

PORTUGUESE BEND
LANDSLIDE

RANCHO PALOS VERDES

CALIFORNIA

PORTUGUESE BEND LANDSLIDE

THE PROBLEM

STOPPING THE LARGEST LANDSLIDE HAS BEEN A TOP PRIORITY FOR THE CITY OF RANCHO PALOS VERDES. CITY OFFICIALS HAVE ALLOCATED OVER \$4 MILLION TO THE STABILIZATION OF THIS NATURAL DISASTER.

REMEDIAL MEASURES

WHEN THE CITY BEGAN PUTTING ITS STABILIZATION PLAN INTO EFFECT IN 1984, THE LANDSLIDE WAS MOVING IN EXCESS OF FORTY FEET PER YEAR. TODAY, ONLY FIVE YEARS AFTER THE PLAN FIRST BEGAN CONSISTING OF:

- THE INSTALLATION OF DEWATERING WELLS TO REMOVE GROUND WATER CONTINUOUSLY;
- MAJOR SURFACE DRAINAGE; AND
- EARTH REDISTRIBUTION WHICH CHANGES MASS FROM A LANDSLIDE DRIVING FORCE TO A RESISTING FORCE.

THE LANDSLIDE IS MOVING LESS THAN ONE FOOT PER YEAR.

THE FINAL SOLUTION

EROSION PROTECTION OF THE BLUFFS AT THE BASE OR TOE OF THE PORTUGUESE BEND LANDSLIDE, HOWEVER, REMAINS A MAJOR OBSTACLE TO MAINTAINING STABILITY. CONSTRUCTION OF SOME TYPE OF SEAWALL WOULD MEAN A PERMANENT SOLUTION. THE TREMENDOUS COSTS ASSOCIATED WITH THE PROJECT PROHIBIT THE CITY FROM TAKING THIS FINAL STEP TO PERMANENT STABILITY.

NEXT STEP

AN ADDITIONAL \$90,000 IS NEEDED FOR MARINE BIOLOGICAL SURVEYS TO COMPLETE THE RECONNAISSANCE STUDY WHICH HAS ALREADY BEGUN BY THE CORPS OF ENGINEERS.



LIVING ENVIRONMENT

OF THE ONE HUNDRED SEVENTY (170) HOMES IN THE PORTUGUESE BEND LANDSLIDE IN 1956, THIRTY (30) REMAIN TODAY. TO MAINTAIN A HABITABLE ENVIRONMENT, THESE RESIDENTS MUST PERFORM MAINTENANCE FREQUENTLY ON THE FOUNDATION OF THEIR HOMES. IT IS NECESSARY TO LEVEL THE FOUNDATION SINCE THE EARTH HAS BEEN MOVING MORE THAN ONE (1) INCH PER DAY. FOUNDATIONS HAVE TO BE SPECIALLY CONSTRUCTED SO THAT THE STRUCTURAL INTEGRITY OF THE HOUSE CAN BE MAINTAINED. THEIR UTILITIES HAVE TO BE REPAIRED AND/OR MAINTAINED ON AN ALMOST DAILY BASIS TO ELIMINATE FREQUENT DISRUPTIONS.

PORTUGUESE BEND LANDSLIDE RANCHO PALOS VERDES, CA

A DISASTER OF MAJOR PROPORTIONS HAS BEEN OCCURRING FOR 30 YEARS. THE EVIDENCE OF A MAJOR DISASTER IS THAT:

