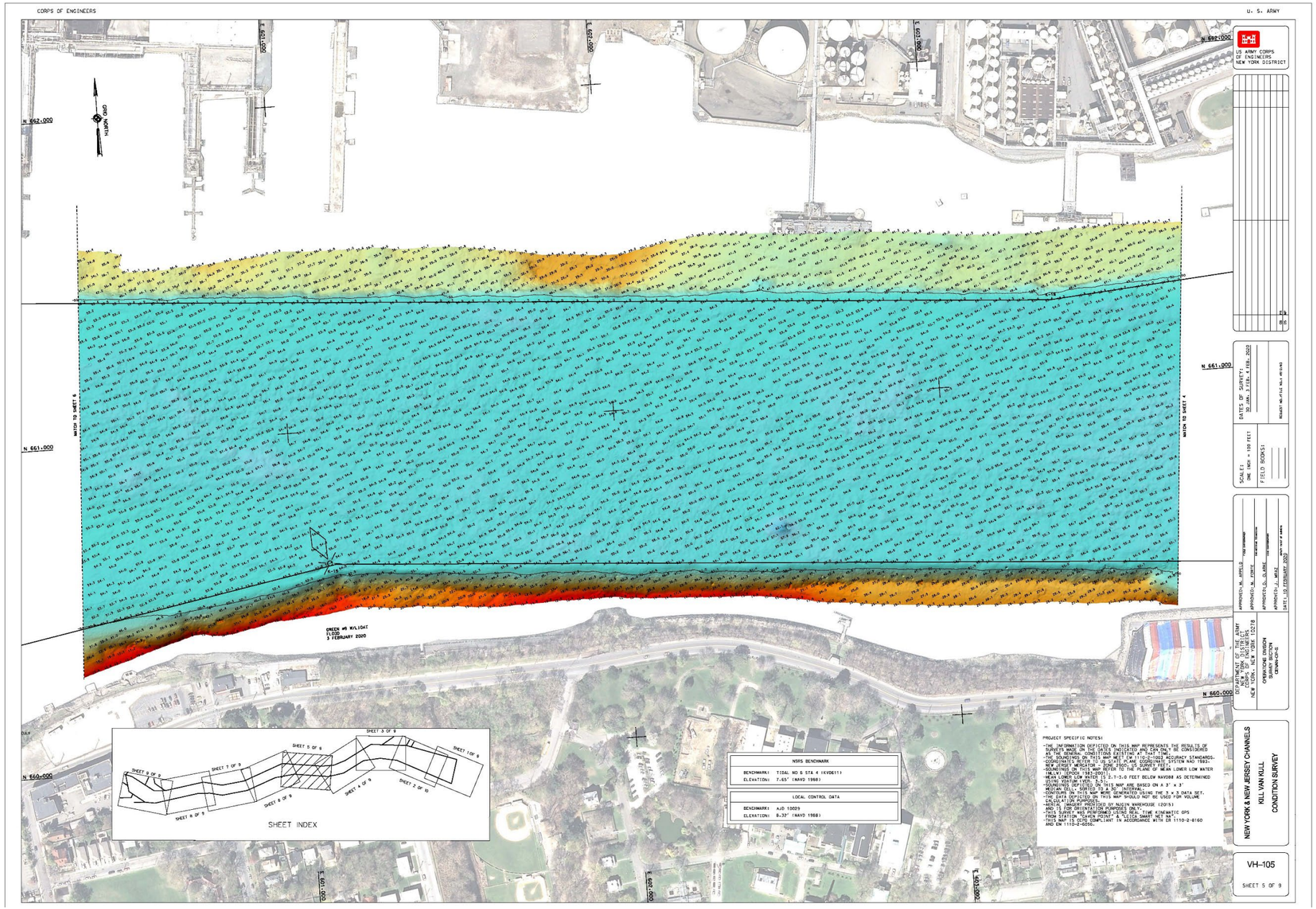

Figure 1.3- 5: Kill Van Kull Bathymetry Information (continued).

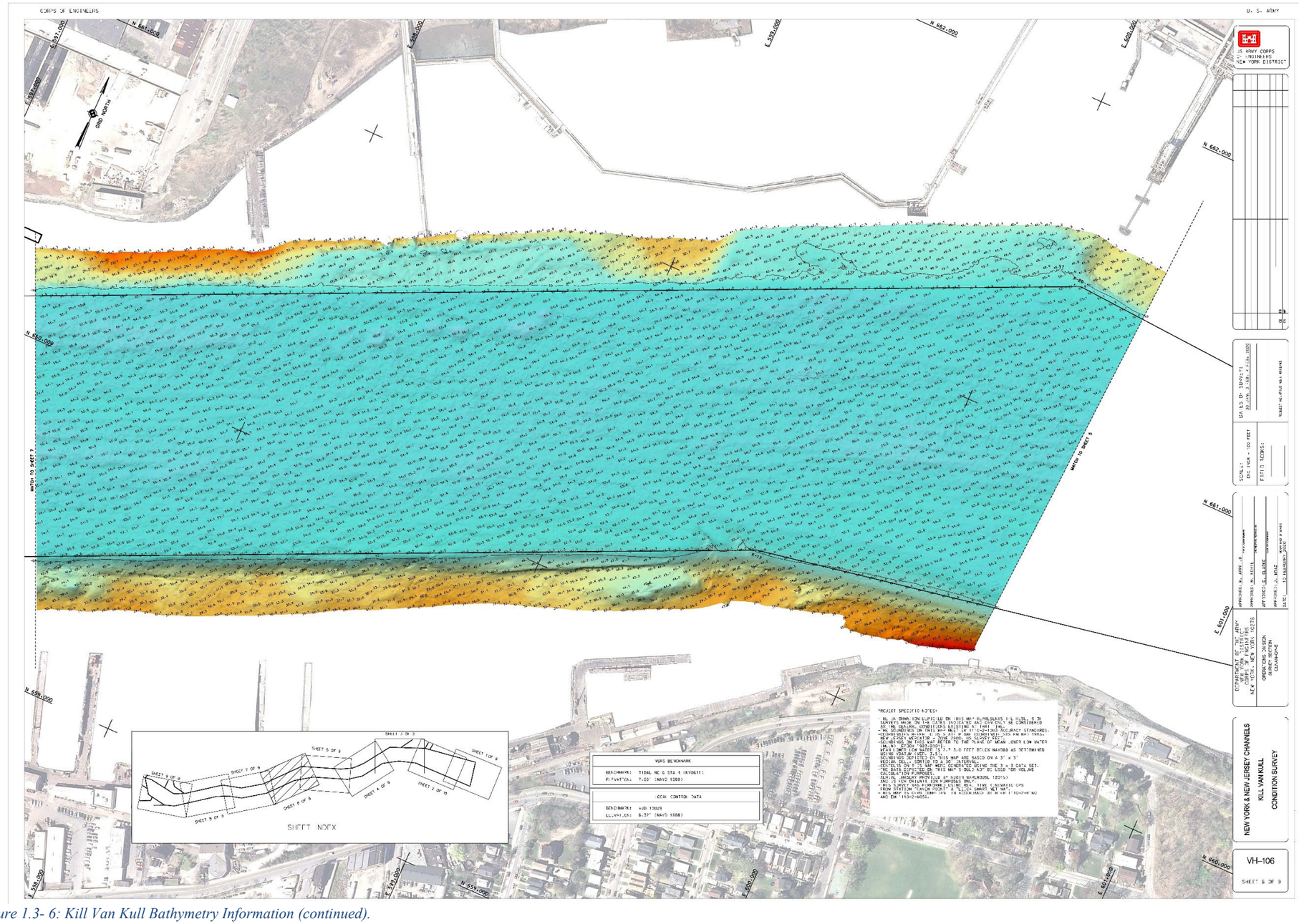

Figure 1.3- 6: Kill Van Kull Bathymetry Information (continued).

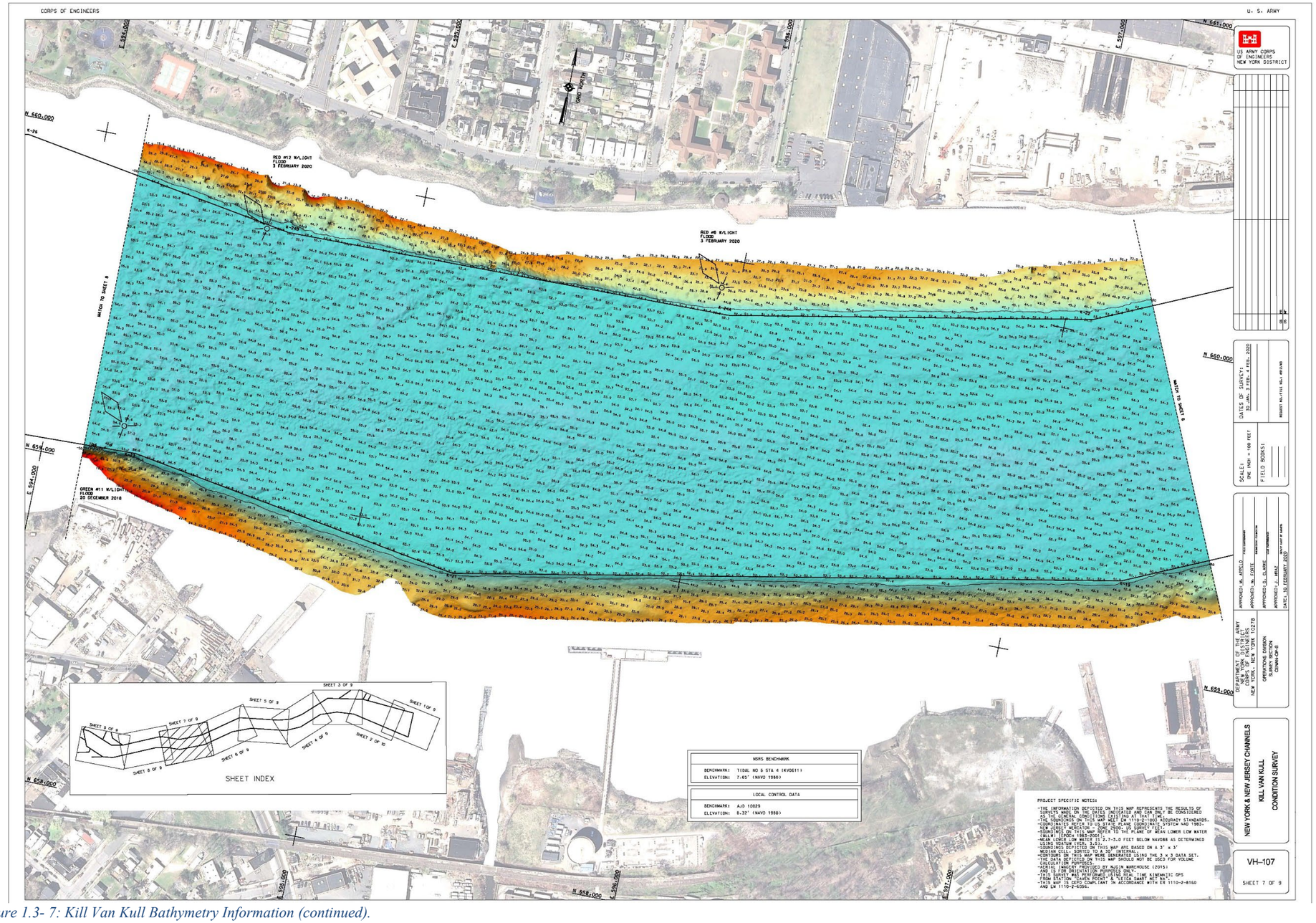

Figure 1.3- 7: Kill Van Kull Bathymetry Information (continued).

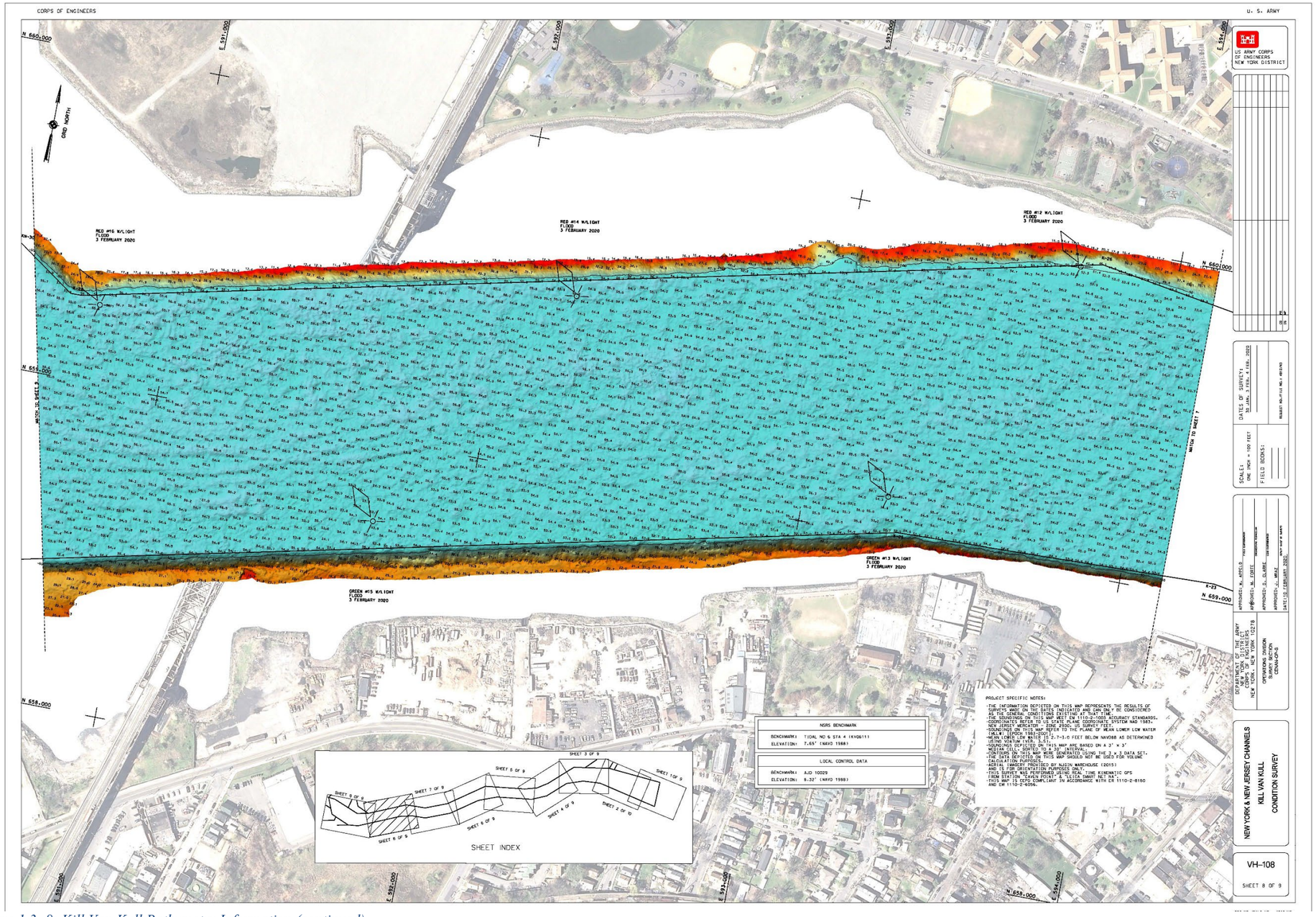

Figure 1.3- 8: Kill Van Kull Bathymetry Information (continued).

