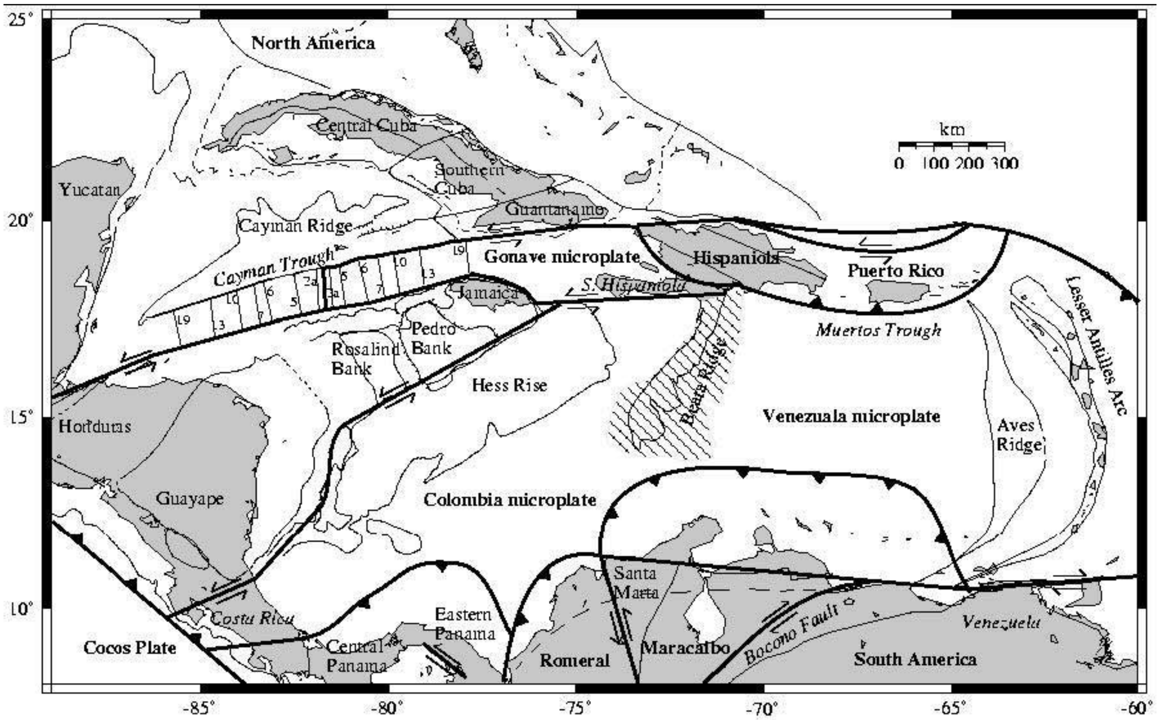
with intensities of 3-4. No damage was reported in either case from the distant country (pers. comm. M. Grandison).



<u>FIGURE 3-8: TECTONIC PLATES IN THE CARIBBEAN REGION</u>

Figure 3-9 shows the epicenters of over one-hundred (100) earthquakes which have occurred in or near Jamaica between 1998 and 2001. With over 100 such occurrences, there was no significant damage to any approved infrastructure within the island to warrant consideration for the adjustment or revision of any building or construction codes for the island.

