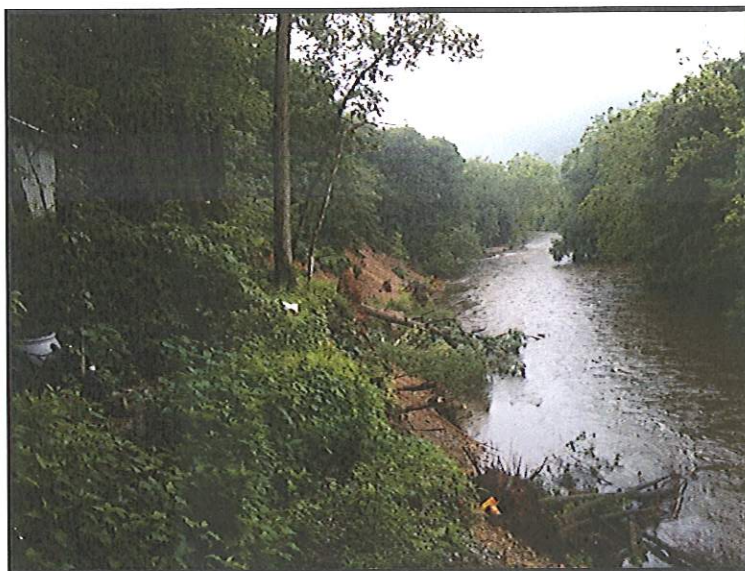


RAMAPO RIVER BANK EROSION INVESTIGATION

**Borough of Oakland
Bergen County, New Jersey**

Our File No. OK-1447



Approved for Release By:

Kevin J. Boswell, P.E.



BOSWELL McCLAVE ENGINEERING
SOUTH HACKENSACK, NEW JERSEY
ENGINEERS • PLANNERS • SURVEYORS • SCIENTISTS

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INTRODUCTION

As requested by the Mayor and Council, our office has prepared the following report regarding the erosion issues at Ramapo River in the vicinity of Lakeshore Drive. A project area location plan is attached in Appendix A. This report will not identify potential causes but will focus rather on the most critical areas requiring bank stabilization and explore potential solutions.

The stretch of Ramapo River, directly north of I-287 appears to have experienced higher stream velocities in recent years which have impacted the adjacent banks. In particular, the flows on the outer bank of the River have washed out the toe of the slope on the eastern bank, causing the land above to collapse. This condition has affected the rear lots of homes along Lakeshore Drive which are approximately 20 to 30 feet higher than the River. 15 Lakeshore Drive has experienced some of the most severe erosion, due to its location on the outermost point of the river bend. The erosion has impacted approximately 800 feet along that bank. There has been a continual loss of mature trees from the top of the bank during the past several years which not only has destabilized this bank further but has also introduced significant amounts of debris into the waterway. Images showing the existing conditions have been included in Appendix B for reference.

This report will outline the various means to stabilize this condition along with the associated costs and permitting requirements.

CONSTRUCTION METHODS & PRELIMINARY COSTS

Below is a summary of various alternatives that could be used to repair this area:

Alternative 1: Sheet Piling

Under this repair method, steel sheet piles would be driven into the ground along the original bank location. This original bank location would need to be verified through historic records and available maps. However, it appears the original bank location is a minimum of ten feet further out than its current location.

Sheet piles would be driven into the ground along the entire affected bank. The exposed height of these piles will be determined after soil tests and a slope stabilization detail is finalized, but preliminarily it is estimated to be 10 feet. This would result in a total pile length of 20 feet (10 feet exposed and 10 feet buried per structural requirements). The area behind these sheet piles (on the side of the Lakeshore Drive properties) would be backfilled with soil to bring the property to grade.

The estimated construction costs for this method (including engineering design and oversight but excluding permitting costs and filing fees) is approximately \$1.2 million.

Alternative 2: Gabion Wall

Under this repair method, large rectangular baskets made of galvanized wire would be filled with stones and stacked in a tiered manner at the base of the eroding slope. These stone baskets would be placed on filter fabric along the original bank line and the remaining slope would be stabilized in a similar fashion as described in Alternative 1 above. Access for this would be provided from the end of Lakeshore Drive as mentioned previously.

The estimated construction costs for this method (including engineering design and oversight but excluding permitting costs and filing fees) is approximately \$1.0 million.

Alternative 3: Large Boulder/Hammered Rock

Under this alternative, large boulders would be placed on filter fabric along the stream bank. The sizing and thickness of these boulders would be a function of the stream velocities, but we have estimated an 8' thick layer of hammered stone 3 to 4 feet in diameter. A preliminary detail of this is included in Appendix C.

The estimated construction costs for this method (including engineering design and oversight but excluding permitting costs and filing fees) is approximately \$600,000.

PERMITTING

The critical permitting agency on this project will be the New Jersey Department of Environmental Protection (NJDEP). Application to the Bergen County Soil Conservation District is also required. The remediation work summarized above will follow one of the three scenarios described below:

1. Normal Permitting Process:

Plans and specifications would be prepared and submitted to NJDEP for Freshwater Wetlands General Permits 20 and 26 as well as a Flood Hazard Area Individual Permit. This alternative will also involve modeling of the stream prior to submission and payment of appropriate application fees. The estimated costs for preparing the submission documents and filing fees are \$150,000, and the permitting process would require one to two years from date of authorization.

2. Emergency Permitting:

If NJDEP deems this project an emergency repair, the above mentioned permits could be issued within 90 days. The anticipated cost to provide the requisite information to the NJDEP and coordinate the associated inquiries is estimated to be \$60,000.