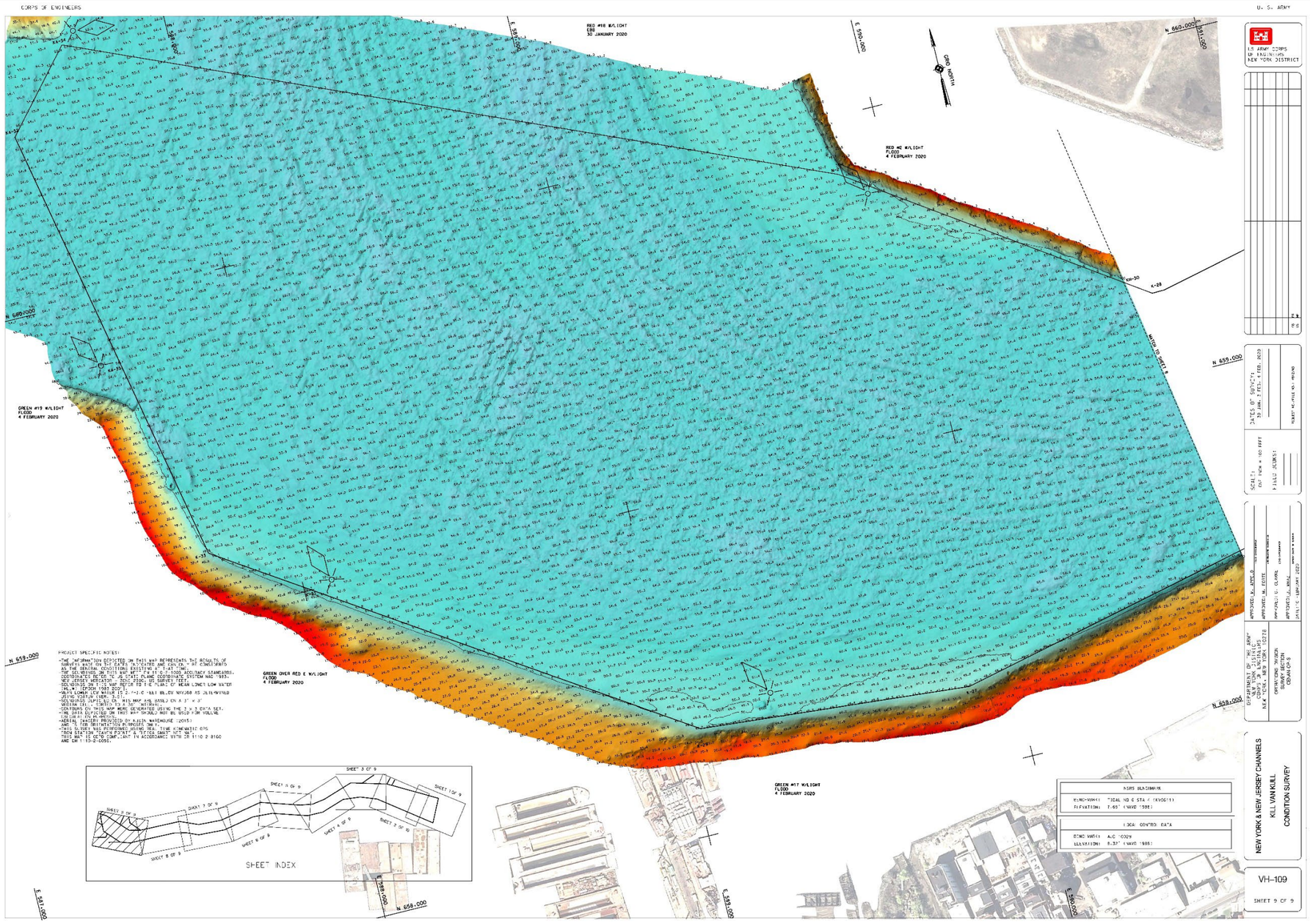

Figure 1.3- 9: Kill Van Kull Bathymetry Information (continued).

1.4 Structural Inventory and Comparison

The two subsections of this section compare current images of structures with aerial images of the structures that were present at the time of the 2003 "Structural Investigation / Blasting Analysis NYNJ Harbor 50' Channel Project." In some instances, additional angles are utilized to clearly document a specific condition. Table 1.4-1 Structures within the Region of Concern lists the structure number as utilized in prior reports, the corresponding location, and the figure(s) documenting the current and former condition.

Table 1.4- 1: Structures within the Region of Concern.

Structure no.	Location	Figure Circa 2004	Figure Circa 2020
KVK-003	404 Richmond Terrace, Greek Revival Temple; SI	1.4.2-7	1.4.2-8
KVK-004	Foot of Bank Street; Staten Island	1.4.2-7	1.4.2-8
KVK-005	Bank Street; Staten Island – Concrete Pillars		
KVK-006	15 Bank Street: Staten Island	1.4.2-7	1.4.2-8
KVK-011A	Across From 500 Richmond Terrace; Staten Island	1.4.2-9	1.4.2-10
KVK-011B	Continuation of KVK 11A	1.4.2-9	1.4.2-10
KVK-087	St Mary's Church	1.4.1-15	1.4.1-16 1.4.1-20
KVK-088	St Mary's Rectory	1.4.1-15	1.4.1-16 1.4.1-20
KVK-089	St Mary's Hall Sharp Ave and Richmond	1.4.1-15	1.4.1-16 1.4.4-20 1.4.4-21
KVK-299	Scaramix Bulkheads	1.4.1-11	1.4.1-12
KVK-301	Junkyard East of Bayonne Bridge	1.4.1-13 1.4.1-15	1.4.1-14 1.4.1-16
KVK-302	Construction Company	1.4.1-15	1.4.1-16 1.4.1-17 1.4.1-18 1.4.1-19
KVK-303	Faber Park	1.4.1-22	1.4.1-23
KVK-304	Atlantic Express Company	1.4.1-22	1.4.1-23
KVK-305	3 Buildings between Atlantic Express and Construction Company	1.4.1-22	1.4.1-23
KVK-306	KVK Construction Company	1.4.1-24	1.4.1-25
KVK-307	Building north of Construction Company	1.4.1-24 1.4.1-26	1.4.1-25 1.4.1-28 1.4.1-29
KVK-309A	Atlantic Salt Company and Building to east	1.4.2-9	1.4.2-10

KVK-309B	Continuation of KVK-309A		
KVK-309C	Continuation of KVK-309B		
KVK-310A	Shoreline east of deteriorated warehouse (KVK-309) to Staten Island Ferry	1.4.2-5 1.4.2-7	1.4.2-6 1.4.2-8
KVK-310B	Continuation of KVK-310A		
KVK-310C	Continuation of KVK-310B		
KVK-313	Exxon – Western Pier	1.4.2-11	1.4.2-12
KVK-323A	Shoreline from Lord Street to Bayonne Bridge	1.4.1-3	1.4.1-4
KVK-323B	Continuation of KVK-323A	1.4.1-5 1.4.1-9	1.4.1-6 1.4.1-10
KVK-323C	Continuation of KVK-309B	1.4.1-7 1.4.1-9	1.4.1-8 1.4.1-10
KVK-324	Bayonne Bridge	1.4.1-1	1.4.1-2
KVK-328	Staten Island Ferry	1.4.2-1	1.4.2-2
KVK-329	Staten Island Yankees Baseball Stadium	1.4.2-1	1.4.2-2
KVK-330	Verrazano Narrows Bridge	1.4.2-13	1.4.2-14
	Empire Outlets	1.4.2-1	1.4.2-2
	Imperial Park	1.4.2-3	1.4.2-4

1.4.1 Kill Van Kull Structures Compared – Diabase

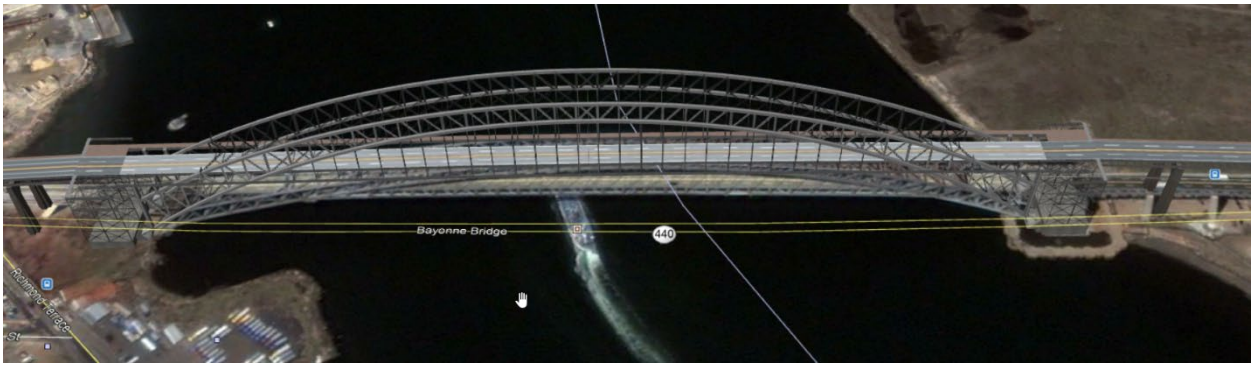

*Figure 1.4.1- 1: **KVK-324**, The Bayonne Bridge circa 2004 prior to the bridge raising project.*

*Figure 1.4.1- 2: **KVK-324**, The Bayonne Bridge circa 2020 after the bridge raising project.*

The Bayonne Bridge, **KVK-324,** was recently raised as part of a navigation project to permit larger ships to pass underneath it. As part of the project the towers on the piers were raised and a precast deck was installed at the higher elevation. The approach ways were replaced and the concrete support piers for the approach ways were also replaced. Also changed from the report by the Master Harbor Partnership is the installation of a visible bumper system above the water at the pier locations.

*Figure 1.4.1- 3: Lord Ave and Brady's Dock, the eastern portion of **KVK-323** – A, B, & C circa 2004.*

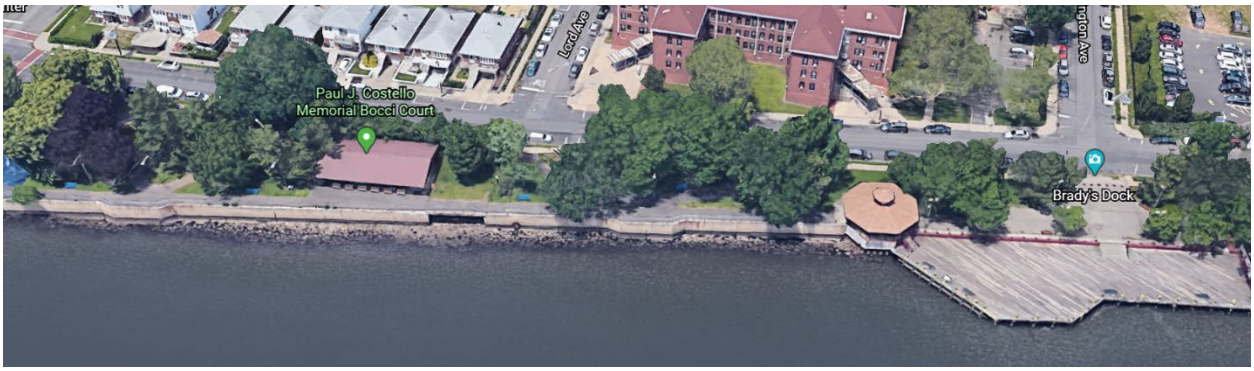

*Figure 1.4.1- 4: Lord Ave and Brady's Dock, the eastern portion of **KVK-323** – A, B, & C circa 2020.*

The figures above show the eastern portion of **KVK-323-A, B, & C,** the shoreline on the New Jersey side of the Kill Van Kull channel near the end of Lord Ave. The region by Brady's Dock appears to be unchanged from the report by the Master Harbor Partnership. The concrete wall from Lord Ave until Broadway appears to be unchanged as well. There appears to be an undocumented pedestrian bridge or drainage structure at the end of Lord Ave.

Figure 1.4.1- 5: The middle eastern portion of **KVK-323-A, B, & C** circa 2004. Continued from Figure 1.4.1-3.

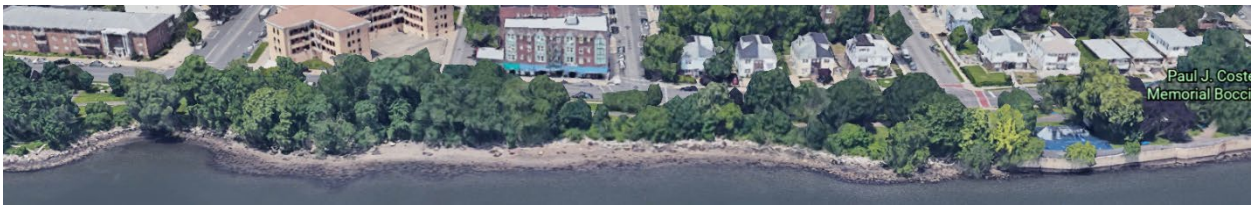

Figure 1.4.1- 6: The middle eastern portion of **KVK-323-A, B, & C** circa 2020. Continued from Figure 1.4.1-4.

The middle eastern portion of **KVK-323-A, B, & C** continues to show the remaining retaining wall which terminates at Broadway and 1st Street as indicated in the report by the Master Harbor Partnership. After the termination of the concrete retaining wall the shoreline appears very similar to the report by the Master Harbor Partnership consisting of rock and debris.

Figure 1.4.1- 7: The middle western portion of **KVK-323-A, B, & C** circa 2004. Continued from Figure 1.4.1-.5.

Figure 1.4.1- 8: The middle western portion of **KVK-323-A, B, & C** circa 2020. Continued from Figure 1.4.1-6.

Continuing to the middle western portion of **KVK-323-A, B, & C**, the Bayonne shoreline continues to consist of rock and debris as documented in the report by the Master Harbor Partnership. The land between the shoreline and 1st street has had some additional recreation facilities installed but remains largely undeveloped. The distinguishable structures are sheds, baseball dugouts, and likely a public restroom.

