news from the NATIONAL RESEARCH COUNCIL

The National Research Council was organized by the National Academy of Sciences in 1916 in order to provide for a broader participation by American scientists and engineers in the work of the Academy. The Academy was chartered by Congress in 1863 as a private organization with a responsibility for advising the Federal Government in science and technology. Since this responsibility is now shared with the National Academy of Engineering, organized in 1964 under the original NAS charter, the Research Council serves, in effect, as an operating agency for both academies.

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NATIONAL PROGRAM RECOMMENDED TO REDUCE EARTHQUAKE LOSSES

FOR RELEASE: AM's Friday, March 7, 1969
(Mailed 3/4/69)

WASHINGTON—A five-year study of the 1964 Alaska earthquake has convinced a committee of the National Research Council that even though accurate prediction is not yet possible, steps can be taken now to reduce substantially the loss of life and property in future earthquakes.

In a report issued today the NRC Committee on the Alaska Earthquake, appointed in 1964 in response to a White House request, recommends a truly comprehensive national program to reduce the destructive effects of earthquakes and other natural disasters such as floods, landslides, hurricanes, tornadoes, volcanic eruptions, and tsunamis. A task force should be appointed to define the relevant goals and functions of government and recommend specific action to achieve those goals. Regional authorities should be created with responsibility for evaluating and coping with natural disasters.

Because man will continue to live and work in areas of seismic hazard, the Committee feels that first consideration should be given to safety factors in building design and construction. Building code requirements and certain engineering practices should be revised to provide greater protection against earthquakes. In densely populated

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seismic areas, maps should be prepared showing the comparative earthquake hazard at each point. Detailed evaluation by experts should be required before sites are purchased for schools, hospitals, and other important public buildings.

Efforts should be increased to develop practical earthquake and tidal wave forecasting and warning systems. The Committee warns, however, of social and economic disruption that can be caused by attempting to forecast the time and specific location of the next major earthquake. For the immediate future at least, forecasting should be limited to the probability of an earthquake of a certain magnitude range in a given region.

Because earthquakes are abrupt and unpredictable events, arrangements must be made in advance for the collection of data useful in reducing future losses. The Committee recommends that emergency funds and scientific personnel be available to collect and analyze data from major earthquakes wherever they may occur and that greater coordination be sought among the various government agencies responsible for research funds.

The Committee also recommends a comprehensive study to develop a more effective system of earthquake insurance. Although insurance is now available, a number of factors limit its use. In California, for example, only five per cent of the property that is insured against fire loss is also insured against earthquakes.

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(A summary of the study and the Committee's twelve major recommendations is attached.)

SUMMARY

March 27, 1969 is the fifth anniversary of the Great Alaska Earthquake—a quake that released in three to four minutes twice as much energy as the earthquake that destroyed San Francisco in 1906. After a five-year study of this fearful event, the National Research Council has published recommendations for reducing losses in future earthquakes.

The report, Toward Reduction of Losses from Earthquakes: Conclusions from the Great Alaska Earthquake of 1964*, was prepared by the NRC's Committee on the Alaska Earthquake, which was appointed shortly after the disaster in response to a request from the White House. In carrying out its charge to "assemble a comprehensive scientific and technical account of the Alaskan earthquake and its consequences," the Committee set up seven specialized panels on geology, seismology, hydrology, biology, oceanography, engineering, and geography. The full report of the Committee is planned as an eight-volume series, The Great Alaska Earthquake of 1964, composed of the detailed scientific reports of each of the seven panels and the Committee's summary and recommendations.

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*Available at $1.50 from the Printing and Publishing Office, National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.

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The magnitude, duration, and geographical extent of damage of the 1964 Alaskan earthquake rank it among the major earthquakes of history. In Alaska, 115 persons were killed, $300 million worth of public and private property was destroyed, and the state's economy was crippled. That the death toll was not many times higher was due to a happy combination of several chance elements; the sparse population, the fortuitous timing (the earthquake occurred on the evening of a holiday, when schools were empty and most offices deserted), a low tide, the absence of fire in residential and business areas, the generally mild weather, and the fact that it was the off-season for fishing.