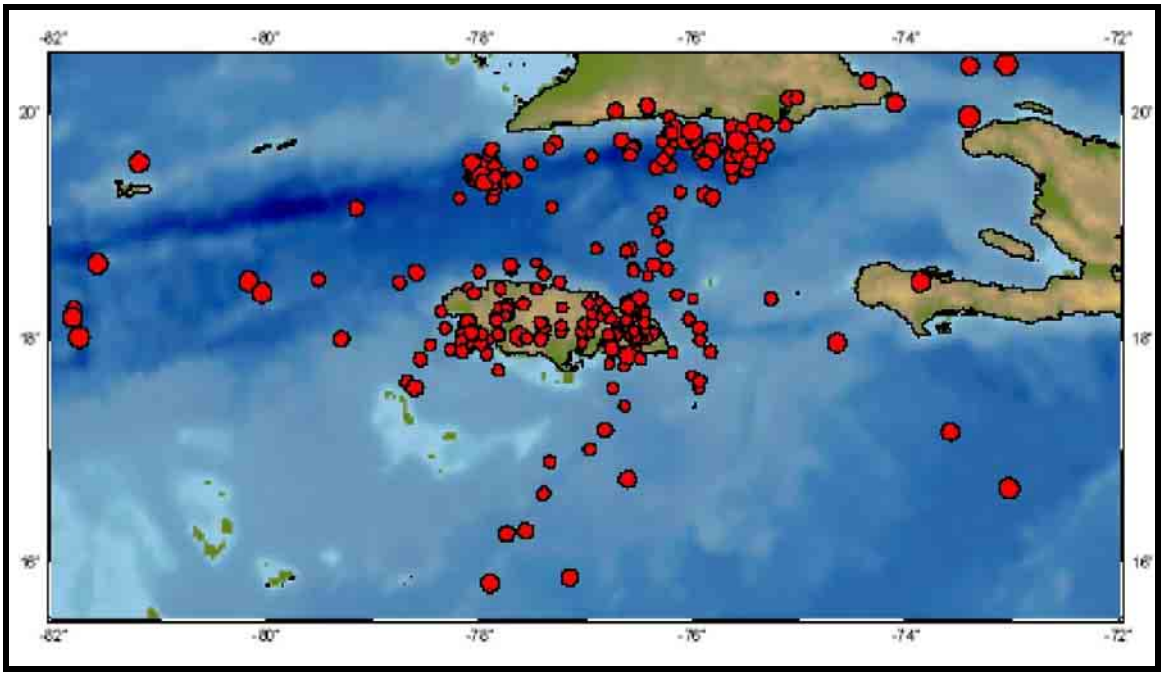


FIGURE 3-9: EPICENTRES OF EARTHQUAKES OCCURRING BETWEEN 1998 AND 2001 IN THE VICINITY OF JAMAICA[1]

Figure 3-10, Figure 3-11, and Figure 3-12 are summarized in Table 3-12 in relation to the proposed coastal landing sites. Table 3-13 allows one to conceptualize the type of effect the predicted values in Table 3-12 are likely to have. In analyzing Table 3-12, it becomes evident the most seismically active of all three sites is that of the Bull Bay site. As such, this site may be used as reference for the expected worst case scenario for any seismic activity which may be experienced by all three sites. From Table 3-12, it is expected that that there is only a 10% probability of any earthquake which occurs in or is felt by the Bull Bay area to exceed an intensity of 8 (VIII) within a 50 year period. An earthquake of such intensity is not likely to damage, or sufficiently damage buildings designated as *Masonry A* or *Masonry B* type construction (Table 3-13). This is significant because most buildings in Jamaica are designed to one of the two Masonry types mentioned above – the proposed onshore shelter station is no different (See Figure 1-8). Further inspection of Table 3-13

[1] Source: *Earthquake Unit, University of the West Indies, Mona*

reveals that earthquakes of such intensity are not likely to cause damage to underground pipes or disrupt their orientation significantly. The cables that will have to be laid underground are of greater strength and flexibility than conventional underground pipes, and do not transmit volatile or heavy fluids, whose dynamics or reactions might produce further stress on the pipes during an earthquake. Therefore, they are less likely to break under similar stress and strain conditions than the conventional underground pipes discussed in Table 3-13. Therefore, given the degree and frequency of seismic activity in the Bull Bay area, it is evident that the installation of the cable system in this area will not be greatly threatened by seismic activity. Further, if one were to extrapolate in consideration of the remaining two sites, one could conclude that these sites are less likely to be threatened by the same intensity of seismic activity as the Bully Bay site and are therefore less threatened by seismic activity.

It is important to note that the Bull Bay building site is an existing cable site that has been in existence long before the 1998-2001 period assessed during this project, and there has not been (to our knowledge) any record of cable failure due to seismic activity in the area.

TABLE 3-12: 10% PROBABILITY EXCEEDANCE IN ANY 50 YEAR PERIOD OF THREE EARTHQUAKE PARAMETERS FOR THE PROPOSED LANDING SITES

Landing Point	Horizontal Ground Acceleration /gals	Maximum Mercalli Intensity /MMI	Horizontal Ground Velocity /cms^{-1}
Bull Bay, St. Thomas	270-295	>8	18-20
Tower Isle, St. Mary	270-295	7-8	18-20
Great River, Montego Bay, St. James	145-190	6-7	10-14

TABLE 3-13: MERCALLI SCALE[2]