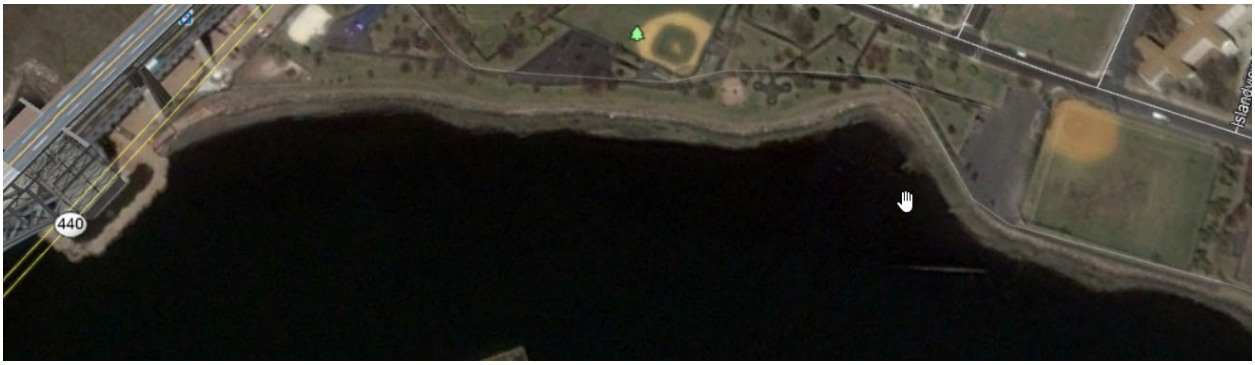

Figure 1.4.1- 9: The western portion of **KVK-323-A, B, & C** circa 2004. Continued from Figure 1.4.1-7.

Figure 1.4.1- 10: The western portion of **KVK-323-A, B, & C** circa 2020. Continued from Figure 1.4.1-8.

The western portion of **KVK-323-A, B, & C** continues to consist of rock and debris and progresses along the New Jersey side up to the Bayonne Bridge. Again, the shoreline remains relatively unchanged with some site improvements undertaken.

*Figure 1.4.1- 11: Scaramix Bulkhead, **KVK-299,** circa 2004.*

Figure 1.4.1- 12: The former site of the Scaramix Bulkhead, KVK-299 circa 2020.

The former site of the Scaramix Bulkhead, **KVK-299**, in Staten Island, NY. The building that was documented in the report by the Master Harbor Partnership appears to have been demolished. The site location is now operating under the name of New York Sand and Stone as a stone/sand supply location with significant stockpiles. The site appears to have stockpiled

material varying in heights from approximately 15’-45’. The bulkhead documented in the report by the Master Harbor Partnership appears largely unchanged.

*Figure 1.4.1- 13: The western portion of the Junkyard East of the Bayonne Bridge, **KVK-301,** circa 2004.*

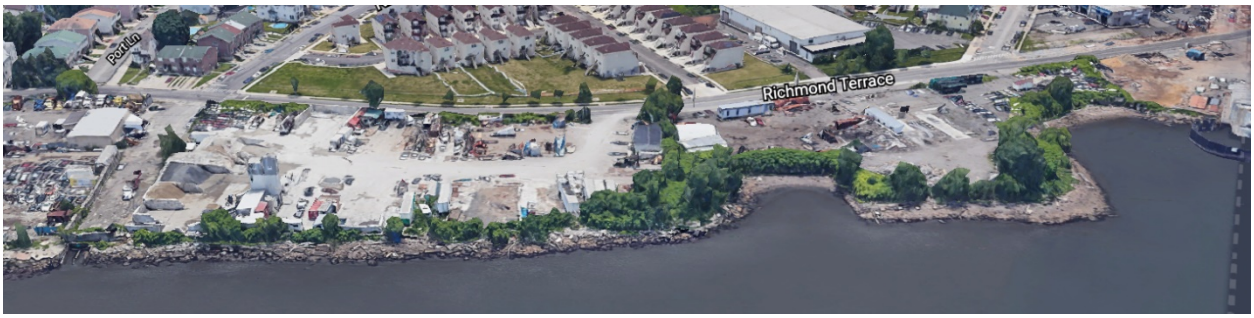

*Figure 1.4.1- 14: The western portion of the Junkyard East of the Bayonne Bridge, **KVK-301,** circa 2020.*

The figure captures the western portion of the Junkyard East of the Bayonne Bridge, **KVK-301.** This area in Staten Island, NY appears to have been transformed into a construction staging area. The shoreline appears to be rock and debris.

*Figure 1.4.1- 15: The photo captures the eastern portion of the Junkyard East of the Bayonne Bridge, **KVK-301**, and the location of Construction Co., **KVK-302**, and the St. Mary's Church Buildings circa 2004.*

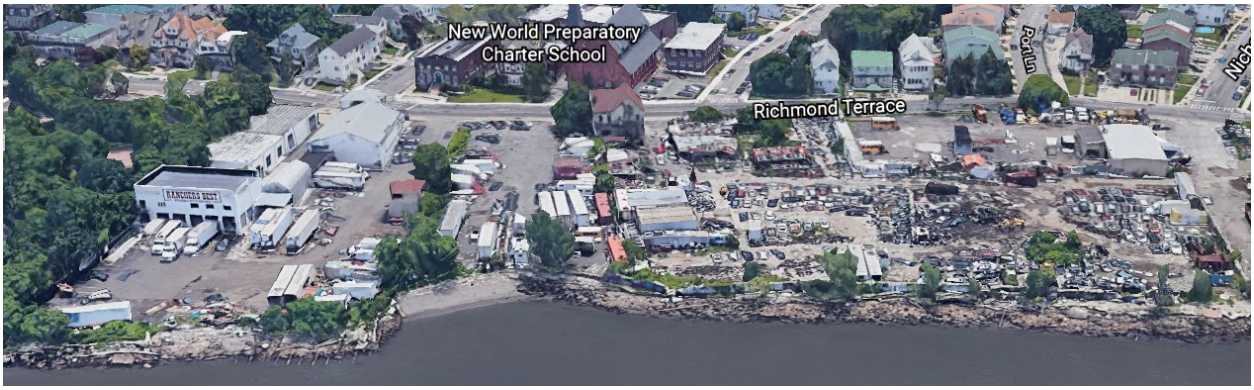

*Figure 1.4.1- 16: The photo above captures the eastern portion of the Junkyard East of the Bayonne Bridge, **KVK-301,** and the location of Construction Co., **KVK-302,** and the St. Mary's Church Buildings.*

The eastern portion of the Junkyard East of the Bayonne Bridge, **KVK-301,** and shoreline remains like the report by the Master Harbor Partnership as a mixture of riprap and large stones. The wooden structure documented by the Master Harbor Partnership remains. The site appears to have several makeshift structures onsite created from stacked tractor trailers and shipping containers as well as corrugated metal. These may be subject to some movement from the blasting and ground motion.

The current site of Construcion Co., **KVK-302,** has an addition on the water side of the main structure (pitched roof). The addition that was constructed is made from CMU blocks with a steel frame. This is not yet documeted in the available areial images in Figure 1.4.1-16, but is

viewable in the Google Map street view. It appears that the shoreline is unchanged from what was documented in the report by the Master Harbor Parnership.

*Figure 1.4.1- 17: This is a blow up of the former Construction Co. Property, **KVK-302,** from Figure 1.4.1-16.*

*Figure 1.4.1- 18: New addition under construction at the location of **KVK-302.***

*Figure 1.4.1- 19: Completed or nearly completed addition at the location of **KVK-302.***

Figure 1.4.1-17 is an enlargement of the site of **KVK-302** from Figure 1.4.1-16. Figure 1.4.1-18 and Figure 1.4.1-19 are Google Map street view images that capture the building under construction and after completion.

Figure 1.4.1-18. Captures the addition to the former Construction Co. Property **KVK-302** with an erected steel frame and partially constructed CMU shell.

Figure 1.4.1-19 is the completed or nearly completed new structure at the location of **KVK-302.** This addition was erected closer to the location of future blasting than the structures that it is connected to. It however does not appear to be closer than the other structures that are also on this site.

Figure 1.4.1- 20:is a blown-up view of the St. Mary's Church buildings from Figure 1.4.1-16. (St. Mary's Hall, **KVK-89**, (Left) St. Mary's Rectory, **KVK-88,** (Middle), St Mary's Church, **KVK-87** (Right))

St. Mary's Church, **KVK-87,** appears to remain unchanged from the report by the Master Harbor Partnership.

St. Mary's Rectory, **KVK-88,** appears to remain unchanged from the report by the Master Harbor Partnership.

St. Mary's Hall, **KVK-89** was documented to have a possible foundation settlement problem that was documented in the report by the Master Harbor Partnership. The building appears to continue to have this problem and it appears that it may have worsened. Figure 1.4.1-21 captures repaired and subsequently re-cracked masonry. This may indicate continued movement. The St. Mary's Church buildings are all located inland of **KVK-301**, the Junkyard East of the Bayonne Bridge.

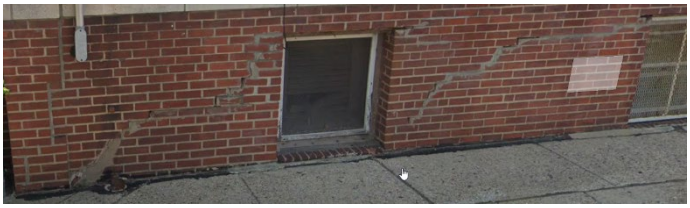

*Figure 1.4.1- 21: Rear of St. Mary's Hall, **KVK-89,** along Sharpe Ave.*

*Figure 1.4.1- 22: This photo captures Faber Park, **KVK-303,** (Right), The Atlantic Express Bus Co., **KVK-304,** (middle) and the three buildings between Atlantic Express Bus Co. and Construction Co.**, KVK-305** (left).*

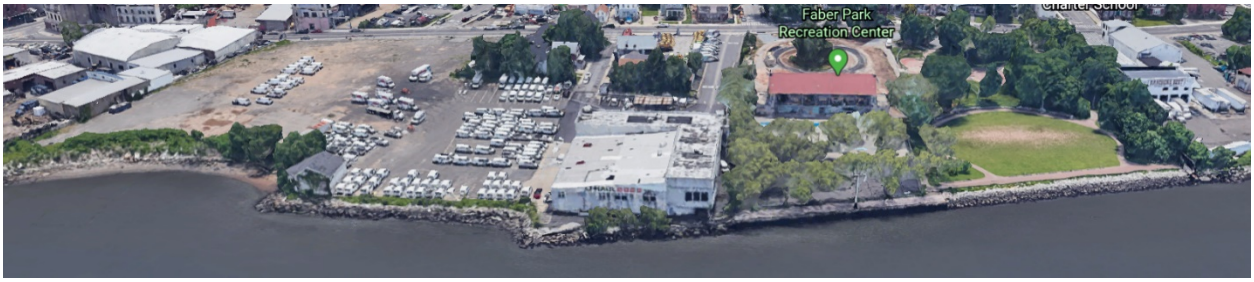

*Figure 1.4.1- 23: This photo captures Faber Park, **KVK-303,** (Right), The Atlantic Express Bus Co., **KVK-304,** (middle) and the site of the three buildings between Atlantic Express Bus Co. and Construction Co.**, KVK-305** (left).*

Faber Park **KVK-303** appears to have been updated since the report by the Master Harbor Partnership. The documented steel sheeting appears to have had a concrete cap and walkway installed on top. The stone rip rap appears to have been rehabilitated since the report. The structure included with **KVK-303** appears largely unchanged as does the pool.

The Atlantic Express Bus Co., **KVK-304** is now a U-Haul rental center. The building and shoreline appear largely unchanged from what was captured by the report by the Master Harbor Partnership. An undocumented outbuilding is located near the shoreline and property boundary shared with Construction Co.

The three buildings between Atlantic Express Bus Co. and Construction Co.**, KVK-305** have been demolished. The property is being utilized as storage for additional vehicles from the U-Haul rental center. The shoreline of KVK-305 appears to be unchanged.

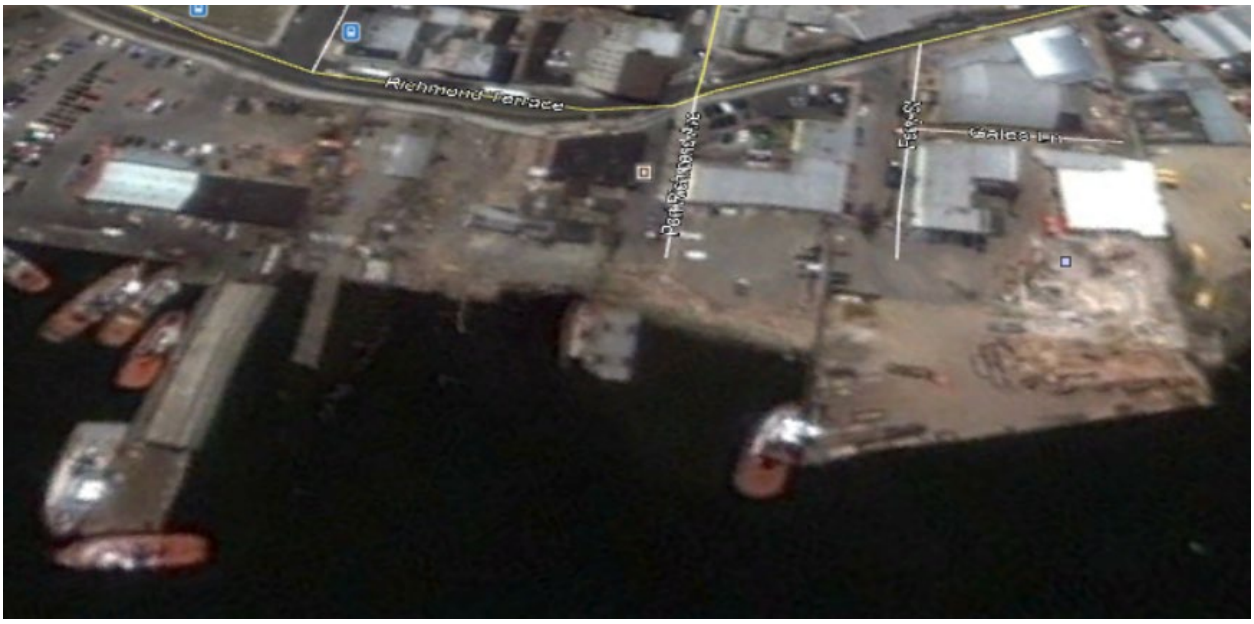

*Figure 1.4.1- 24: The buildings of KVK Construction Co., **KVK-306**, and the buildings of **KVK-307** (see Figure 1.4.1-26)*

*Figure 1.4.1- 25: The buildings of KVK Construction Co., **KVK-306**, and the buildings of **KVK-307** (see Figure 1.4.1-27)*

The buildings of KVK Construction Co., **KVK-306,** appear to contain the structures documented in the report by the Master Harbor Partnership along with several additions and a new garage building. The steel sheathing for the bulkhead appears to remain unchanged. The chimney that was reported to have had a dislodged brick fall and break a skylight during past activities remains.

*Figure 1.4.1-26: This is an aerial blow up of the buildings north of Construction Co., **KVK-307**.*

Figure 1.4.1- 27: This photo is from the approximate time of the report by the Master Harbor Partnership

Building 1. The building at this location was demolished and the area has no new structures (Red outline from Figure 1.4.1-27).

Building 2. The building at this location was demolished and the area has no new structures. (Orange outline from Figure 1.4.1-27)

Building 3. The shorter portion of the building is approximately half a story taller than the building that was documented in the report by the Master Harbor Partnership. The taller portion of Building 3 appears to remain unchanged from the condition captured in the report by the Master Harbor Partnership. (Yellow outline from Figure 1.4.1-27)

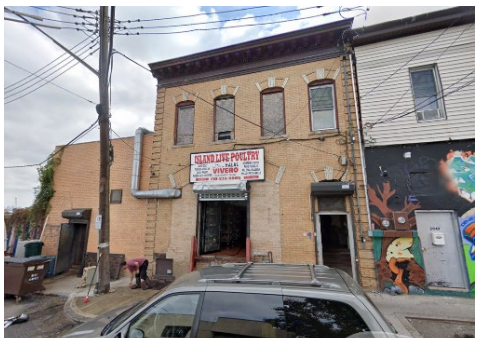

Figure 1.4.1-28:. Current view of building 3 on Port Richmond Ave.