The Committee notes, however, that had an earthquake of this magnitude and duration occurred in a densely populated region during the daytime, it could easily have caused 50 times as many deaths as did the Alaska earthquake, and perhaps 60 times as much property damage. It is in light of this highly variable potential of an Alaska-type earthquake that one should seek to learn lessons from the experience, the Committee says.

The recommendations reflect the Committee's conviction that man will continue to live and work in areas of seismic hazard and that first consideration therefore should be given to safety factors in structural design and in patterns of use and occupancy. The first four of their twelve major recommendations reflect concern for improving earthquake engineering skills and the regulatory systems that control construction in areas of seismic hazard. The recommendations are:

"Studies should be undertaken to develop improved earthquake-resistant designs, and more accurate and reliable methods of structural analysis, for all types of structures and for a variety of ground conditions." Both engineering practice and existing building codes require revision to cover all significant aspects of the earthquake design problem. The Committee draws particular attention to the need to understand the behavior of mechanical and electrical equipment in buildings subjected to severe ground motion and notes the special hazards posed by large oil-storage tanks.

"Improved regulatory systems for control of structural and non-structural design and of construction in seismic areas are needed." Building code requirements should be expressed in terms of the dynamic behavior of structures rather than in terms of the currently used equivalent static forces and should require consideration of soil conditions and local geology in the selection of earthquake design criteria. The report also recommends the establishment of a model building code for waterfront areas that are subject to tsunami, or "tidal wave", hazard.

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"Periodic reappraisals should be made of major dams, reservoirs, storage tanks, and older buildings in seismic areas to identify existing hazardous structures and to reduce hazards to life and limb." The Committee notes that while large earthquakes are far more frequent in California and Alaska than elsewhere in the United States, the present state of buildings in some other regions is such that a major earthquake might cause a greater disaster than would an earthquake of the same magnitude in California and Alaska.

"Increased effort should be devoted to collecting data on ground movements and associated physical-field changes both between and during major earthquakes." The design requirements to be used in implementing the first three recommendations can be determined only through precise measurement of ground movement and analysis of structural response to that movement. The report recommends the establishment of a more complete geodetic network to determine the strain fields in seismic areas.

Reduction of losses depends on improving systems for warning responsible officials and the general populace of impending natural disasters. Therefore, an additional four recommendations deal with improved forecasting and warning systems.

"Needed improvements in the tsunami warning system include better recording, faster transmission, improved analysis of data, more knowledge of the generation and propagation of tsunamis, and greater understanding of the human response to such warnings." The report emphasizes the importance of educating the coastal public to the tsunami hazard associated with strong earthquakes.

"Studies are needed to make earthquake forecasting and hazard evaluation practicable; not only the feasibility but also the socio-economic implications of such forecasting need to be studied." A recent earthquake forecast for an area in Japan is said to have resulted in great tension and damage to the local economy. For the immediate future at least, forecasting should be limited to terms of probability of an earthquake of a certain magnitude range in a seismic region, rather than prediction of the time of the next major earthquake at a specific place.

"Earthquake-hazard maps should be made of all densely populated seismic areas." Cities should be encouraged to prepare maps of this sort as guides to land-use decisions, particularly decisions on the location of schools, hospitals, and other important public buildings. The decision to relocate the town of Valdez following the Alaska earthquake illustrates the positive use of such information.

"Informing the threatened public of the nature of earthquake hazard and education on means of reducing risk are vital to effective measures of loss reduction and loss adjustment." The Committee emphasizes that the public and its leaders need to be informed of the nature of the earthquake hazard, including associated phenomena such as landslides and tsunamis, and taught ways of dealing with it.

The remaining recommendations of the Committee deal with a variety of steps that could reduce losses and assure that future disasters would yield information valuable in planning.