3. Emergency Permitting with a Retroactive Permit Application Process:
NJDEP could deem this project an emergency and issue permits within 90 days, subject to all permits being applied for retroactively. The entire process would still need to be followed after repair work is completed, with approvals taking one to two years. We estimate the total costs to initially coordinate the emergency permit, as-built the improved condition, model the stream, and submit the completed documents (along with the filing fees) to be \$200,000.

CONCLUSION

This assessment has determined the most cost effective method to stabilize the failed stream bank condition is hammered rock stabilization at an estimated cost of \$600,000. This estimate does not include the permitting procedures which can be better determined following consultation with NJDEP.

As previously stated, the factors contributing to the failure of the area have not been investigated within this report. The intent has been rather to summarize the means of stabilizing a significant stream bank failure which currently is resulting in extensive property damage, introduction of mature trees into the Ramapo River waterway, and, if left unattended, could result in the ultimate loss of residences as habitable, safe structures.

APPENDIX A

APPENDIX B



Figure 1. View of Existing Shed on Rear Lot of 15 Lakeshore Drive



Figure 2. Downstream View of Ramapo River Stream Bank

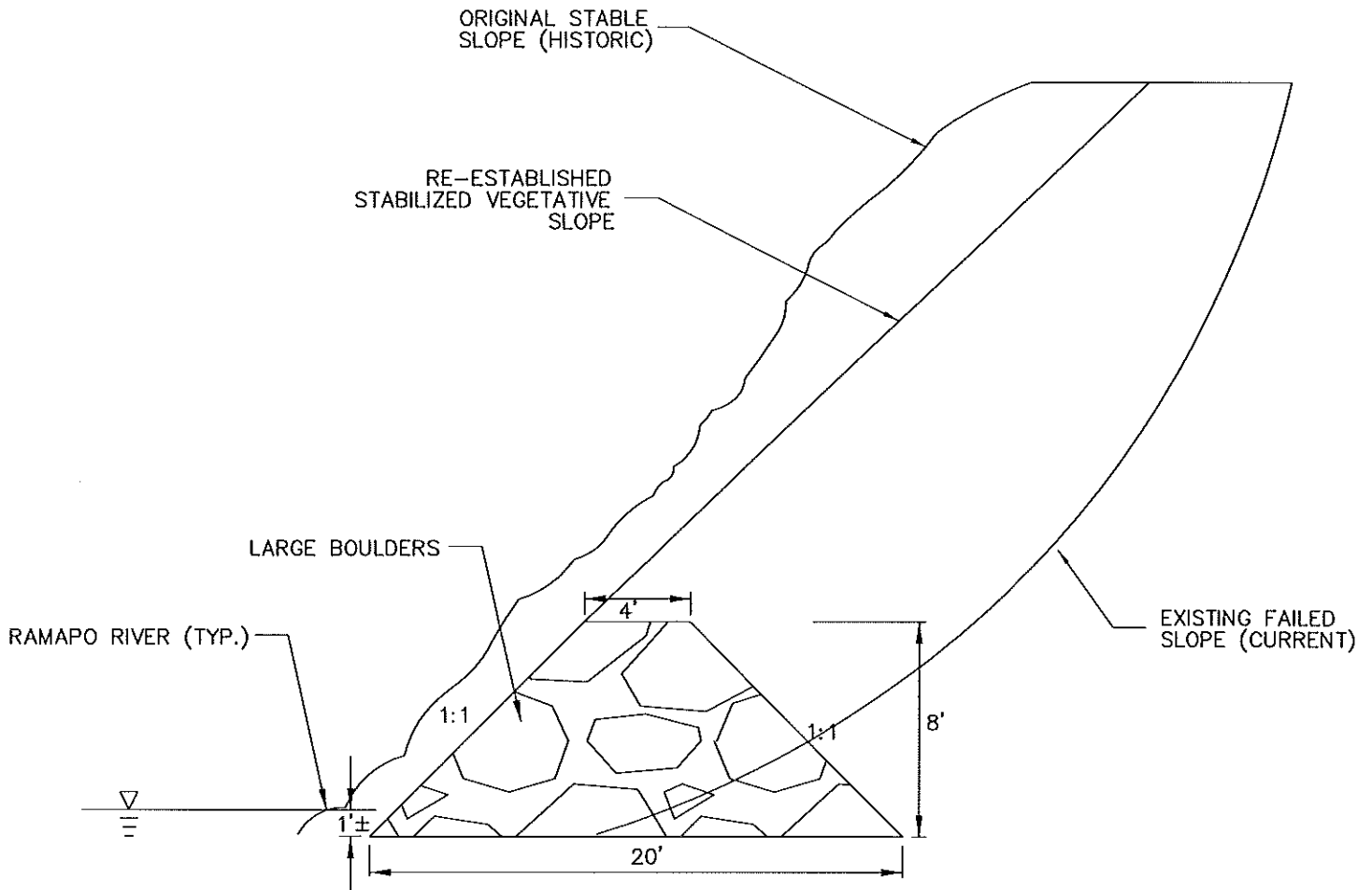


Figure 3. Additional Downstream View of Ramapo River Stream Bank



Figure 4. Upstream View of Ramapo River Stream Bank

APPENDIX C



HAMMERED ROCK DETAIL

N.T.S.



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N.J. CERTIFICATE OF AUTHORIZATION NO. 24GA27958000

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HAMMERED ROCK DETAIL

BOROUGH OF OAKLAND

BERGEN COUNTY

NEW JERSEY

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CADD FILE: OK-1447-HAMMERED ROCK DETAIL