Building 4. The building remains largely unchanged from the condition captured in the report by the Master Harbor Partnership. (Green outline from Figure 1.4.1-27)

Building 5. The building appears to be currently undergoing a façade repair and has sidewalk bridging installed. (Blue outline from Figure 1.4.1-27)

Building 6. Appears to be abandoned. The windows are currently filled with plywood. (Purple outline from Figure 1.4.1-27)

Building 7. This building appears to be in similar condition to what was documented in the report by the Master Harbor Partnership. (Pink outline from Figure 1.4.1-27)

1.4.2 Kill Van Kull Structures Compared – Serpantine

KVK-310-A, B,

*Figure 1.4.2- 1: Captures the location of the Staten Island Ferry Terminal, **KVK-328**, and The Staten Island Yankees Baseball Stadium, **KVK-329** in 2004*

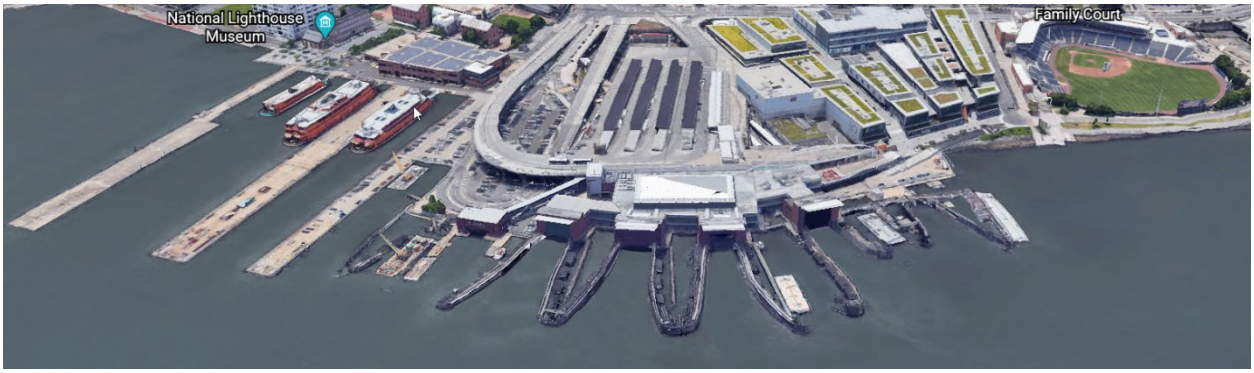

*Figure 1.4.2- 2: Captures the Staten Island Ferry Terminal **KVK-328**, Empire Outlets, and the Staten Island Yankees baseball stadium **KVK-329**.*

The Staten Island Ferry Terminal, **KVK-328**, appears to have a new form of bumper system installed and something done to the piles originally documented in the report by the Master Harbor Partnership. It appears that the current bumper system is a replacement for the pilings that were documented by the Master Harbor Partnership report. It is unclear from the image if the newer system replaced or encompassed part or all of the original pilings.

Empire Outlets is the series of structures built between the Staten Island Ferry Terminal and the Staten Island Yankees Baseball Stadium. These buildings have living roofs and opened in 2019. A pedestrian walkway extends the length of the shore and is protected by riprap.

The Staten Island Yankees Baseball Stadium, **KVK-329** appears to be a relatively unchanged but completed from what was present in 2004. The Master Harbor Partnership report indicated that it was under construction during that review process.

Figure 1.4.2- 3: The above photo captures the area to the west of the Staten Island Yankees Baseball Stadium in 2004.

Figure 1.4.2- 4: The above photo captures the area to the west of the Staten Island Baseball Stadium.

The Staten Island September 11th Memorial has been installed along the shoreline since the Master Harbor Partnership report. A small pier or bulkhead was constructed to the west of the Memorial that will require more information to confirm if there is any impacts to the blasting/dredging efforts..

The Structure to the west of the Staten Island Yankees Baseball Stadium is an Imperial Park parking garage which has been constructed since the Master Harbor Partnership report.

KVK-310 Shoreline east of Deteriorated Warehouse

Figure 1.4.2- 5: The above photo indicates the condition of the shoreline to the west of the Imperial Park parking garage in and is representative of ***,KVK-310,*** *circa 2004.*

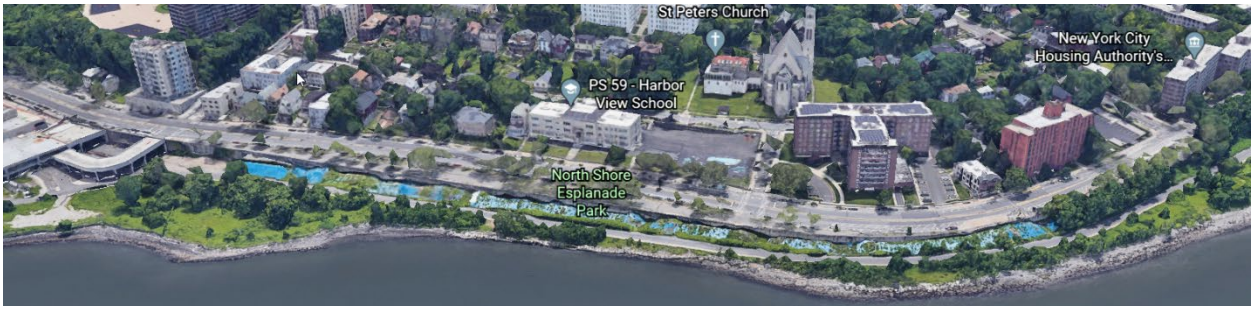

Figure 1.4.2- 6: The above photo indicates the current condition of the shoreline west of the Imperial Park parking garage and is representative of, ***KVK-310****, circa 2020*

There are no structures on the water side of Richmond Terrace between the Imperial Park parking garage and building **KVK-4** which appears to be a partially collapsed abandon building visible in Figure 1.4.2-7. Richmond Terrace is supported by a masonry retaining wall from the parking garage until Terrace Street near the NYC Housing Authority buildings where it transitions to a soil slope.

*Figure 1.4.2- 7: The above photo captures the continuation of the shoreline west of the Imperial Park parking garage through **KVK-6***

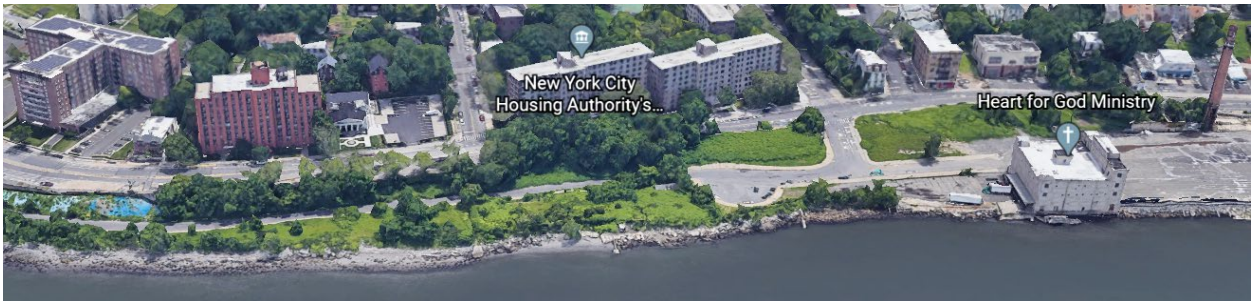

*Figure 1.4.2- 8:: The above photo captures a continuation of the shoreline west of the Imperial Park parking garage until **KVK-6.***

Figure 1.4.2-7 and 1.4.2-8 capture the continuation of the shoreline west of the Imperial Park parking garage captured in Figures 1.4.2-5 and 1.4.2-6.

These figures indicate that The Greek Revival Mansion, **KVK-3**, appears to be in similar condition to what was documented in the report by the Master Harbor Partnership and that the building at the Foot of Bank Street**, KVK-4**, appears to have further deteriorated and partially collapsed.

15 Bank Street, Staten Island, **KVK-6,** is currently known as the Heart for God Ministry building**.** It appears to be in similar condition to that which was documented in the report by the Master Harbor Partnership. A small portion of it appears to be supported by piles.

KVK-309-A, B, C Atlantic Salt Company and area to the east.

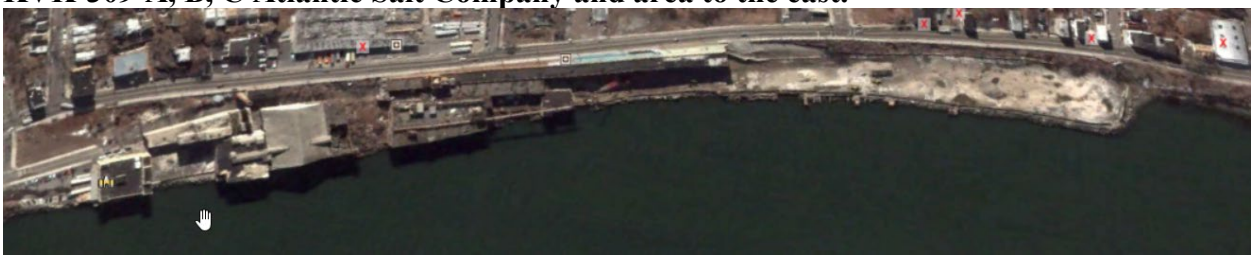

Figure 1.4.2- 9: The above photo captures the buildings present at the Atlantic Salt Company and the area to the east.

Figure 1.4.2- 10: The above captures the buildings present at the Atlantic Salt Company and the area to the east.

The buildings indicated between Heart for God Ministry Building, **KVK-6,** and **KVK-11A/B** at the Atlantic Salt Company appear to have been mostly demolished or collapsed. The remaining structure appears to be a brick chimney that was documented in the Master Harbor Partnership report as 100'. The chimney appears to be utilized to support a series of telecommunication equipment.

KVK11A/B, the long building on the site of the Atlantic Salt Company appears to remain abandon and in similar condition to what was documented in the report by the Master Harbor Partnership.

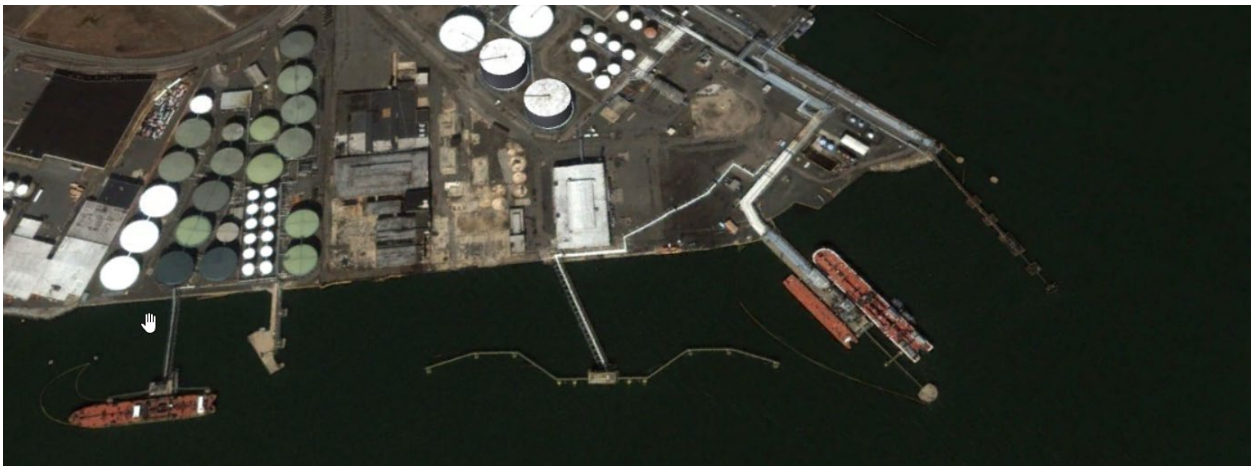

Figure 1.4.2- 11: The above photo captures, KVK-313, Exxon-Western Pier in 2004.

*Figure 1.4.2- 12: Exxon-Western Pier, **KVK-313** and adjacent structures.*

KVK-313 appears to be unchanged from what was captured in the report by the Master Harbor Partnership. It is on the New Jersey side of the channel and the shoreline is comprised of riprap and bulkheads.

The "bird shaped" structure to the left of **KVK-313** is not captured in either the report or the map from URS. This bird shaped structure was present at the time of the report by the Master Harbor Partnership. It first appears in the aerial photographs between 1995 and 2001.

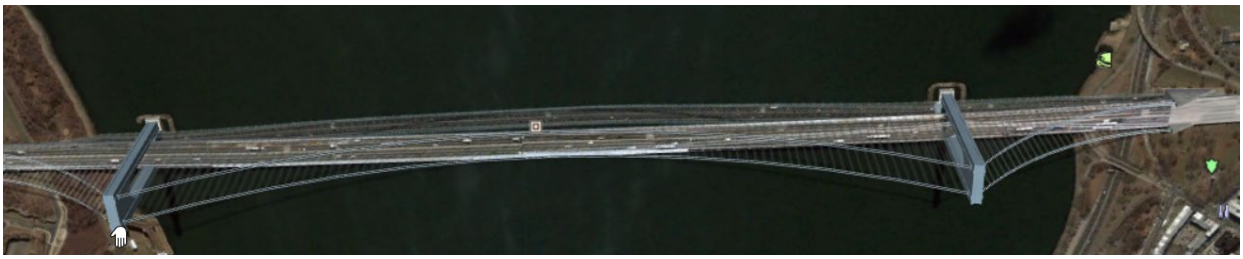

Figure 1.4.2- 13: The photo captures the Verrazano-Narrows Bridge, ***KVK-330.***

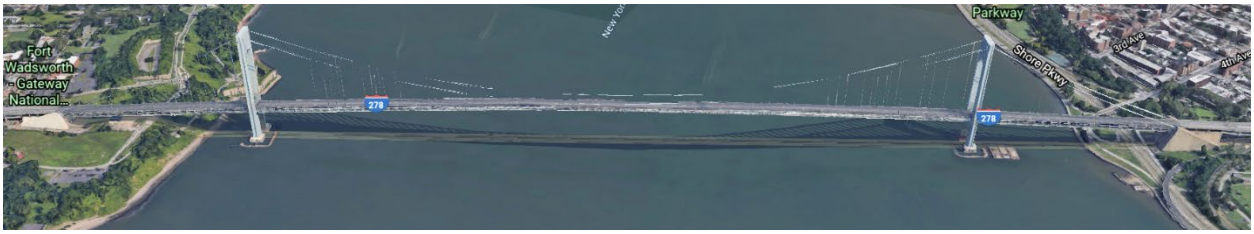

Figure 1.4.2- 14: The photo captures the current condition of the Verrazano-Narrows Bridge.