Intensity	Effects	PGA*(gals)
I	Not felt. Marginal and long-period effects of large earthquakes.	less than 1
II	Felt by persons at rest, on upper floors or favourably placed.	1 - 2
III	Felt Indoors. Hanging objects swing. Vibration like passing of a light truck. Duration estimated. May not be recognized as an earthquake.	2 - 5
IV	Hanging objects swing. Vibration like passing of heavy trucks: or sensation of a jolt like a heavy ball striking the walls. Standing motor cars rock. Car alarms activated. Windows, dishes, doors rattle. Glasses clink, crockery clashes. In the upper range of IV wooden walls and frames creak.	5 - 10
V	Felt Outdoors. Direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close open. Shutters, pictures move, pendulum clocks stop, start, change rate.	10-25
VIa	Felt by all: many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books etc. off shelves. Pictures off walls. Furniture moved or overturned. Weak plaster and masonry D cracked. Small church and school bells ring. Trees, bushes shaken (visibly or heard to rustle).	25-50
VII	Difficult to stand. Noticed by car drivers. Hanging objects quiver. Furniture broken. Damage to masonry D including cracks. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones tiles cornices unbraced parapets, and architectural ornaments. Some cracks in masonry C. Waves on ponds; water turned turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Concrete culverts damaged.	50-100
VIII	Steering of motor cars affected. Damage to masonry C: partial collapse. Some damage to masonry B, none to masonry A. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and steep slopes.	100-250
IX	General panic. Masonry D destroyed; masonry C heavily damaged, sometimes with complete collapse; masonry B seriously damaged. General damage to foundations. Frame structures shifted off foundations if not bolted down. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks on ground. Sand boils, earthquake fountains, and sand craters.	250-500
X	Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes etc. Sand shifted horizontally on beaches and flat land. Rails bent slightly.	500-1000
XI	Rails bent greatly. Underground pipelines completely out of service.	**
XII	Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into the air.	**

Notes[3]:
* PGA is the effective Peak Ground Acceleration during the earthquake. That is the maximum horizontal ground acceleration excluding high frequency spikes. 1 gal = 1 cm/sec/sec. Since the intensity of gravity (g) is about 10 meters/sec/sec 10 gals is about 1% of gravity
** At the highest intensity levels damage potential is determined increasingly by the effects of ground failure. Most types of ground are unable to sustain prolonged accelerations much greater than 500 gals.

[2] http://www.uwiseismic.com/Earthquakes/eq_monitoring.html#Anchor-MEASURIN-48543
[3] http://www.uwiseismic.com/Earthquakes/eq_monitoring.html#Anchor-MEASURIN-48543

Masonry A. Good workmanship, mortar and design: reinforced especially laterally and bound together using steel, concrete etc. Designed to resist lateral forces.
Masonry B. Good workmanship and mortar. Reinforced but not designed in detail; to resist horizontal forces.
Masonry C. Ordinary workmanship and mortar. No extreme weaknesses like failing to tie in at corners but neither reinforced nor designed to resist horizontal forces.
Masonry D. Weak materials such as adobe; poor mortar; low standards of workmanship; weak horizontally.
(From Elementary Seismology by C.F. Richter, Published by W.F. Freeman and Company, San Francisco 1958)

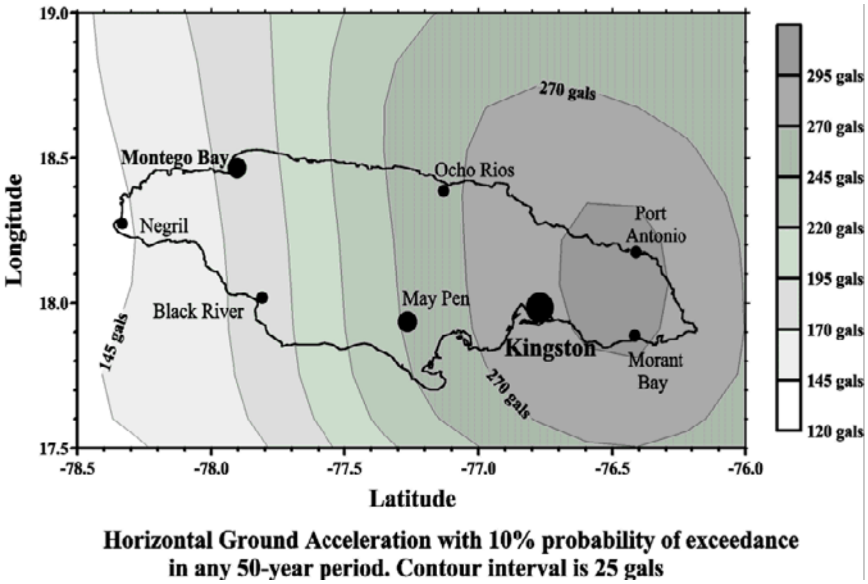


FIGURE 3-10: HORIZONTAL GROUND ACCELERATION IN JAMAICA[4]

