Appendix B

Task 1, Technical Memorandum Earthquake Scenario

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Memorandum

Date: December 29, 2010

To: David Tremont, Municipality of Anchorage Planning Department

From: Donald Ballantyne, MMI Engineering

Subject: Downtown Anchorage Seismic Risk Assessment –
Task 1, Proposed Earthquake Scenario

This memorandum describes the scenario proposed for use in the Downtown Anchorage Seismic Risk Assessment. A scenario consistent with International Building Code (IBC) design ground motions is proposed. The IBC requires buildings to be designed to two-thirds of the probabilistic ground motion that has a 2 percent chance of occurring in 50 years (2,500 year return period).

The USGS (2002) 2,500-year probabilistic ground motion for the Anchorage area is 66.3 percent of gravity. This ground motion is located on Class B (firm) soils). Two-thirds of this ground motion is 44.2 percent of gravity. This lies between the USGS probabilistic ground motions for a 750-year return earthquake (45.9 percent g) and a 500-year return earthquake (38 percent of gravity). It is noted that the 1964 Alaska Earthquake is estimated to have a return period of about 700 years, so the proposed scenario is consistent with the 1964 Alaska Earthquake.

The most significant source zones that contribute to the probabilistic ground motion are the Subduction Fault that caused the 1964 event (Pacific Plate moving under the North American Plate), and the Castle Mountain Fault. The earthquake scenario is intended to show the result of catastrophic soil failure similar to that which occurred in 1964, so it is important to select an event where that ground movement will occur.

The area is underlain by a 200-foot thick layer of Bootlegger Clay. This clay layer impacts earthquake hazards in two ways: 1) it fails structurally resulting in the soil layers it supports moving down gradient, and 2) it deamplifies the ground motion introduced at its interface with the till layer below. The entire study area is underlain by this formation, so the entire area is subject to the deamplification. The varying degrees of ground deformation are dependent on the soil's lateral restraint, so the areas closer to the water with less confinement are expected to move more (e.g. Hazard Zone 5).

Failure of the Bootlegger Clay formation that results in the catastrophic ground deformation is a function of both ground shaking intensity and duration of shaking (number of cycles). A Subduction Fault earthquake will result in an extended duration of shaking, five minutes or more as occurred in 1964. It is not clear that a Castle Mountain Fault event would have the shaking duration that would result in failure of the Bootlegger Clay formation. Therefore, the scenario is based on a Subduction Fault Event.

Surface ground motions in the scenario are expected to be on the order of 20 percent of gravity, similar to the 1964 event. This is the result of deamplification occurring in the Bootlegger Clay formation. That is, the 44.2 percent ground motion would be input into the base of the 200-foot thick Bootlegger Clay formation. The clay material is too weak to transfer all of the energy upward to the surface. The attached USGS Shake-Map shows the expected ground accelerations in the region for the 1964 event. There is some belief that even if the area was subjected to larger ground motions (such as the 66.3 percent 2,500-year return earthquake ground motion), the surface ground motion would not increase over the 20 percent of gravity.

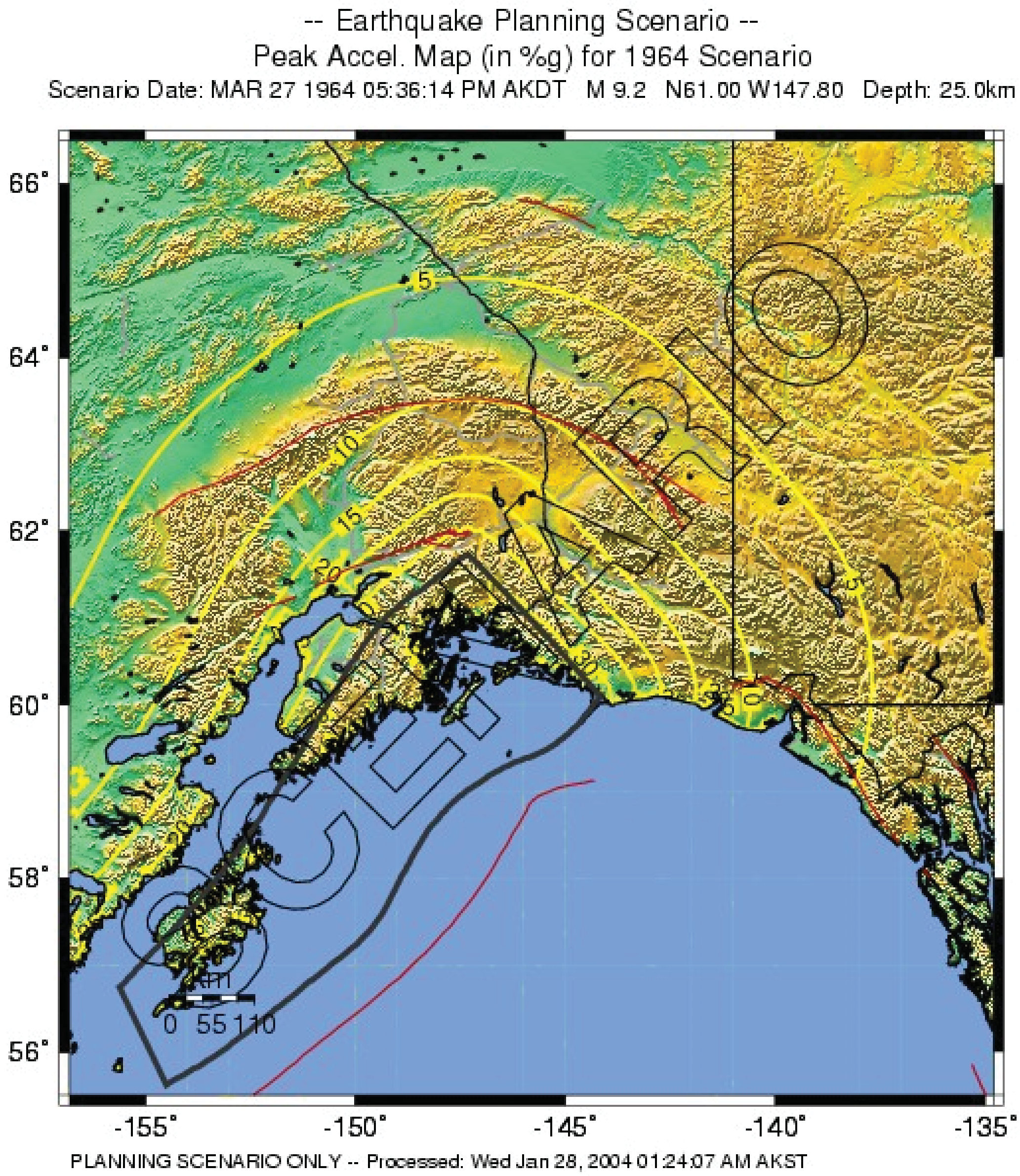

Figure 1. Scenario Shake Map (from the USGS)