The Verrazano-Narrows Bridge, **KVK-330,** was considered too far from the site of anticipated blasting that was evaluated in the 2003 report by the Master Harbor Partnership. Because of its significance the Master Harbor Partnership report recommended the structure should be further studied. A thorough site-specific study for the Verrazano-Narrows Bridge is recommended at this time because of its significance.

2. Impacts of the Harbor Deepening

The impacts of the deepening of the harbor are possible from several different mechanisms throughout the course of the deepening. The first would be by the blasting activities that are necessary to remove the rock from the channels. This will be addressed in section 2.1 Blasting. In addition, the structures that are likely to have their structural stability compromised will be discussed in section 2.2 Structural Stability. This can occur based on the building's characteristics or from the removal of soil from the waterside of a bulkhead or from around pilings.

2.1 Blasting

Blasting of the rock contained within the New York Harbor system has been performed during prior efforts to deepen the channels. The past deepening has been successful in fracturing the rock for its removal. The USACE plan is to utilize a similar methodology once again.

The principal criteria that ensures blasting is not going to compromise nearby structures is the Peak Particle Velocities (PPV). The prior projects have utilized the maximum safe values set forth by the U.S. Bureau of Mine Safety and the local restrictions set forth by the states of New York and New Jersey as the basis for the limiting values discussed in section 2.1.2 Regulatory Limits.

Damage to structures is typically caused by frequencies that are similar to the natural frequency of the building or structure. Most low-rise structures have a natural frequency that is between 4 Hz and 10 Hz while taller structures are likely to have natural frequencies that are even lower. Thus, most damage to buildings will be the result of low frequency waves. The blasting activities are anticipated to produce waves with higher frequencies that are less likely to resonate with the buildings. In the past it has been documented that the prior blasting caused frequencies were typically be between 20 and 50 Hz.

In addition to the building's frequencies, the building's material, age, and condition are important factors in determining if the building will experience damage from the blasting activities. Typically, steel and wood structures are less rigid than those of concrete and brick and are less likely to experience damage from vibration. Newer buildings are typically less susceptible than older buildings as the history of events the building has experienced is less demanding. Lastly, buildings with prior structural deficiencies are more susceptible to damage as the building or structure is not as robust as designed.

2.1.1 Peak Particle Velocity (PPV)

The estimated peak particle velocities associated with the blasting limits are anticipated to occur at the distances recorded in Table 2.1.1-1. These values have been utilized for prior blasting and provide a good representation of what is expected from further blasting activities within the regions. The regions are based upon the 3 major rock formations encountered in the area. It is anticipated that most activities under evaluation will utilize those of the Diabase and Serpentine values as the Shale/Sandstone values are mostly prevalent in areas that are not under investigation at this time.

These values were originally developed for the "Update of Blasting Analysis: New Jersey –New York Harbor" and subsequently updated in the "Structural Investigation / Blasting Analysis NYNJ Harbor 50' Channel Project." These values were developed for shallower depths but the increase in depth to the range from 52'-62' below MLLW within the same rock formation is considered negligible.

Table 2.1.1- 1: Minimum Distance from a Critical Structure to the Site of Production Blasting

Estimated Distance (ft) to critical structures for PPV's from Production Blasting			
PPV	Diabase	Serpentine	Shale/Sandstone
2.0	142	138	165
1.0	232	223	270
0.5	379	369	450
0.3	545	535	660

The values within Table 2.1.1-1 are developed based upon the standard production blasting pattern which utilizing a grid of 4.5" diameter drilled holes that are typically spaced 10' on center and drilled 8' below the intended final depth. For the typical production blast, the holes are filled with explosives to 3 feet below the surface and then packed with crushed stone. The pattern is represented by Figure 2.1.1-1. This layout has been utilized successfully on prior deepening efforts.

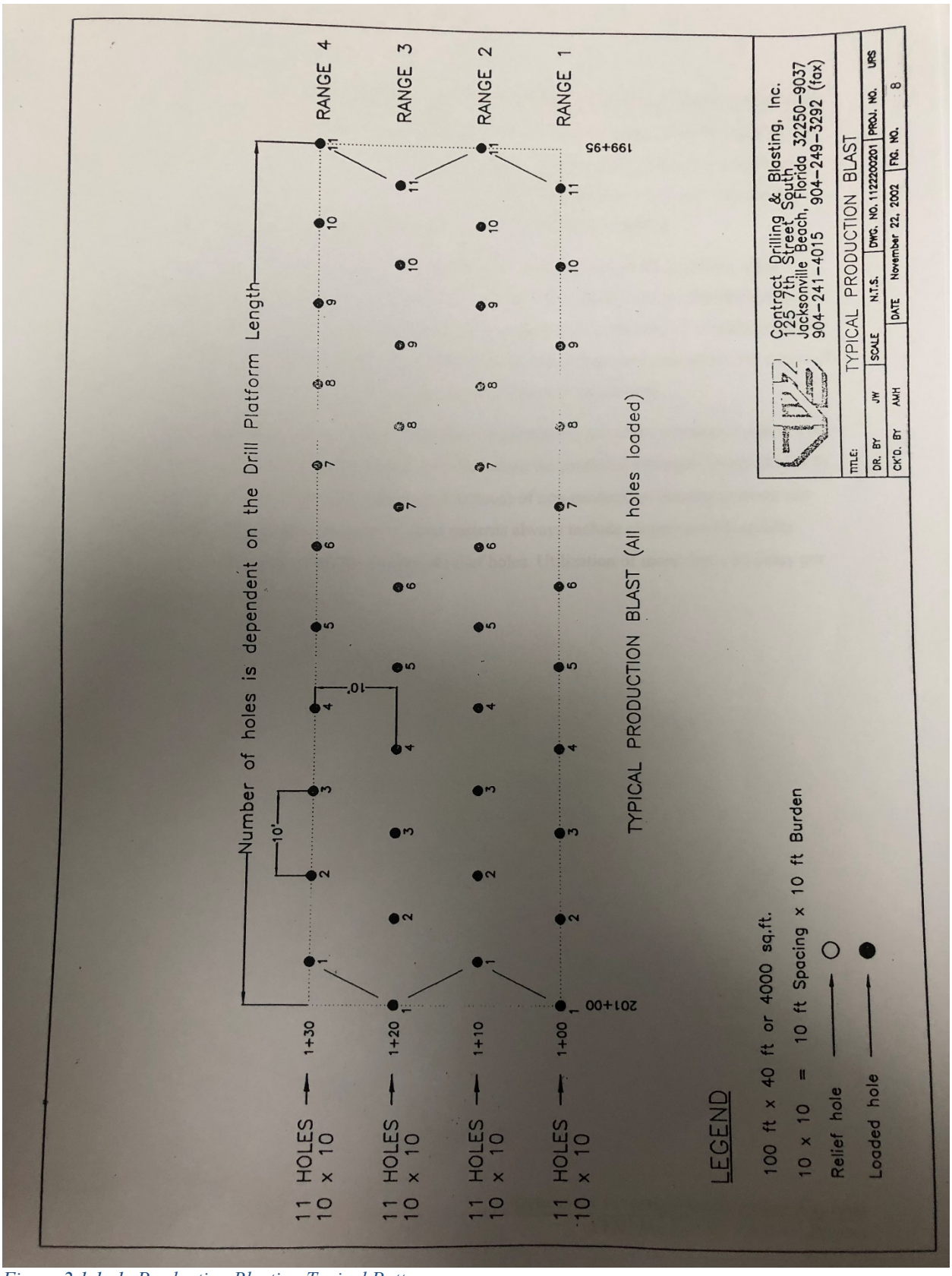

Figure 2.1.1- 1: Production Blasting Typical Pattern.

The distances shown in Table 2.1.1-1 is the result of information from seismograph data that was captured in the 1990's and early 2000's during blasting activity. This information was used to calculate a regression curve for the rock types present. This data was utilized to relate the charge weight (pounds), distance (feet), and measured peak particle velocity. The regression equation was determined with a 95% confidence level and an r^2 (relative fit) greater than 0.75 and a standard deviation of 0.16. This was used to relate the distance to the weight of the charge. This relationship is expressed as:

$$K = \frac{D}{C^{(\frac{1}{2})}} \quad \text{(Equation 2.1.1-1)}$$

Where:

K = coefficient that depends on the PPV and the rock type.

D = distance in feet

C = the charge weight per detonation in pounds.

Equation 2.1.1-1 and the test data was utilized in determining the values for K shown in Table 2.1.1-2. These values for K can be further utilized to develop the PPV at any distance from the blast location.

Table 2.1.1-2: Predictive K Values Based Upon the Regression Equation 2.1.1-1.

Predictive K Values Based Upon the Regression Equation		
PPV (in/sec)	Diabase	Serpentine (shale/sandstone)
2.0	15.0	14.2
1.0	24.5	23.5
0.5	40.0	38.9
0.3	57.5	56.4

The blast hole utilized in the development of this equation was as described by the normal production blast. It also utilizes the explosive density of 1.30mg/l to 1.36 mg/l which corresponds with approximately 9 pounds of explosive per foot of hole.

2.1.2 Regulatory Limits

The regulatory limits for blasting so that structural damage is avoided are documented in Table 2.1.2-1 Peak Particle Velocity Limits and are represented by the Figure 2.1.2-1 which was originally developed by the U.S. Bureau of Mine Safety and adopted by the state of NJ as the limiting guideline for blasting. It is also recognized by the City of New York Department of Buildings within Technical Policy and Procedure Notice # 10/88 (TPPN 10/88) which establishes the 0.5 in/sec requirement for historic structures. Where regulations conflict between the two states the jurisdiction limit that is the stricter of the limits has been adopted for all. In addition, to the Regulatory Limits in Table 2.1.2-1 also contains the threshold of 0.3 in/s which USACE has observed is the threshold for residential complaints.

Table 2.1.2- 1: Peak Particle Velocity Limits

Upper limit for blasting	2.0 in/sec
Upper limit for residential structures	1.0 in/sec
Historic Structures	0.5 in/sec
Limit at which complaints arise	0.3 in/sec

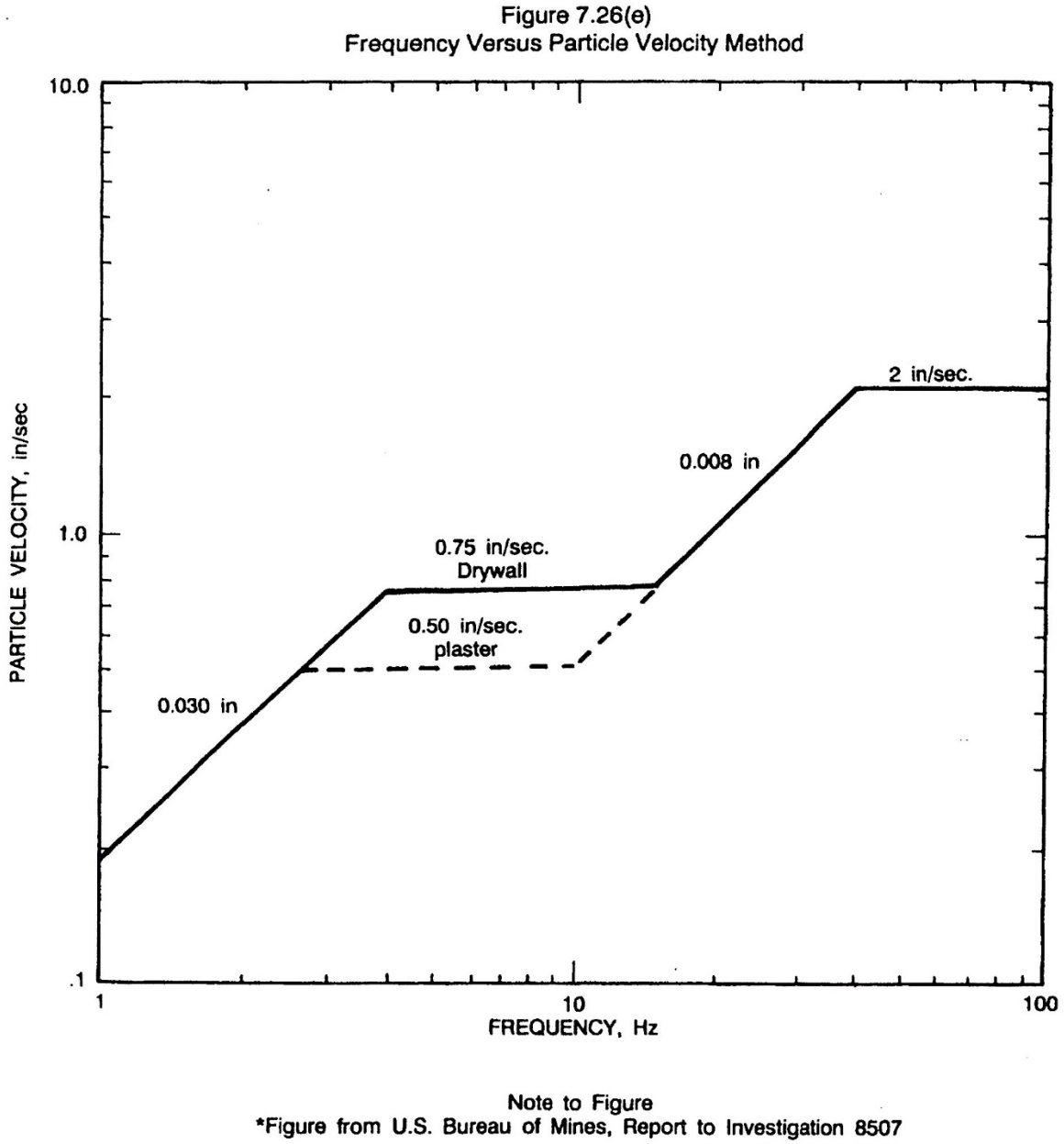

Figure 2.1.2- 1: Frequency Versus Particle Velocity Method Graph Adopted by the State of New Jersey from the U.S. Bureau of Mines for Limiting the Peak Particle Velocities from Blasting.

In instances where the PPV will be greater than the limits set forth in Table 2.1.2-1 utilizing normal production blasting, the blasting will be mitigated in accordance with non-production blasting methods described in Section 2.1.3 Blast Mitigation so that the regulatory limits are maintained.

The structures that have been designated as historic structures within the region of the channels and are subject to the reduced PPV limit of 0.5 in/sec as per TPPN 10/88 are listed in Table 2.1.2-2 Historic Structures.

Table 2.1.2-2 Historic Structures.

State	Name
New York	Vessel fish hawk KVK 33
New York	V-45 WOOD DREDGE
New York	Balanced Floating Dry Dock KVK 38
New York	Suction Dredge KVK 36
New York	Vessel Paul E. Thurlow KVK 37
New Jersey	Bayonne Bridge
New Jersey	Newark Bay Bridge
New York	Bayonne Bridge (Route 440)
New York	Faber Park
New York	Greek Revival Temple
New Jersey	St. Mary's Church
New Jersey	St. Mary's Rectory
New Jersey	St. Mary's Hall Sharp Avenue and Richmond
New York	Staten Island Ferry
New York	Staten Island Yankees Baseball Stadium
New York	Verrazano Narrows Bridge

In addition to the regulatory limits that are established for the PPV there are limits on the maximum air blast that is permissible from blasting activities. This is maintained at 130 decibels but because of the continuous nature of this activity it is required to be maintained below 124 decibels. Air blasts are not anticipated to be a problem for this work as the typical explosion from prior activities has resulted in a value of approximately 100 decibels. Monitoring is required in accordance with those guidelines that will be further discussed in Section 2.1.4 Blast Monitoring.

2.1.3 Blast Mitigation

Several structures would be subject to PPV values in excess of the regulatory limits as shown in Table 2.1.3-1 if production blasting is utilized throughout the entire area to be deepened. The location of these structures is shown in Table 2.1.3-1 along with the anticipated Production PPV value.

Table 2.1.3-1: Anticipated Production PPV's in excess of the regulatory limits.

Structure no.	Location	Production PPV (in/sec) in excess of limits
KVK-011A	Across From 500 Richmond Terrace; Staten Island	3.6
KVK-011B	Continuation of KVK 11A	2.7
KVK-304	Atlantic Express Company	2.6

For compliance to be maintained, reduced blasting is facilitated by sequencing multiple smaller charges within a single bore hole so that the explosive force occurring at any given time is reduced thus reducing the anticipated PPV at the structures. The standard layout is typically utilized for this type of blasting, but the charges are separated by sand and detonated with independent blasting caps allowing for the sequencing. This sequencing of charges reduces the amount of the explosives and reduces the peak particle velocities while maintaining the required amount of rock fracture. This reduced blasting is typically performed in accordance with one of the following patterns in Figures 2.1.3-1, Cautious Blasting Pattern, Figure 2.1.3-2 Very Cautious Blasting Pattern, or Figure 2.1.3-3 Extremely Cautious Blasting Pattern.

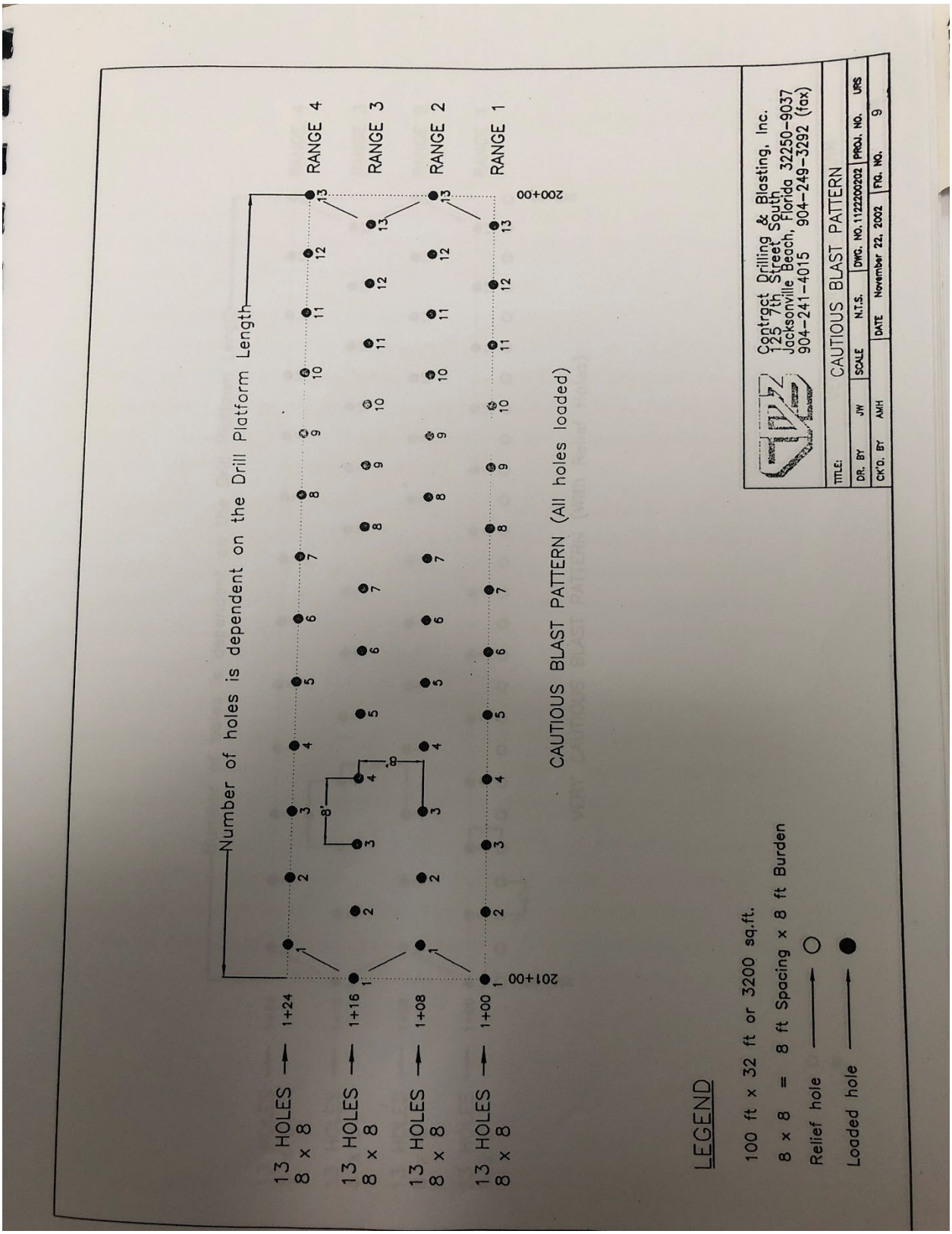

Figure 2.1.3-1 Cautious Blasting Pattern.

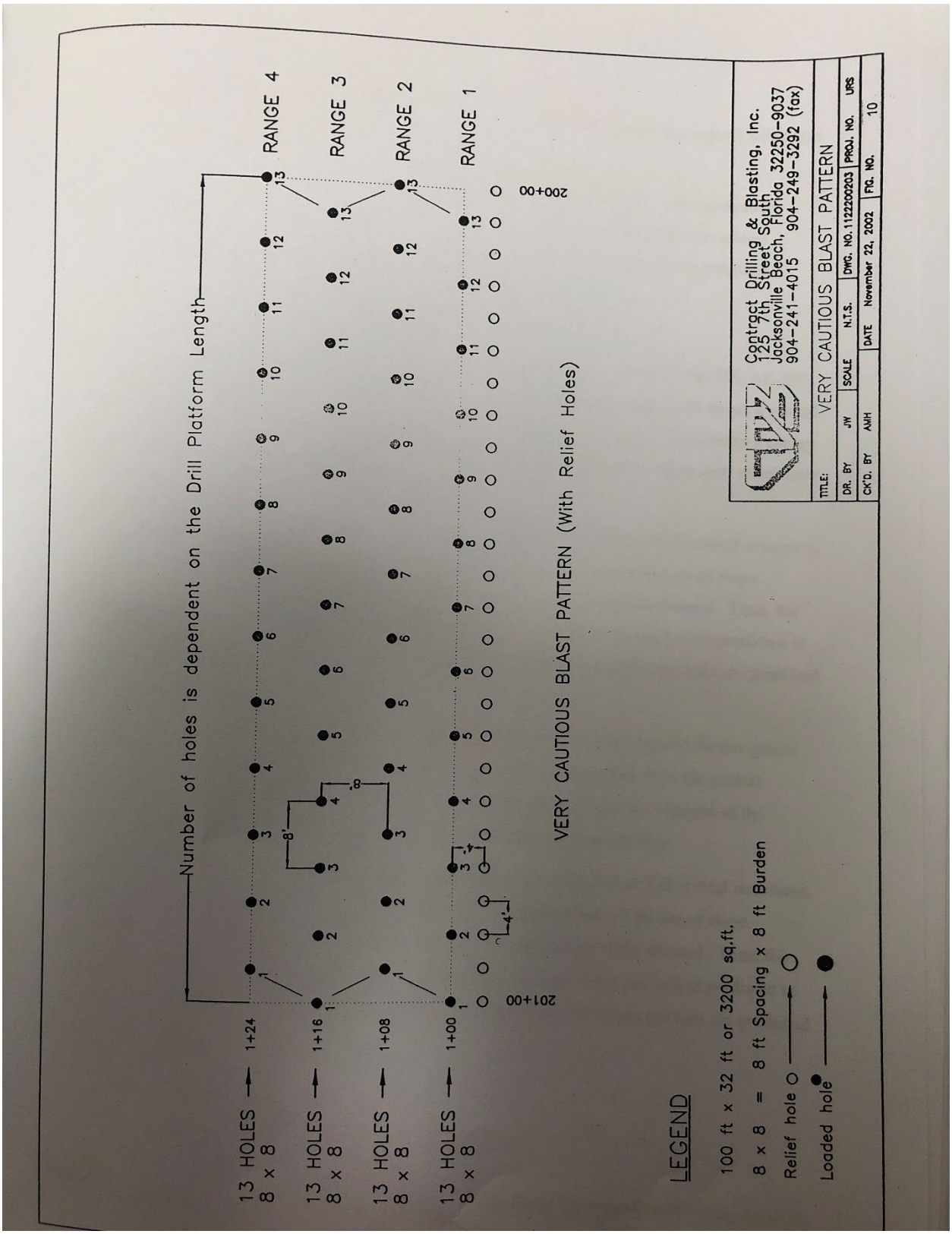

Figure 2.1.3-2 Very Cautious Blasting Pattern.

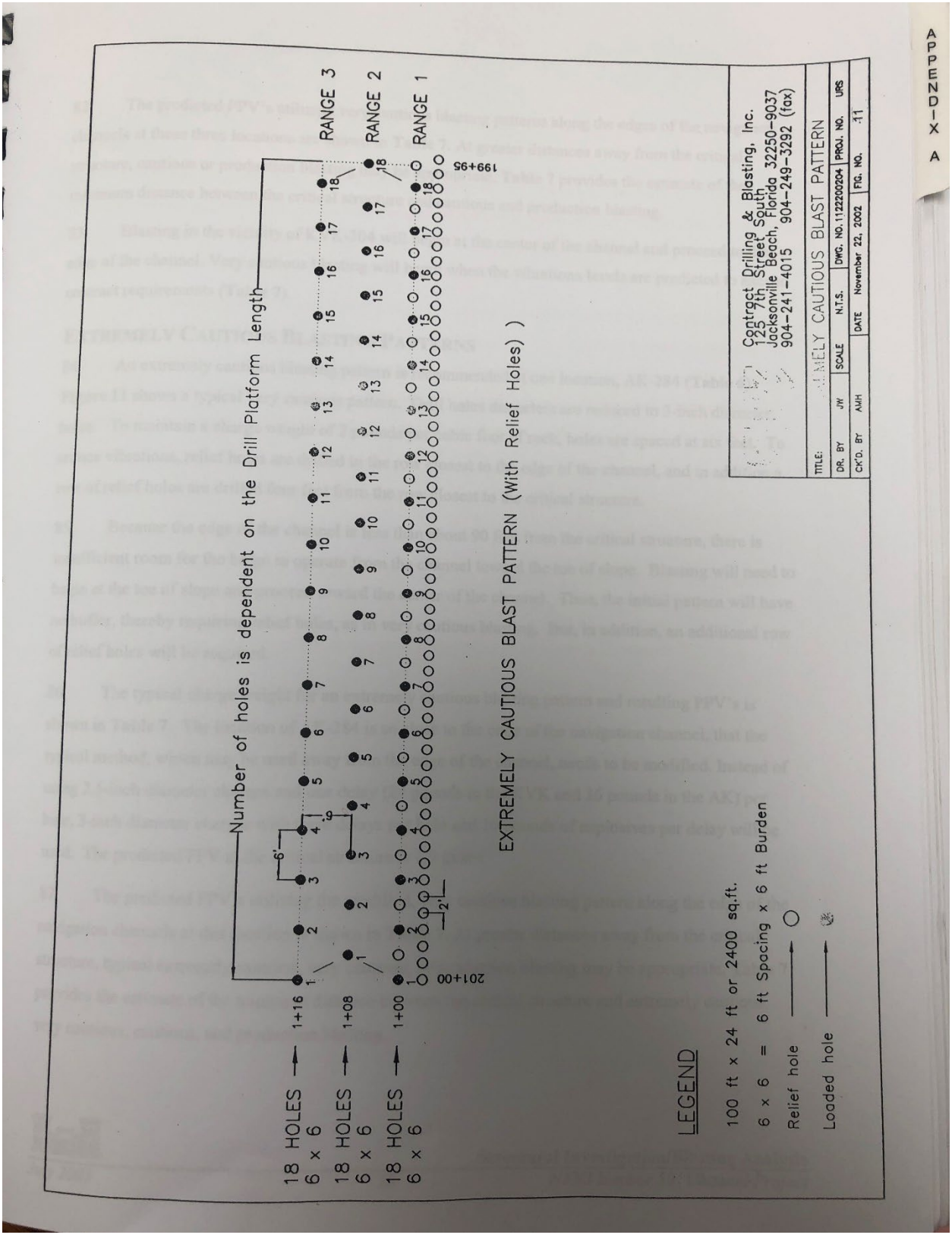

Figure 2.1.3-3 Extremely Cautious Blasting Pattern.

If the smaller sequenced explosions of cautious blasting are not able to reduce the anticipated PPV to within the regulatory limits, relief holes are utilized between the shoreline and the location the explosives are to be detonated. This allows for the blast waves to escape from the rock and further reduce the PPV felt by the structure. This technique is normally utilized in addition to sequencing explosions not instead of sequencing explosions as the additional drilling of relief holes is expensive.

To accommodate the reduced PPV that is required other than production blasting is currently anticipated to take place along the south western segment of the Serpantine formation within the Kill Van Kull and along the eastern portion of the Diabase region of the Kill Van Kull. This will reduce the anticipated PPV velocities to a point at which the neighboring structures do not experience a PPV in excess of the regulatory limit and thus structural damage is not anticipated. The final blasting determination is the responsibility of the individual blasting contractor.