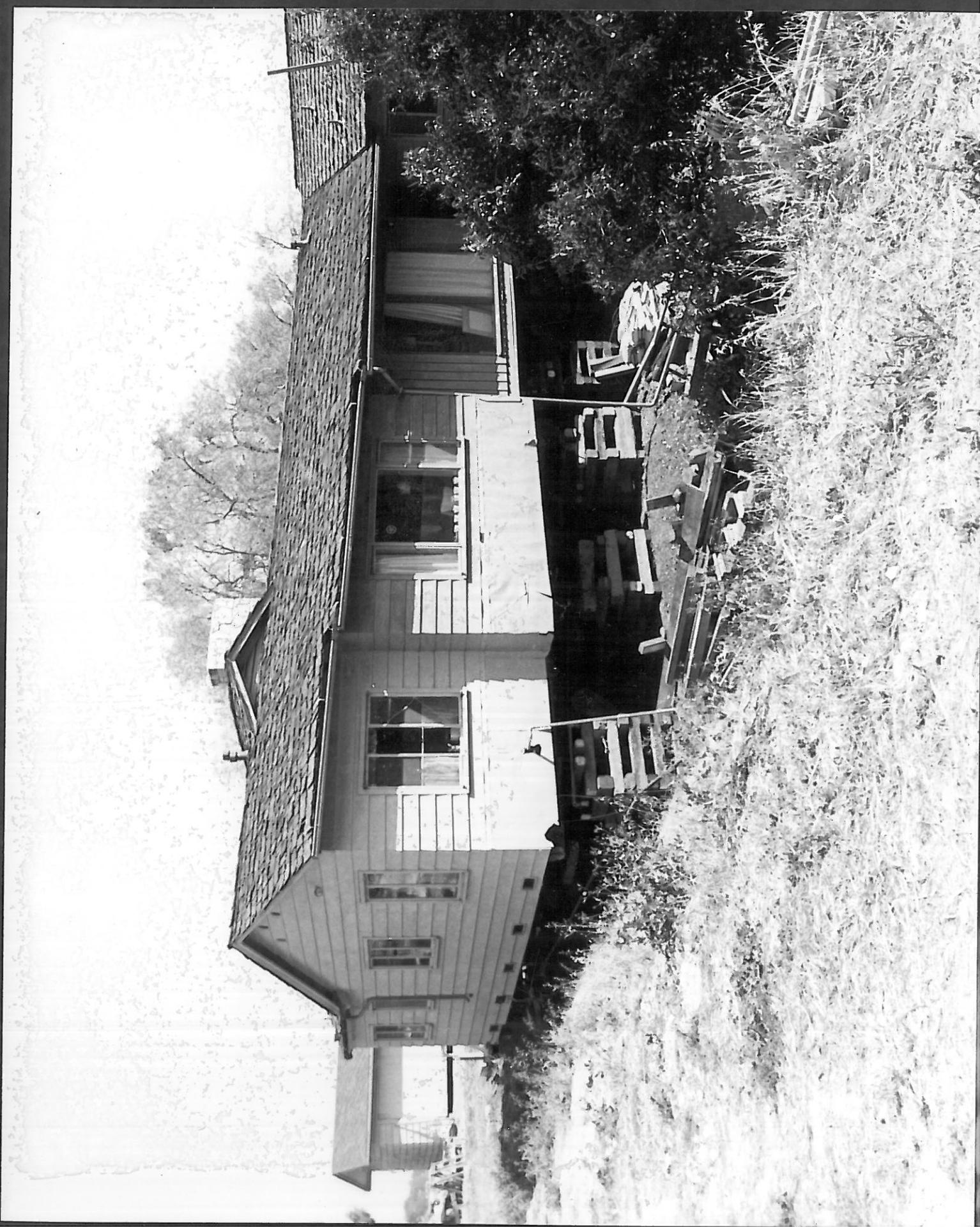
- o 140 HOMES HAVE BEEN DESTROYED OR DISPLACED;**
- o 10 MILLION TONS OF MUD AND ROCK HAVE BEEN DEPOSITED IN THE OCEAN ALONG SEVERAL MILES OF COASTLINE;**
- o OVER 8.5 MILLION SQUARE FEET OF COASTAL ZONE HAS BEEN DESTROYED OR DISTURBED;**
- o DISRUPTION OF VITAL TRANSPORTATION SERVICES HAS OCCURRED;**
- o DISRUPTION OF MAJOR UTILITY TRANSMISSION LINES CONTINUES TO BE THREATENED;**
- o MILLIONS OF DOLLARS HAVE BEEN SPENT ATTEMPTING TO MAINTAIN THE ENVIRONMENT AND THESE CRITICAL SERVICES TO THOUSANDS OF PEOPLE.**

THIS DISASTER HAS THE POTENTIAL TO ADD TO ITS RECORD OF DESTRUCTION. THE RESIDENTS OF RANCHO PALOS VERDES HAVE BEGUN A PROGRAM TO HALT THIS DISASTER AND HAVE ALREADY INVESTED IN EXCESS OF \$4 MILLION TO THIS END. HR 6 AUTHORIZED THE CORPS OF ENGINEERS TO STUDY THE FEASIBILITY OF PREVENTING SHORELINE EROSION IN THE COASTAL ZONE IN THE AREA OF THE LANDSLIDE. APPROPRIATION OF FUNDS TO ACCOMPLISH THE RECONNAISSANCE PHASE OF THE FEASIBILITY STUDY IS NOW NECESSARY.