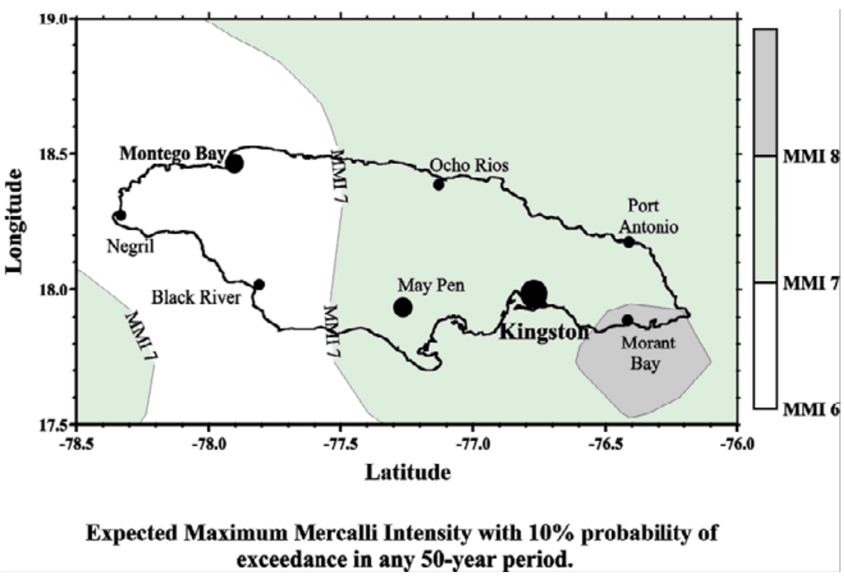


FIGURE 3-11: MAXIMUM MERCALLI INTENSITY IN JAMAICA[5]

4 http://www.oas.org/CDMP/document/seismap/
5 http://www.oas.org/CDMP/document/seismap/

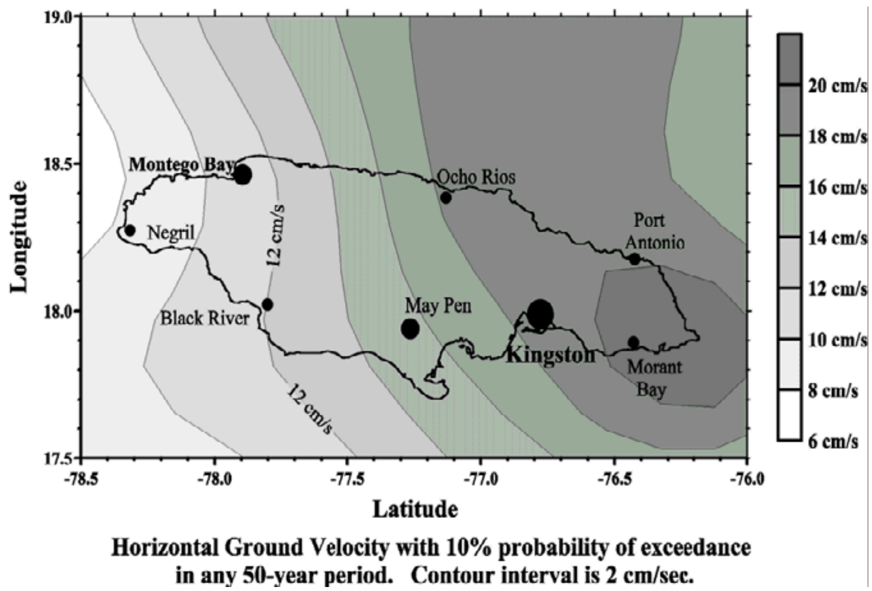


FIGURE 3-12: HORIZONTAL GROUND VELOCITY IN JAMAICA[6]

3.6.3 Hurricane/Cyclone Activity

Generating the data commonly associated with storm activity, and the consequent probable trends, for each landing point of the island is not necessarily feasible or a pragmatic assessment given the scope of this Environmental Impact Assessment. However, an appreciable approach would be to consider a reference point on the island, namely the center of the port of Kingston, and then use recorded cyclone activity over a period of time within the Caribbean region to estimate any associated trends related to the cyclone activity and the return period of such activities to the island[7]. This can be done confidently as Jamaica is a small island and is likely to be affected wholly regardless of the point of approach of a tropical depression or storm system.

Based on the values recorded in Table 3-14, Jamaica is estimated to have a 95% chance of experiencing, at the most, the wind

[6] http://www.oas.org/CDMP/document/seismap/

[7] ***Organization of American States General Secretariat Unit for Sustainable Development and Environment USAID-OAS,*** **Return Period Estimation of Hurricane Perils in the Caribbean,** Caribbean Disaster Mitigation Project April 1999