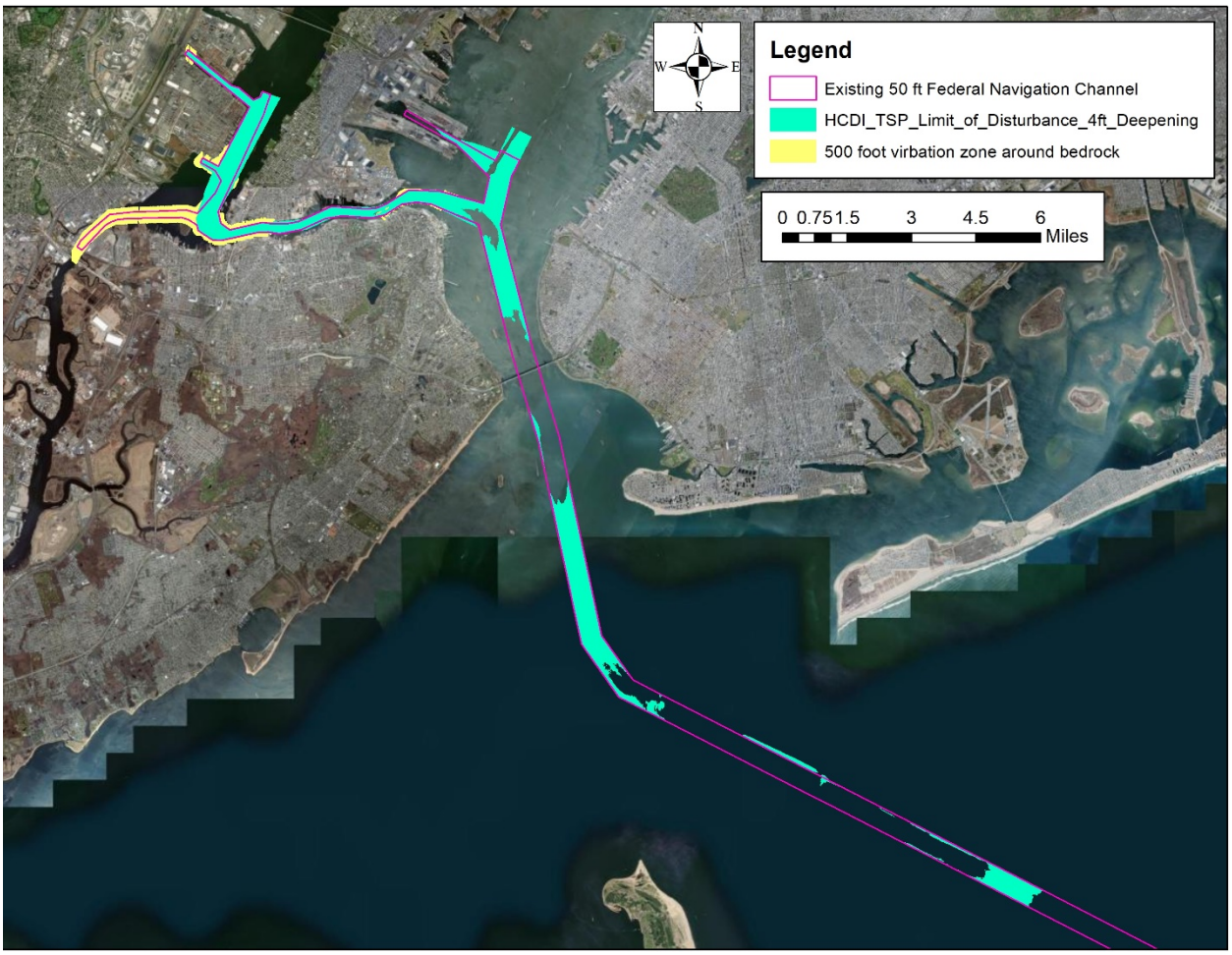

Figure 2.1.3-4: Project limits with 500-foot vibration buffer around bedrock

Mitigation of the vibrations caused by blasting activities to prevent structural damage for those structures referenced in Table 2.1.3-1 is necessary to avoid damage. In past deepening projects it was determined that interference to residential properties would likely be minimal. Thus the 0.3 in/sec limit at which blasting is detectable to humans was not a restricting factor as the buildings within this region were largely of a commercial or public nature. Since the last deepening was performed this is believed to still be the case.

2.1.4 Blast Monitoring

Blast monitoring will need to be conducted to ensure that the Peak Particle Velocities (PPV) are occurring in accordance with the limits described within Section 2.1.2 Regulatory Limits. This monitoring will require seismographs to be installed in the vicinity of the ongoing blasting to monitor the vibrations. The seismographs are required to be able to meet these minimum requirements:

A.) The ability to measure and record particle velocity displacement or acceleration in the three orthogonal directions.

B.) Must have a seismic range from 0.005 to 10 inches per second.

C.) Must have a frequency response range from 2 to 300 hertz.

It is specifically recommended that any historic or high impact structure specifically be monitored during blasting activities. These high impact structures would include the various bridges and public facilities along the channels.

In addition to the monitoring of the Peak Particle Velocities for the ground acceleration, monitoring of the air blast is also required. This requirement is to ensure that the sound of the explosion is limited to an acceptable level as described within Section 2.1.2 Regulatory Limits. The equipment utilized to measure the air blast must be capable of a flat frequency response (+/- 3 decibels) over the range of at least 6 to 200 Hertz. As the blasting is to be of a continuous nature the peak decibel level should be maintained at a value less than 124 decibels to avoid reevaluation of the blasting protocol and not to exceed the maximum allowable value of 130 as described in 12:190-7.25 Air blast effects of the New Jersey statutes.

2.2 Structural Stability

The structures that are anticipated to be susceptible to a possible loss of structural stability are shown in the Table 2.2-1 Structures Susceptible to a Possible Loss of Structural Stability. This loss of structural stability is clearly separable into two distinct categories.

1. Inland structures that are susceptible to a failure of the lateral force resisting system resulting in collapse.
2. Waterfront structures that are likely to experience a loss of structural stability resulting from a soil failure and subsequent collapse due to reduced embedment depth.

Those inland structures that are likely to experience a failure of the lateral force resisting system would require strengthening or demolition depending on the unique nature of the building and its current status. Those structures that have been identified to exhibit characteristics that would make the structure susceptible to this type of failure include two masonry chimneys.

Waterfront structures that are reliant upon soil that is to be removed to provide structural stability and support are several waterfront structures along the channel. For many of these structures the ability to determine the tip elevation of the bulkhead or pilings is not discernable or available currently. Because of this lack of information those structures that are within the region to have the mudline reduced have been categorized as possible situations where the structural stability could be compromised.

These waterfront structures could be ruled in or out during the Preconstruction Engineering Design phase if additional information or underwater subsoil imaging is obtained. For this reason, several structures that have been identified to require additional action may need not have any action taken in the future. Due to the currently available information the need has not be conclusively ruled out.

Table 2.2-1: Structures Susceptible to a Possible Loss of Structural Stability.

Location	**Description**	**Structures**	**Shoreline**
KVK-011A	Across From 500 Richmond Terrace; Staten Island	Building &Chimney	
KVK-309A	Atlantic Salt Company and Building to east		Bulkhead
KVK-309C	Continuation of KVK-309B	Chimney (Several buildings demolished)	Stone/Riprap
KVK-313	Exxon- Western Pier		pier/pilings

2.2.1 Waterfront Structural Stability

The mechanism by which the stability of a waterfront structure would be compromised is from the removal of the supporting soil as the channel is deepened and the side slopes of the channel expanded so that the soil slopes remains stable. Those structures within 186’ of the channel may be susceptible to a loss stability during the deepening. This distance was determined based upon the assumption of a 3 horizontal to 1 vertical (3H: 1V) slope. This slope has been routinely utilized as a stability assumption when characteristics are unknown.

If the slope of the new channel is to intersect the existing profile before the structure or the structure is outside the 3H: 1V slope it should not be compromised in this manner. In the instances in which the slope from the channel does intersect the structure below the mudline the

structure has been considered compromised. If the mudline is unknown it was assumed to be 0' MLLW which requires the full 186' for the structure not to be considered compromised.

In some instances, the slope has been and will be analyzed to use a steeper ratio than the 3H: 1V to reduce the need to provide physical stabilization or replacement of existing structures. In the instances where this is present the existing slope has been considered adequate at this time.

2.2.2 Inland Structural Stability

The mechanism by which an inland structure is likely to fail is from a loss of structural stability via the failure of the lateral force resisting system. The buildings identified are known to be susceptible via either their general structural characteristics or documented conditions.

The two structures that are indicated for demolition are two chimneys. These chimneys are identified because of their structural characteristics and documented past condition or changes to supporting structures.

The chimney located on the grounds of the Atlantic Salt Company appears to be abandoned. The chimney appears to have been repurposed as a support for some kind of electrical equipment and the supporting building demolished. This building would have provided some lateral bracing before it was demolished. With the demolition of the supporting structure and the apparent nonuse of the chimney as well as its susceptibility to vibrations it is recommended that this structure be taken down.

The current recommendation for the chimney at the Atlantic Salt Company property could be updated pending additional information or evaluation. Without evaluation to the contrary it is not possible to ensure that the safety of the public and those working within the facility would not be compromised. The slenderness of the chimney along with its mass make a failure likely to be catastrophic placing those in the surrounding area in danger.

The other chimney which is located on the grounds of KVK-306 status is unknown. The chimney is documented to have had bricks displaced from it during prior work activities. Because of its slenderness and history, it is recommended that this chimney be demolished to prevent further danger to the neighboring buildings or those that work at or near its location. Again because the structure is more susceptible to magnifying vibrations due to its slenderness.

2.3 Slope Stability

The various waterfront structures that are along the channels are susceptible to a loss of lateral stability if the soil providing active resistance is removed. For this reason, any bulkhead or pier is considered susceptible if the mudline is to be reduced. In these instances where the mudline is to be reduced and the embedment depth is either unknown or insufficient it is recommended that a new bulkhead be installed on the channel side of the structure, most likely in the form of a cantilevered bulkhead.

In the event that a location were to have the mudline reduced at the supporting pilings it is intended that the structures be demolished and reconstructed to provide the same as currently in place while the piles are extending to an appropriate embedment depth that is sufficient given

the deepened condition. This is currently not anticipated to occur but may be encountered pending additional information in the Preconstruction Engineering and Design phase.

2.4 Overview of all information

The chart below captures a full overview of the information regarding the structures that are of concern for deepening of the channel. These buildings are mostly located along the Kill Van Kull Channel and most of these structures were present during the last deepening project and remain in similar condition. The information in this chart is an overarching table of the information presented in the various tables throughout the report. It also contains some additional information that was utilized in making determination about various structures. The information is largely historical as a new building survey was not performed.

The additional information contained within this chart was utilized for coordination purposes between the various disciplines involved in evaluating the harbor for possible further deepening. The additional information was used to locate various structures and discuss the various options. This information is being provided for reference purposes only.

	Structure no.	Location	Structure	Shoreline	Historic	Distance (ft.) [1]	Reach		Waterfront Structure	Within (1V:3H)	Blasting				Blast Protection	Slope Improvement	Structural Mitigation			Notes	Risks Blasting		Risks Non-Blasting	
							Name	Number			Type of Blasting	Type of Reduced Blasting	Production PPV (in/s)	Reduced PPV (in/s)			Structural Stability	Demolition	No Impact		Likelihood	Severity	Likelihood	Severity
18	KVK-003	404 Richmond Terrace, Greek Revival Temple, St	Building		Yes	440	Constable Hook	KVK-F			Production		0.2						X		Moderate	Low	unlikely	Low
19	KVK-004	Foot of Bank Street, Staten Island	Building			280	Constable Hook	KVK-F			Production		0.4							Abandon Building	Likely	Very Low	unlikely - Abandon Building	Very Low
20	KVK-005	Bank Street, Staten Island - Concrete Pillars				300	Constable Hook	KVK-F			Production		0.4						X		unlikely	Low	unlikely	Low
21	KVK-006	15 Bank Street: Staten Island	Building	Pilings		340	Constable Hook	KVK-F			Production		0.3						X		Moderate	Low	unlikely	Low
22	KVK-011A	Across From 500 Richmond Terrace; Staten Island	Building &Chimney			75	Constable Hook	KVK-F		Yes	Non-Production	Very Cautious	3.6	1.7	Yes		Yes				Likely	Severe	Moderate - Chimney to be demolished as supporting structure appears to have been demolished	Low
23	KVK-011B	Continuation of KVK 11 A	Building &Chimney (same as KVK-011A)			90	Constable Hook	kvk-f		Yes	Non-Production	Very Cautious	2.7	1.7	Yes						Likely - (same as 22) chimney to be demolished as supporting structure appears to have been demolished	Severe	Moderate - (same as 22) chimney to be demolished as supporting structure appears to have been demolished	Low
24	KVK-087	St Mary's Church	Building		Yes	450	Bergen Point West	KVK-J			Production		0.4						X		unlikely	Moderate	unlikely	Low
25	KVK-088	St Mary's Rectory	Building		Yes	455	Bergen Point West	KVK-J			Production		0.4						X		unlikely	Moderate	unlikely	Low
26	KVK-089	St Mary's Hall Sharp Ave and Richmond	Building		Yes	440	Bergen Point West	KVK-J			Production		0.4						X		Very Likely - Building is documented to have a likely settlement issue that the extent is continuing	High	Moderate	Moderate
27	KVK-299	Steamix bulkhead	Buildings (Several others demolished)	bulkhead		400	Bergen Point West	KVK-K	Yes (bulkhead)		Production		0.5						X		unlikely	Low	unlikely	low
28	KVK-301	Junkyard east of Bayonne Bridge	Building	Stone/Riprap		235	Bergen Point West	KVK-K & KVK-J			Production		1.0							Warning to owner, Make shift structures are utilized for storage	Likely - warning to owner as parts are stored in makeshift structures	Low	unlikely	low
29	KVK-302	Construction Company		bulkhead		170	Bergen Point West	KVK-J		Yes	Production		1.6			Assume Rock 1V:1H					Moderate - Building has had new structures constructed locations not exactly known with onsite.	Low	moderate	Low
30	KVK-303	Faber Park	Building	bulkhead		280	Bergen Point West	KVK-J	Yes (bulkhead)		Non-Production		0.8							Should this have a historic designation?	Moderate	Moderate	Moderate	Moderate
31	KVK-304	Atlantic Express Company	Building	Stone/Riprap		120	Bergen Point West	KVK-J		Yes	Non-Production	Very Cautious	2.6	1.3	Yes	Assume Rock 1V:1H					Moderate	Moderate	unlikely	Low
32	KVK-305	3 Buildings between Atlantic Express and Construction Company	Demolished			300	Bergen Point West/East	KVK-J &KVK-I			Production		0.7						X		unlikely	Moderate	Very unlikely	Very Low
33	KVK-306	KVK Construction Company	Buildings	Bulkhead		180	Bergen Point East	KVK-I	Yes (bulkhead)	Yes	Production		1.5			Assume Rock 1V:1H					Very Likely-Chimney has been noted to have bricks fall in prior activities	High	Moderate	Low
34	KVK-307	Building north of Construction Company	Buildings			450	Bergen Point East	KVK-I &KVK-H			Production		0.4						X		unlikely	Low	unlikely	low
35	KVK-308A	Atlantic Salt Company and Building to East		bulkhead		250	Constable Hook	KVK-G & KVK-F	Yes (bulkhead)		Production		0.7				Yes				Moderate	Low	unlikely	low
36	KVK-308B	Continuation of KVK-308A	Building	Stone/Riprap		100	Constable Hook	KVK-F		Yes	Production		2.3			Assume Rock 1V:1H				Abandon	unlikely	Low	moderate	low
37	KVK-308C	Continuation of KVK-308B	Chimney (several buildings demolished)	Stone/Riprap		175	Constable Hook	KVK-F		Yes	Production		0.9			Assume Rock 1V:1H	Yes				Likely - Chimney to be demolished as supporting structure appears to have been demolished	Severe	Moderate	Low
38	KVK-310A	Shoreline east of deteriorated warehouse (KVK-306) to Staten Island Ferry	none	Stone/Riprap		200	Constable Hook	KVK-F, KVK-E, & KVK-D			Production		0.8						X		unlikely	Low	unlikely	Low
39	KVK-310B	Continuation of KVK-310A	none	Stone/Riprap		430	Constable Hook	KVK-D			Production		0.2						X		unlikely	Low	unlikely	Low
40	KVK-310C	Continuation of KVK-310B	none	Stone/Riprap (small Pier)		780	Constable Hook	KVK-1			Production		0.1						X		unlikely	Low	unlikely	Low
41	KVK-313	Exxon- Western Pier		pier/pilings		234	Constable Hook	KVK-2			Non-Production		0.6		Yes		Yes				Moderate - This building is reliant upon the LRR report for the determination that it will not be effected	Moderate	Moderate - This building is reliant upon the LRR report for the determination that it will not be effected	Moderate
42	KVK-323A	Shoreline from Lord Street to Bayonne Bridge	none	Retaining wall, Riprap, Debris		225	Bergen Point West	KVK-K-KVK-J			Production		1.1						X		unlikely	Low	unlikely	Low
43	KVK-323B	Continuation of KVK-323A	none	Retaining wall, Riprap, Debris		250	Bergen Point West	KVK-J			Production		0.8						X		unlikely	Low	unlikely	Low
44	KVK-323C	Continuation of KVK-323B	none	Retaining wall, Riprap, Debris		285	Bergen Point East	KVK-I ,KVK-S &KVK-H			Production		0.8						X		unlikely	Low	unlikely	Low
45	KVK-324	Bayonne Bridge	Bridge			240	Bergen Point West	KVK-K			Production		1.0						X		Very unlikely	Severe	unlikely	High
46	KVK-328	Staten Island Ferry	Building	pier/pilings	Yes	800	Constable Hook	KVK-1 , KVK-C,& KVK-B			Production		0.3							This building may require improvement if channel is closer	unlikely	Severe	unlikely	High
47	KVK-329	Staten Island Yankees Baseball Stadium	Stadium	Stone/Riprap	Yes	1,250	Constable Hook	KVK-1 , KVK-C , & KVK-B			Production		<0.1						X		unlikely	High	unlikely	high
48	KVK-330	Verrazano Narrows Bridge	Bridge		Yes	15000+					Production		<0.1						X		very unlikely	Severe	very unlikely	Severe
									Below this line are no wstructures that are not captured in prior information.															
49		Outlet/shopping center with living roof	Shopping Center	Stone/Riprap			Constable Hook	KVK-1 , KVK-C,& KVK-B			Production*										Moderate - Exact location is unknown	Moderate	Moderate - Exact location is unknown	High
50		Imperial Park	Parking Garage	Stone/Riprap			Constable Hook	KVK-D, KVK-1 , & KVK-C			Production*										Moderate - Exact location is unknown	Moderate	Moderate - Exact location is unknown	Low