PRE STABILIZATION













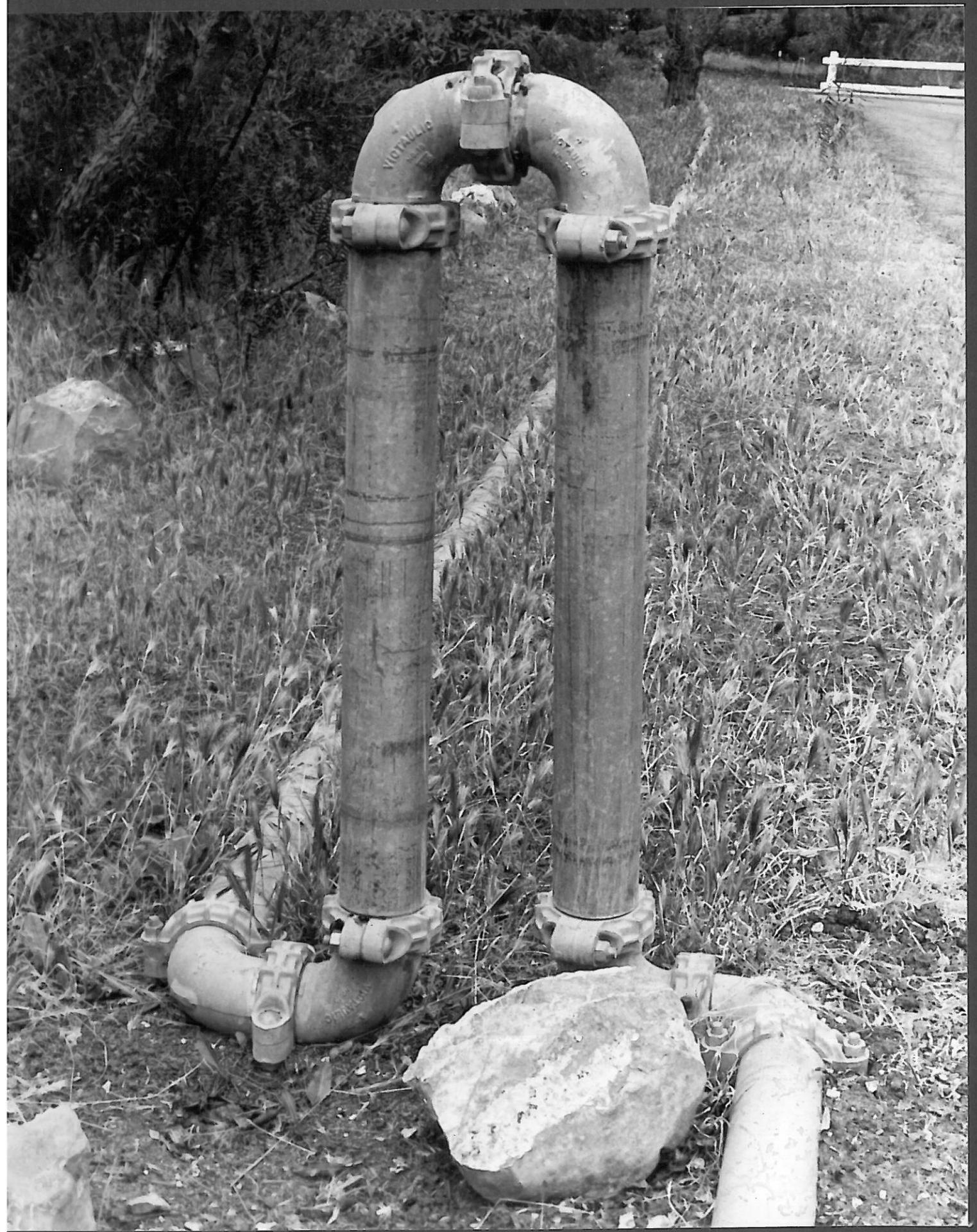


VITAL SERVICES

TRANSPORTATION FACILITIES AND UTILITIES ARE CONTINUALLY DISRUPTED. CONTINUOUS REPAIRS ARE MANDATORY IF THESE VITAL SERVICES ARE TO BE MAINTAINED. BUS SERVICES HAVE BEEN SUSPENDED PERIODICALLY. MAJOR RECONSTRUCTION HAD TO BE PERFORMED ON PALOS VERDES DRIVE SOUTH TO HAVE BUS