"A comprehensive study should be undertaken concerning the problems involved in establishing a system of earthquake insurance that will be widely used and that will lead not only to loss adjustment but also to loss reduction." Although commercial earthquake insurance is available, it is not widely used. A commission composed of persons from insurance companies, government, and universities should be convened to draw up guidelines for the establishment of a more useful and more used system of earthquake insurance.

"Emergency funds and personnel should be available to collect and analyze data from major earthquakes wherever they may occur." Steps should be taken to maintain a group of government and university experts on ready alert, provide them with equipment and assistance to record and analyze scientific and engineering information, and to assist developing nations in seismic regions to install strong-motion seismographs to record destructive ground motions. The expense involved in such activities, the Committee states, would be small in comparison to the expectable economic benefits and saving of lives from consequent improvements in earthquake-protection measures.

"The mechanisms for funding earthquake research and data collection should be improved." The Committee notes that the greatest obstacle it encountered was the absence of a mechanism to secure quick funding for data-collection efforts. The Office of Emergency Preparedness, the Committee suggests, would seem an appropriate agency to fund earthquake data collection that falls outside other agencies' missions. Support of research not related to specific earthquakes should be encouraged within the appropriate action and granting agencies by a coordinating and guidance group like that recommended recently by the Ad Hoc Interagency Working Group for Earthquake Research of the Federal Council for Science and Technology.

"A federal task force should be established to recommend a comprehensive government program directed toward reduction of losses from hazards such as earthquakes; at the same time, individual state or regional authorities should give attention to appropriate mechanisms for coping with these hazards." In proposing such a task force the Committee stresses that because earthquakes are infrequent, abrupt, and unpredictable, and because the public tends to regard the hazard from earthquakes as largely confined to only two states, a comprehensive program should deal collectively with the entire class of sudden-impact environmental events, including hurricanes, tornadoes, floods, volcanic eruptions, tsunamis, major landslides, and earthquakes.

Since 1964 the Alaska earthquake has become the best documented and most thoroughly studied in history. Described as a "natural scientific experiment on a grand scale," it has provided insights into a host of long-standing scientific problems. Accordingly, the eight volumes that will comprise the Committee's complete report will constitute a scientific and engineering report on the earthquake, its effects, and the lessons to be learned from it. The first volume, Hydrology* was published in January of this year and covers the effects of the earthquake on water in its continental forms—groundwater, surface water, glaciers, and snow and debris avalanches.

Human Ecology, the next scheduled volume, is expected to be available this fall. This volume will include an analysis of the human consequences of the earthquake, including changes in familial, economic, judicial, educational, and health and welfare activities, and disruption of communication nets and transportation systems. The panel's recommendations focus on the need for local, state, and national groups to plan means of alleviating such disruptions. Other volumes nearing completion deal with Seismology and Geodesy and Biology.

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*Publication 1603, available at $19.75 from the Printing and Publishing Office, National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.