1 Distance provided from the Harbor Master Partnership 2003. Distance is from the existing channel and may need to be adjusted to account for any widening of the channel.
* Blasting based on estimate of building location to channel.

Figure 2.4: Structural Impacts and Stability Matrix Chart

3. Utilities

Utility crossings in the Ambrose, Anchorage, Kill Van Kull, Newark Bay, and Port Jersey Channels were investigated for this report. Maps, construction drawings and previous USACE studies and dredging plans were used to compose a list of utilities that require further investigation, relocation, or removal in order to complete the project.

3.1 New York New Jersey Harbor Utilities

All harbor utilities should be further investigated, but the utilities with existing elevations above or within ten feet of the new proposed elevations have been flagged to be either relocated or removed. These utilities have been flagged because they can be damaged or damage the dredging equipment being used to complete the mission.

3.1.1 Ambrose Channel Utilities

There is only one utility in the Ambrose Channel. The Ambrose Channel will be dredged to a level of -57 feet below MLLW, plus an additional foot of overdredge. Transco-Williams owns a gas pipeline that intersects the site of the deepening. The pipeline must be partially removed or relocated.

3.1.2 Anchorage Channel Utilities

There are several utilities of interest in the lower reach of the Anchorage Channel. The project will include blasting and dredging to a depth of -54 feet below MLLW, plus an additional 1.5 feet of overdredge. The flagged utilities include two 24-inch gas pipelines and two 20-inch oil pipelines north of the Verrazano Bridge all owned by Brooklyn Union. The four lines are in a trench at elevation -40 feet below sea level and should be removed. Con Edison owns two 8.75-inch steel pipes that hold six active electric cables located at elevation -60.5 feet below sea level. There are also two cast iron water pipes spanning across the channel measuring 36 and 42 inches in diameter. The pipes are at elevations -50.2 feet and -50.9 feet below mean lower low water level, respectively. The cast iron pipes contain lead and should be removed with the proper cautions. There is also a New York Telephone Cable in the channel beneath the scope of the project.

3.1.3 Arthur Kill Channel Utilities

The Arthur Kill Channel is outside of the current harbor deepening project limit. There are several utilities that would affect the project if the Arthur Kill Channel was included in this channel improvement effort.

3.1.4 Kill Van Kull Channel Utilities

Most utilities of concern were removed during previous projects. However, there is a section of the Bayonne Energy Center pipeline that will need to be removed or relocated in order to complete the project. There are also two Spectra Energy steel pipelines in the channel, but neither will impede the proposed new elevation of the channel. The channel will be dredged to -

56 feet below MLLW plus an additional 1.5 feet of overdredge. Additionally, structure KVK-313, a wing-shaped pier owned by Exxon, is a structure and utility of interest in the Kill Van Kull channel.

3.1.5 Newark Bay Channel Utilities

The Newark Bay Channel will be dredged to an elevation of -56 feet below MLLW plus an additional 1.5 feet of overdredge. The utilities of interest are in the lower reach between Newark and Elizabeth, New Jersey. There is an inactive 12-inch diameter PSE&G gas line that was partially removed during a previous project. Additional sections of the pipeline should be removed if necessary.

3.1.6 Port Jersey Channel Utilities

The Port Jersey Channel will be dredged to an elevation of -56 feet below MLLW plus an additional 1.5 feet of overdredge. The Bayonne Energy Center pipeline will need to be removed or relocated in order to complete the project safely.

3.2 Utility Classification

The utilities in the New York New Jersey Harbor channels have been classified into three types: A, B, C. Type A utilities are utilities that will not affect the project scope. Type B utilities are utilities that are inactive but are within the project scope. Type C utilities are both active and within the project scope.

3.2.1 Type A Utilities

There are four Type A utilities in the scope of this project. In the Anchorage Channel there is a New York Telephone Cable deeper than the scope of the project. In the Kill Van Kull Channel there are two steel pipelines owned by Spectra Energy holding active cables. The two pipelines are about 6600 and 7900 feet in length and are at a deeper elevation than the project scope. In the Newark Bay Channel, there is a 16-inch PSE&G gas main that runs deeper than the scope of the project.

Table 3.2.1-1: Type A Utilities

Utility	Existing Elevation (ft. below MLLW)	Approximate Global Coordinate Location	Channel
New York Telephone Cable	90+	649950 N 616436 E	Anchorage
Spectra Energy APL 5L X-70 Steel Pipe	100+	14763367.48 N 1877546.75 E	Kill Van Kull
Spectra Energy APL 5L X-70 Steel Pipe	110+	14763422.41 N 1884524.69 E	Kill Van Kull
PSE&G 16” Gas Main	133	656610 N 614682 E	Newark Bay

3.2.2 Type B Utilities

There are three Type B utilities in the harbor channels. In the Anchorage Channel there are two cast iron water pipelines. In the Newark Bay channel, there is a 12-inch PSE&G gas main that has been abandoned and partially removed. They are inactive, but they do require removal in order to complete the project.

Table 3.2.2-1: Type B Utilities

Utility	Existing Elevation (ft. below MLLW)	Approximate Global Coordinate Location	Channel
42" Cast Iron Water Pipe	53.7	652975 N 615632 E	Anchorage
36" Cast Iron Water Pipe	53	656610 N 614682 E	Anchorage
PSE&G 12" Gas Main	33, 54, 36, 39, 48, 83, 100, 110, 120, 127	664627 N 589356 E	Newark Bay

3.2.3 Type C Utilities

There are eight Type C utilities in the harbor channels. A Transco-Williams gas pipeline is present in the Ambrose Channel. Brooklyn Union owns two 24-inch gas lines and two 20-inch oil pipelines in the Anchorage Channel. Con Edison owns two 8.75-inch steel pipelines holding electric cables also in the Anchorage Channel. A Bayonne Energy Center pipeline that is approximately 2.5 miles in length is within the project scope of both the Kill Van Kull and Port Jersey Channels. These utilities are active and will need to be deactivated before removal or relocation in order to safely complete the project.

Table 3.2.3-1: Type C Utilities

Utility	Existing Elevation (ft. below MLLW)	Approximate Global Coordinate Location	Channel
Transco-Williams Gas Pipeline	53.3, 59.8, 61.6, 62.3, 62.6, 54.7, 39.6, 37.8	608953 N 646587 E	Ambrose
Brooklyn Union- (2) Gas 24" (2) Oil 20"	40	649950 N 616436 E	Anchorage
Con Edison (2) 8.75" Steel Pipes holding (6) Electric Cables	60.5	650640 N 616240 E	Anchorage
Bayonne Energy Center	60, 70		Port Jersey/ Kill Van Kull

3.3 Utility Relocation and Removal

The relocation or removal of utilities is an interactive process. The communication between the engineer, utility provider/owner, and the contractor is key to a safe and successful project. Prior to removal or relocation, a utility must be inactivated as to not cause damage to any project equipment or the surrounding environment. The utility provider will need to communicate a list of detailed information that may pertain to the removal process. The cast iron water pipes in the Anchorage Channel were sealed with lead and will require certain precautions during the removal process. Even with all the available information from the engineer and utility provider/owner, the contractor should still take caution when working with the utilities as their exact locations could slightly differ from as-built plans. Technologies such as radar could be helpful in the removal/relocation process if accessible.

3.4 Utilities Summary

The New York New Jersey Harbor channels have fifteen total utilities of interest. Four utilities are categorized as Type A- not within the scope of the project, three as Type B- inactive and within the scope of the project, and eight as Type C- active and within the scope of the project. The main concerns for the harbor deepening project will be with the Type B and Type C utilities. These utilities will require relocation or removal in order to complete the project. The relocation, removal, and monitoring of these utilities will help ensure the project is completed in a safe and efficient manner.

Utility	Existing Elevation (ft.below MLLW)	Status	Approximate Global Coordinate Location	Reach		Length (ft.)	Notes	Type
				Channel Name	Number			
New York Telephone Cable	90+	Active, deeper than project scope	644894 N 617864 E	Anchorage	AN	2156		A
Passaic Valley 12' Sewer		Active, Not in project scope	668024 N 610303 E	Anchorage	AN			A
Spectra Energy APL 5L X-70 Steel Pipe	100+	Active	14763367.48 N 1877546.75 E	Kill Van Kull	KVK	7893	Asbuilt DWG LD-H-1030	A
Spectra Energy APL 5L X-70 Steel Pipe	110+	Active	14763422.41 N 1884524.69 E	Kill Van Kull	KVK	6566	Asbuilt DWG LD-H-1040	A
PSE&G 16" Gas Main	133	Active, deeper than project scope	66400 N 591500 E	Newark Bay	S-NB-2		Asbuilt DWG from September 2008	A
36" Cast Iron Water Pipe	53	Inactive	656610 N 614682 E	Anchorage	AN	2257	inactive but requires removal, contain lead	B
42" Cast Iron Water Pipe	53.7	Inactive	652975 N 615632 E	Anchorage	AN	2614	inactive but requires removal, contain lead	B
PSE&G 12" Gas Main	33,54,36,39, 48 , 83,100,110,120,127	Inactive, partially removed	665410 N 588044 E	Newark Bay	S-NB-2	1547*	partially removed, partially abadoned in place	B
Transco-Williams Gas Pipeline	53.3, 59.8, 61.6, 62.3, 62.6, 54.7, 39.6, 37.8	Active	608953 N 646587 E	Ambrose	AM		active, needs at least partial relocation	C
Brooklyn Union- (2) Gas 24" (2) Oil 20"	40	Active	649950 N 616436 E	Anchorage	AN	2076	in a 40' trench	C
Con Edison (2) 8.75" Steel Pipes holding (6) Electric Cables	60.5	Active	650640 N 616240 E	Anchorage	AN	2029		C
12" Oil Pipeline- The Coastal Corporation	39	1 Active, 1 Abandoned	660904 N 583051 E	Arthur Kill	AK-2			--
Exxon Company (2)-8" (1)-12"	47		660882 N 582497 E	Arthur Kill	AK-2			--
Exxon Company (2)-8" (1)-12"	47'		655878.67 N 575971.14 E	Arthur Kill	AK			--
Colonial Pipeline Co. (2)-14"	53.5-55.5	Active	660763 N 580802 E	Arthur Kill	AK-2			--
Bayonne Energy Center	60, 70	Active		Port Jersey/Kill Van Kull	PJ/KVK	~34848	active, require relocation or removal, 345 kV AC 3 Phase circuit	C

Key	
Type A	
Type B	
Type C	
Not withtin the project scope	

Figure 3.4-1: HDCI Utilities Matrix Chart

4. Recommendations

There is some information that was not available to the USACE for evaluation of the structures along the channels to be deepened. Some structural evaluations along the channels were based on the worst-case scenarios due to this missing information. Some of the determinations may be able to be updated upon further investigation. At this time USACE recommends the following 5 actions be taken.

1.) A site-specific survey be conducted to determine the actual tip elevation of the structures listed in Table 2.2-1 Structures susceptible to a possible loss of structural stability to conclusively determine if there is or is not an impact. The site-specific survey would allow for updates to the anticipated impact, based upon a final determination of the structures subsoil position. This determination is likely to be possible from various forms of non-destructive testing. Some of the available options may be to commission an ultra-seismic survey of the structures or a Sonic Echo/Impulse Response evaluation. These surveys as well as several other non-destructive testing methods are suitable for determining the depth of embedment of both bulkheads and pilings.
2.) It is recommended that a detailed analysis of the Verrazano-Narrows and Bayonne Bridges be conducted as the structures do not have common frequency characteristics. In addition, the Bayonne Bridge is not representative of the bridge present during the last deepening as a new road deck, modified support structures, and new approach ways were recently constructed.
3.) Two chimneys are recommended for demolition as their structural integrity is suspect. The chimneys have experienced changed supporting conditions or have been documented as having had portions fall during prior work activities. Given no new information it is unlikely that the structures can undergo the anticipated work while ensuring the safety of the public.
4.) As additional information becomes available for the geotechnical properties of the region. The locations that indicate the assumption of a 1V:1H slope within the rock regions should be confirmed.
5.) It is recommended that the majority of the fifteen channel utilities should be removed and replaced in locations that will allow for a safe completion of the project. Utilities indicated as Type A are not within the scope of this project and will not be removed or relocated. Those that are Type B are inactive utilities that need to be removed or relocated and those that are Type C are active utilities that need to be removed or relocated.
6.) Non-production blasting is required in the south western segment of the Serpantine formation within the Kill Van Kull and along the eastern portion of the Diabase region of the Kill Van Kull. This will cause less than ideal production but is anticipated to be necessary to maintain compliance with the regulatory limits.

Ultimately, it is the recommendation of the USACE that the structural impacts of deepening the New York and New Jersey Harbor are manageable.