SERVICE RESTORED. PALOS VERDES DRIVE SOUTH IS A MAJOR ARTERIAL STREET AND IS THE ONLY STREET THAT CONNECTS THE EASTERN AND WESTERN SECTIONS OF THE CITY. MAINLINE GAS, WATER, AND SEWAGE SERVICES HAVE TO BE MAINTAINED ABOVE GROUND WHICH EXPOSES THEM TO ADDITIONAL DAMAGES.

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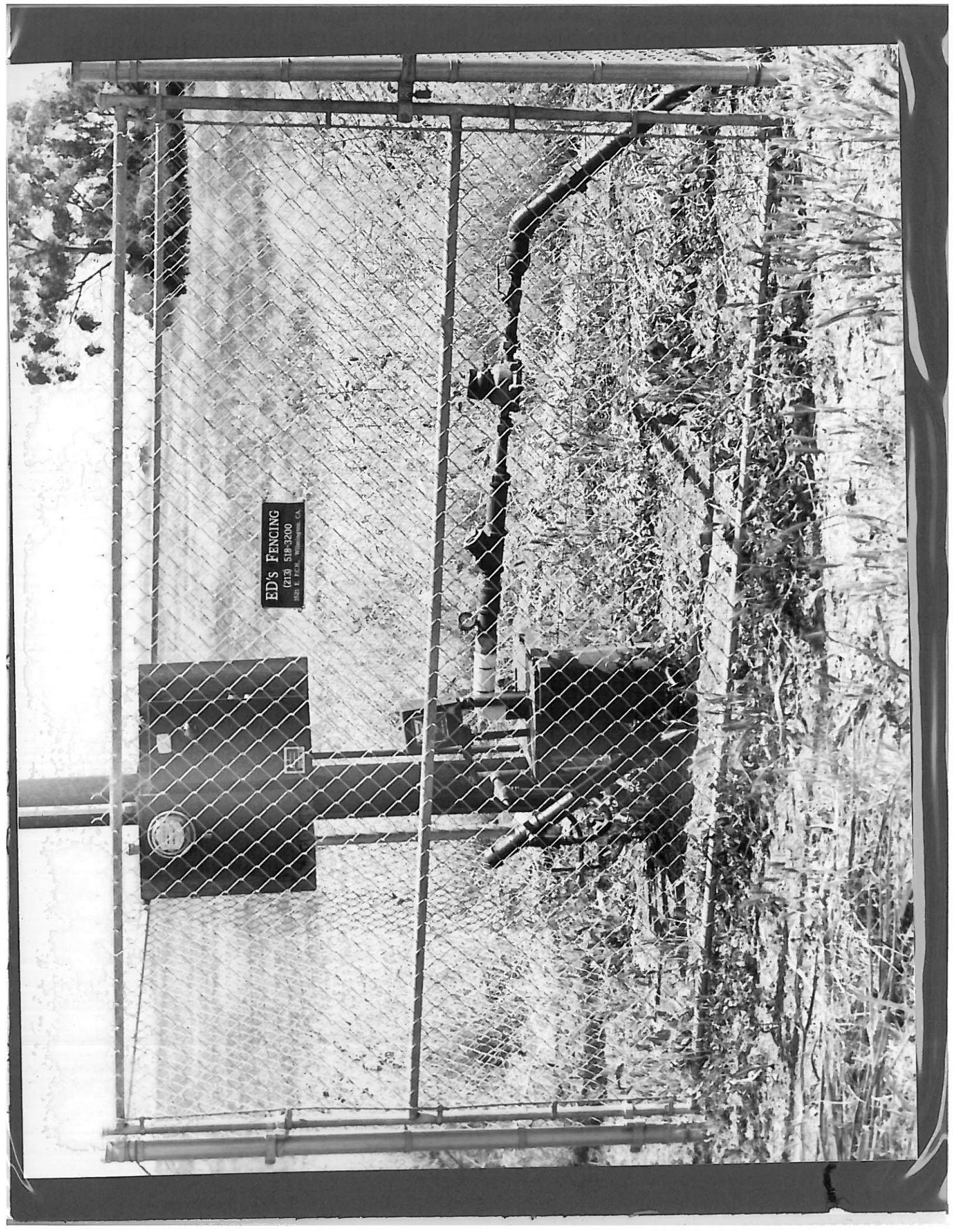




MARINE ENVIRONMENT

APPROXIMATELY 10 MILLION TONS OF SLIDE DEBRIS HAVE BEEN CARRIED INTO THE OCEAN BY WAVE ACTION SINCE THE PORTUGUESE BEND LANDSLIDE BEGAN MOVING MORE THAN 30 YEARS AGO. ALMOST 7 MILLION TONS OF THAT TOTAL HAVE ERODED INTO THE COASTAL ZONE SINCE 1979. SLIDE DEBRIS CONSISTS OF MUD AND ROCK THAT HAS BEEN PUSHED ON THE BLUFF BY THE LANDSLIDE. THE MARINE ENVIRONMENT IN 8.5 MILLION SQUARE FEET OF COASTAL ZONE HAS BEEN SEVERELY DISRUPTED OR DESTROYED BY THIS DEBRIS.

ED'S FENCING
(213) 518-3200
883 E. Foothill Blvd. West Covina, CA



**POST STABILIZATION
EFFORTS**

STABILIZATION

(PHASE ONE)

TO ABATE THE LANDSLIDE'S DESTRUCTION, RANCHO PALOS VERDES HAS ACCOMPLISHED SEVERAL MAJOR TASKS SINCE 1984:

- O PERFORMED EXTENSIVE GEOLOGY AND ENLISTED THE SUPPORT OF SOME TWENTY-FIVE EXPERTS IN THE FIELD OF GEOLOGY AND ENGINEERING;**
- O SPENT \$1.5 MILLION DOLLARS ON GRADING TO HALT MOVEMENT OF THE LANDSLIDE;**
- O INSTALLED DEWATERING WELLS;**
- O CONSTRUCTED DRAINAGE TO CONTROL WATER THROUGH THE LANDSLIDE; AND**
- O ENHANCED SAFETY AND SERVICES TO THE PUBLIC.**





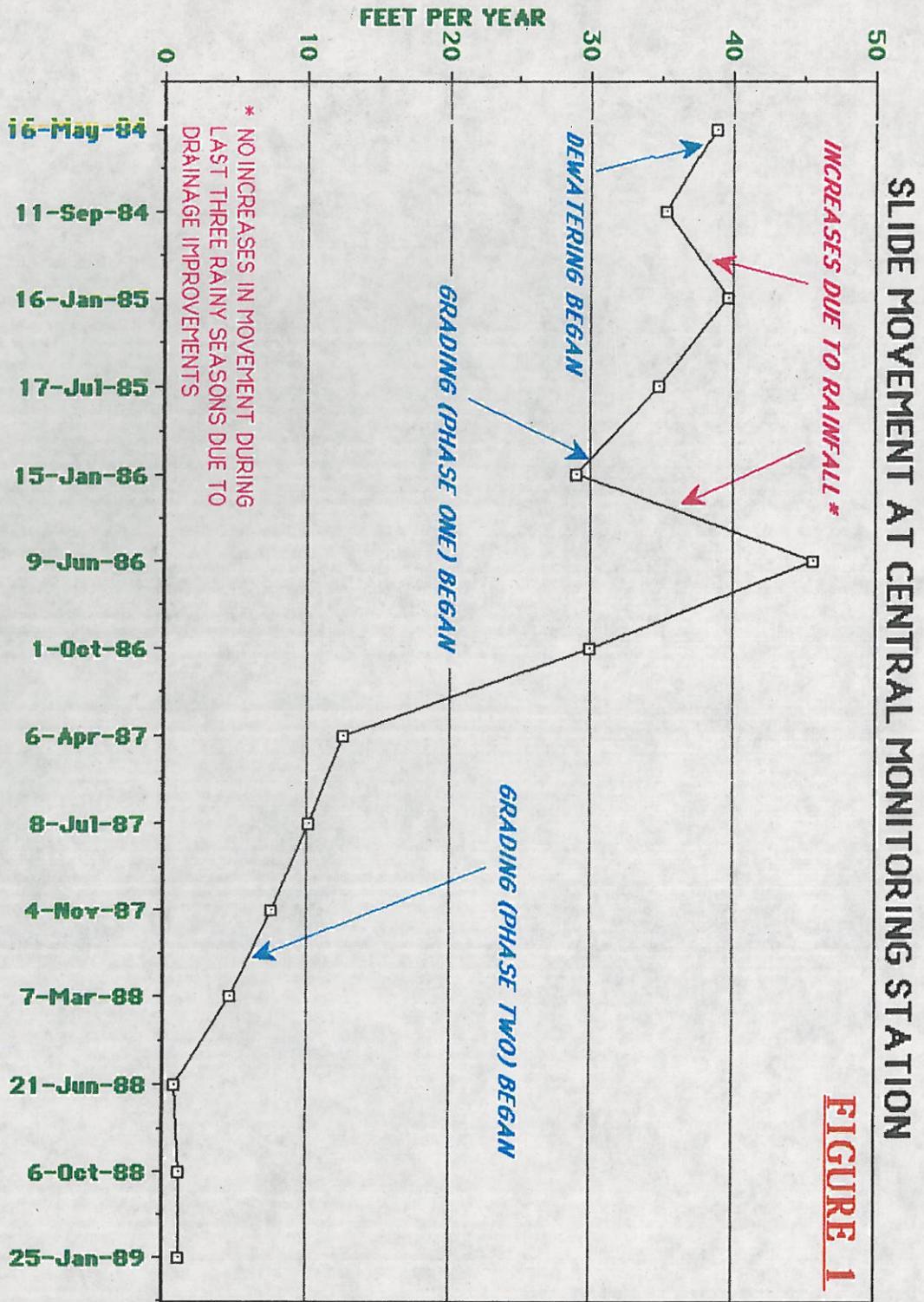
STABILIZATION

(PHASE TWO)

IN 1987, PHASE TWO BEGAN. MAJOR TASKS ACCOMPLISHED INCLUDED:

- O RECONSTRUCTING AND RELOCATING PALOS VERDES DRIVE SOUTH, A MAJOR ARTERIAL ROUTE ALONG THE COAST;
- O MOVING APPROXIMATELY THREE HUNDRED THOUSAND CUBIC YARDS OF EARTH TO RELOCATE PALOS VERDES DRIVE SOUTH AND REDUCE DRIVING FORCES;
- O MOVING AN ADDITIONAL THREE HUNDRED THOUSAND YARDS OF EARTH ON THE WEST SIDE OF THE LANDSLIDE TO CREATE A BERM WHICH ACTS AS A COUNTER-WEIGHT OR RESISTANCE TO SLIDING.

FIGURE ONE HIGHLIGHTS THE SUCCESS OF PHASE ONE AND TWO, WHICH SHOWS THE MOVEMENT OF THE LANDSLIDE IN 1984 TO BE IN EXCESS OF FORTY FEET PER YEAR. TODAY THE MOVEMENT IS LESS THAN ONE FOOT PER YEAR.

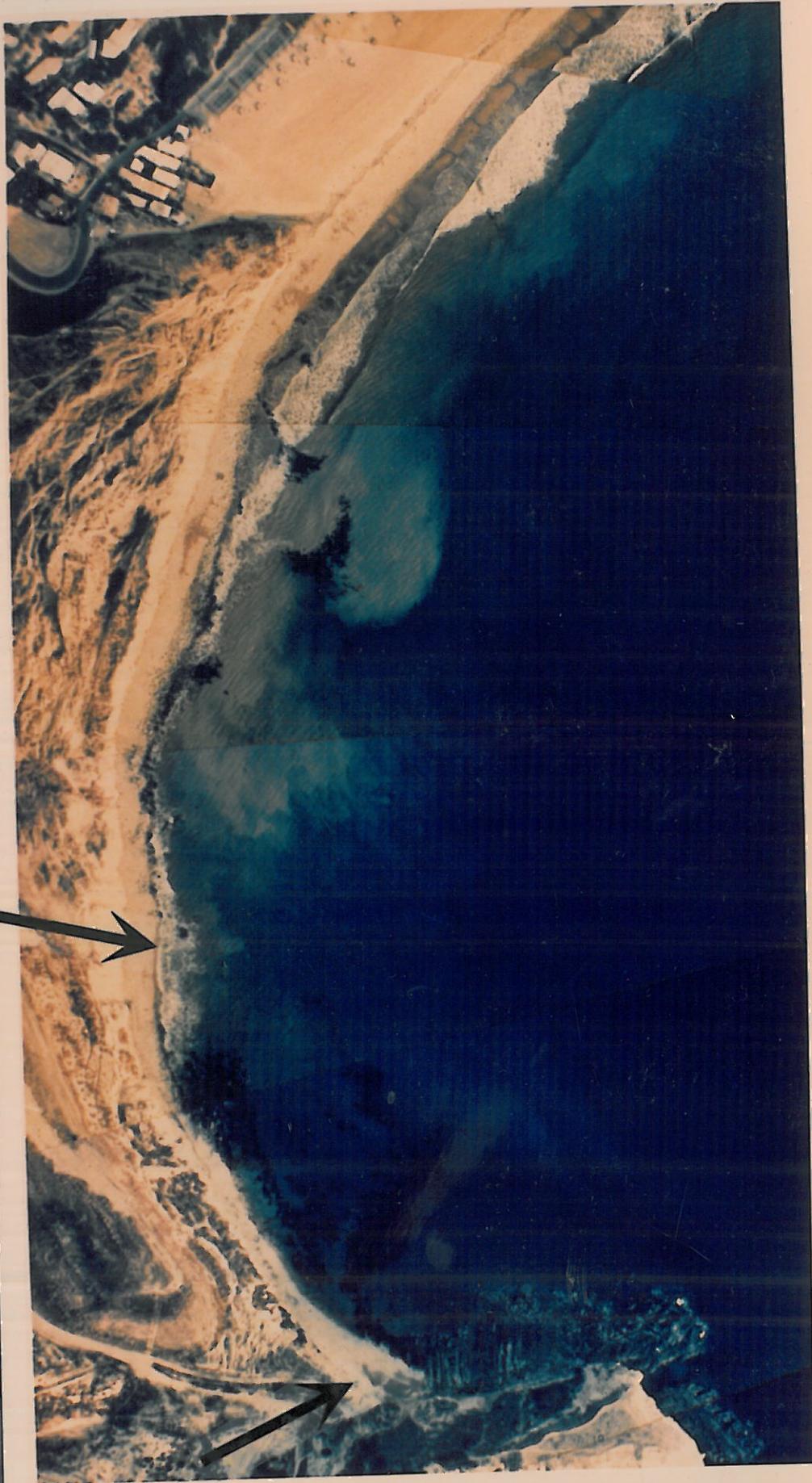


STABILIZATION

(CONTINUING EFFORTS)

EROSION PROTECTION OF THE BLUFFS AT THE BASE OR TOE OF THE PORTUGUESE BEND LANDSLIDE REMAINS A MAJOR OBSTACLE TO MAINTAINING STABILITY:

- O TEMPORARY PROTECTION WAS CONSTRUCTED IN LATE 1988 IN FRONT OF THE PART OF THE BLUFFS WHERE THE BERM OR COUNTERWEIGHT HAD BEEN PLACED DURING PHASE TWO. (ACCOMPANYING COMPOSITE PHOTO HIGHLIGHTS THE VALUE OF THE TEMPORARY MEASURES IMPLEMENTED.) NOTE: LESS DISCOLORATION IN THE WATER IN FRONT OF THE GABIONS;
- O BIOLOGISTS AND ENVIRONMENTALISTS ESTIMATE THAT OVER 850 ACRES OF THIS VALUABLE COASTAL RESOURCE HAS BEEN IMPACTED BY THE EROSION IN THE VICINITY OF THE LANDSLIDE;
- O CONSTRUCTION OF SOME TYPE OF SEAWALL IS THE FINAL STEP NEEDED FOR PERMANENT STABILITY. COST OF THE PROJECT PROHIBITS THE CITY FROM TAKING THIS FINAL STEP; AND
- O CORPS OF ENGINEERS PRESENTLY PERFORMING A RECONNAISSANCE STUDY. THE CITY IS SEEKING AN ADDITIONAL \$90,000 TO THIS STUDY TO DETERMINE THE AMOUNT OF DESTRUCTION AND THE EXACT AREA IMPACTED.



TEMPORARY SHORELINE PROTECTION - GABIONS -
*Rectangular wire baskets filled with local rocks from the
landside and wired together along the beach to prevent wave
erosion of the bluffs for a distance of approximately 800 feet.*