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UNITED STATES DEPARTMENT OF THE INTERIOR
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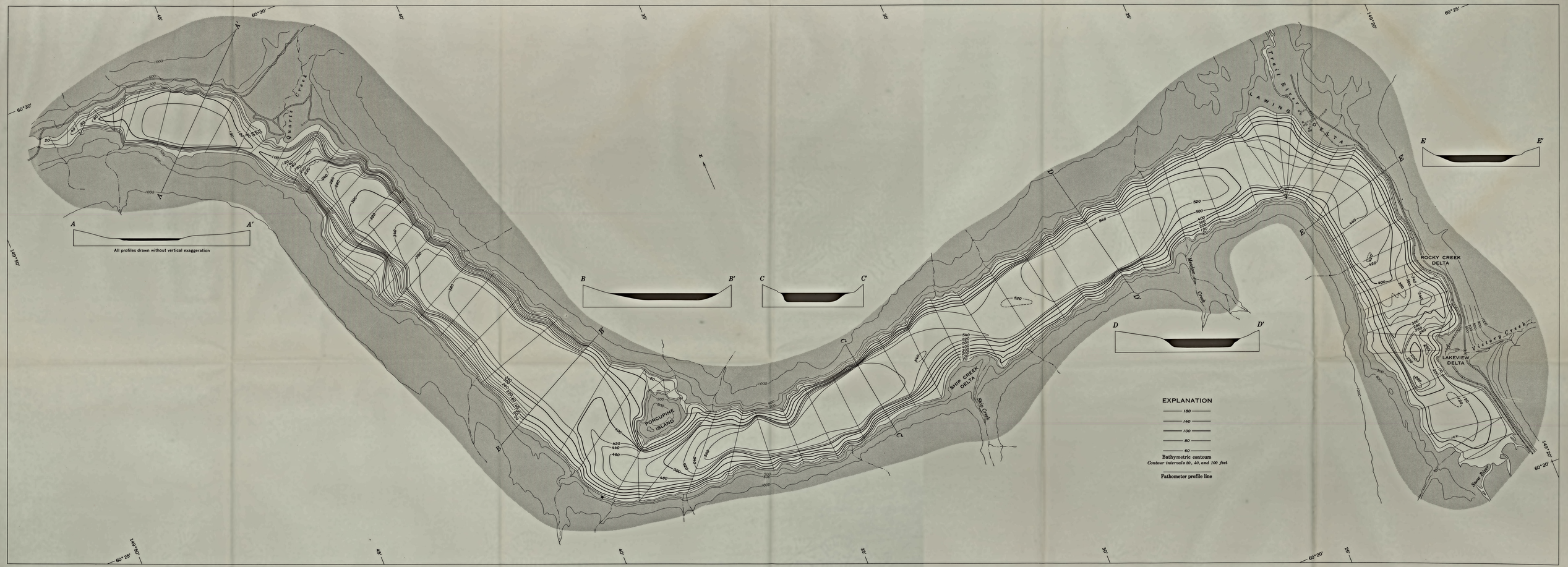
PROFESSIONAL PAPER 543-A
PLATE 1



Base from U.S. Geological Survey Seward B–7 and Seward B–8 quadrangles

BATHYMETRIC MAP AND PROFILES OF KENAI LAKE, ALASKA

Bathymetry by D. S. McCulloch and L. R. Mayo, August 1964

796-520 O - 66 (In pocket)

SCALE 1:31 680

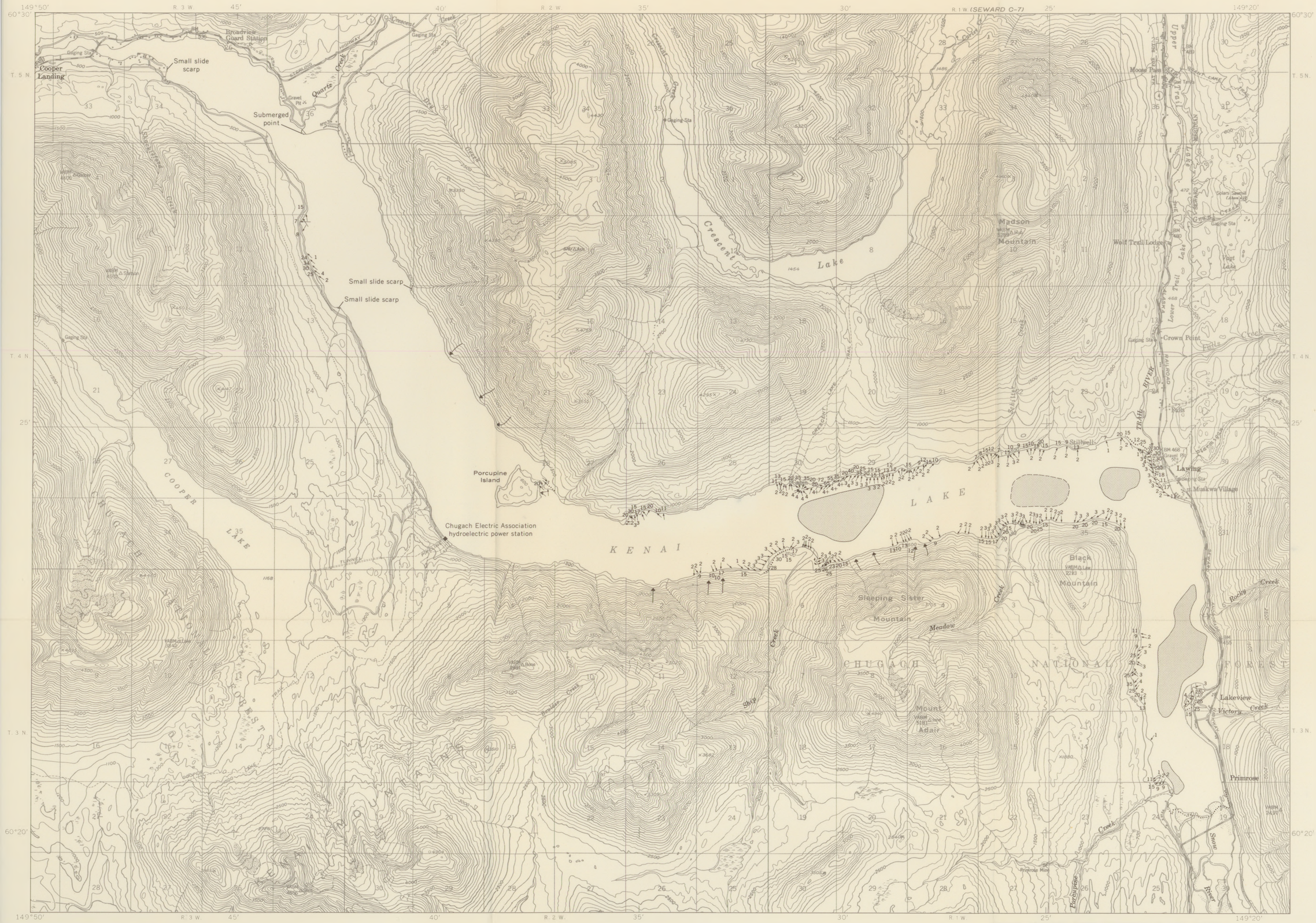
1 ½ 0 1 2 MILES

1 .5 0 1 2 KILOMETERS

TOPOGRAPHIC CONTOUR INTERVALS 100 AND 500 FEET
DATUM IS MEAN SEA LEVEL

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PROFESSIONAL PAPER 543-A
PLATE 2



Base from U.S. Geological Survey Seward B–7 and Seward B–8 quadrangles

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1966—G66069

Data collected by David S. McCulloch and L. R. Mayo, 1964

EXPLANATION

Area of slide deposition
Outline is dashed where area is indefinite

30
4

Direction, magnitude of damage (at base of shaft), and runup height of waves, in feet

Magnitude of damage, shown here and other illustrations, was assigned on the basis of a numbering system similar to one developed by George Plafker and L. R. Mayo. Damage increases from 1 through 4 as follows:

1. *Brush combed in direction of wave travel. Small limbs broken and minor ice scarring on trees. Runup heights only a few feet*
2. *Trees and limbs as much as 6 inches in diameter broken. Small trees uprooted. Runup reached 20 feet on steep slopes*
3. *Trees and limbs as much as 1 foot in diameter broken. Extensive ice scarring. Boulders and small blocks of frozen sediment carried on shore. Runup reached a maximum of about 30 feet*
4. *Some turf stripped from bedrock. Large limbs and trees as much as 2½ feet in diameter broken; large trees uprooted. Very large blocks of frozen sediment carried on shore by wave. Runup heights of 35 feet common, maximum was 72 feet*

Inshore limit of waves

Path of snow and rock avalanche

Change in shoreline shown by darkline

MAP OF KENAI LAKE, ALASKA, SHOWING THE DIRECTION, MAGNITUDE, AND RUNUP HEIGHTS OF WAVES, AND THE CHANGES IN THE SHORELINE THAT RESULTED FROM SLIDING DURING THE MARCH 27 EARTHQUAKE

SCALE 1:63 360

1 ½ 0 1 2 3 4 5 MILES

1 .5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET