From: Jamaica Environment Trust [mailto:jamentrust@cwjamaica.com]
Sent: Thursday, July 02, 2009 2:35 PM
To: Knight, Peter
Cc: 'Danielle Andrade'
Subject: Proposed Falmouth Cruise Ship Terminal Development and the biolumuniscence of Oyster Bay
Importance: High

Dear Mr. Knight,
We have sought overseas review of the two studies on the NEPA website with regard to the above matter as below:

1. Assessment of Currents in Inner Harbour submitted to Port Authority of Jamaica (June 2009)

2. Hydrodymanic Model with Flood Conditions Falmouth Cruise Ship Terminal Development (June 2009)

At issue is whether the development of the project, which would involve construction of a pier and the berthing of two large cruise ships (vessels), would change current patterns of the inner bay in a manner that would endanger rare species of dinoflagellates that impart a unique bioluminescence to the inner bay.

The two new reports are virtually identical, so our critique of one report can be applied to both reports.

The new data that these reports rely on are current patterns in the inner and outer bay that the project proponents measured using two drogues (a floating beacon) on one day (May 12th, 2009).

Figure 9 of both reports shows the drogue tracks. The drogues started in the inner harbor and then floated down and out of the harbor.

Figure 13 of both reports compares the drogue tracks with the project proponent's model (assumptions) of current patterns in the inner and outer harbor.

In interpreting this comparison (actual movement of the drogue tracks and the assumptions about current patterns in the inner and outer harbor), both reports state: "Both the drogue and the model display the gyre effects which seem to occur within the bay. This quite clearly demonstrates shows the spatial capability of the hydrodynamic model."

However, if you look closely, the drogue tracks and the assumptions about current patterns in the inner harbor don't correlate at all!! We feel this is a glaring inadequacy of the model that the project proponents are using.

Look carefully at Figure 13 (in either report).

According to the assumed current patterns, the drogues should have started moving in a southerly and easterly direction after their release; instead the drogues started moving nearly due west. According to the assumed current patterns, when the drogues entered the approximate midpoint of inner harbor (the tip of the first arrow), the drogues should have moved in a southeasterly direction; instead, the drogues continued moving nearly due west. It is only after the drogues reach relatively stronger modeled currents near the southern reach of the transition between the inner and outer harbors do the drogues actually move in the direction the model predicts that they will move.

Neither report offers an explanation for the discrepancy between the actual movement of the drogues and the predicted movement according to the hydrodynamic model that the project proponents are using.

Considering that the inner harbor is where the critical dinoflagellates reside, the inability of the hydrodynamic model to predict actual movement of the drogues in the inner harbour seems like a serious shortcoming; it should call into question the entirety of the other predictions in the report (such as the predicted changes in salinity and suspended sediment concentrations in Figures 17-28 of the first report, and in Figures 15-16 of the second report).

In a similar vein, Figure 14 of the first report compares actual salinities and predicted salinities according to the hydrodynamic model that the
project proponents are using. Figure 14 characterizes this data as follows: "Overall, the performance of the model in simulating the dynamics of the outer and inner harbour is within expected limits from a physical standpoint."

However, if you look closely at the diagram of salinities at Site 2, there is roughly a 20% difference between measured and predicted salinities at the water's surface is substantial, especially considering that dinoflagellates do not tolerate lower salinities.

The Jamaica Environment Trust strongly recommends that further public consultation is needed for this project. The plans have changed substantially from what was first put before the public, we understand the Jamaica National Heritage Trust has significant concerns about the new plan, and the public has a right to learn of the risks of this very large scale undertaking to the island's unique natural resources and heritage.

We look forward to hearing from you on the weaknesses of the two reports above and the scheduling of the new public consultation.

Yours sincerely,
Diana McCaulay
Chief Executive Officer
Jamaica Environment Trust
11 Waterloo Road
Kingston 10
Jamaica

SWI Responses to JET Comments

1. JET suggests that the new data which the two reports rely on are current patterns measured in the inner and outer bays using drogues during a programme of measurement carried out on May 12th 2009.

Response

It should be noted that SWI deployed a current meter within the inner bay for a period of 15 days specifically in order to measure currents within the inner bay and also to capture the spring and neap tidal cycles. Prior to that, a current meter was also deployed in the outer bay for a period of 30 days, thereby providing good detail of the current characteristics within both inner and outer bays. In addition, drogue measurements were carried out in order to give an appreciation for the overall water mass movements (Lagrangian velocity fields). It is important to note that the drogue tracking data was not used to calibrate the model, as is implied by JET's reviewers. In summary, the drogues provided additional spatial interpretation of the model's representation of certain gyre effects which occur away from the current meter. The model was however, actually calibrated using the current meter measurements.

2. JET indicates that Figures 9 and 13 in the report highlight incompatibilities between the drogue tracks and the model predictions (e.g. when the drogues were released they should have headed south or in an easterly direction, instead they move nearly due west).

Response

The report should have clarified this comparison a bit more. In effect, Figure 9 (reproduced here as Figure 1) is showing the total movement of the drogues over an 8 hour period, while Figure 13 shows by contrast, a snapshot in time. Figure 13 shows clearly however that the model does represent well the gyre effect that occurs during the early afternoon and which moves from the inner to the outer bay. This means that what is occurring at the point of drogue deployment, which is in the early morning, would be different from the "snapshot" showing the afternoon gyre that occurred at a distance from the current meter.

In order to clarify things, the plots following show the current patterns at specific times during the drogue tracking period as predicted by the model with the drogue tracks for that specific time superimposed for comparison. The first of these plots, Figure 2, shows the model predictions at 9:45am with the observed drogue tracks superimposed. The correlation of the two data sets is quite good, however the model results do imply more spatially instantaneous information than is revealed by the drogue tracking. For example it can be seen that for this stage of the tide flow is generally inwards at the northern boundary of the harbour and outwards along the south boundary. This motion is seen to trigger a gyre near to the north boundary, which is what seems to have been picked up by the drogue.

In Figure 3, the model predictions are shown at 1:15pm and the drogues track information at that time is superimposed onto the current vector plot. In general, the predicted flow is similar to the earlier flow patterns , however in this case the drogue path is primarily along the southern boundary of the bay. For these, the correlation between these drogue tracks and the predicted vectors at this time are quite good. There was also information from a drogue at the entrance to the bay on the north side, which exhibited a return flow back into the bay. The direction taken by this drogue is not in exact agreement with the vectors predicted by the model, however both show the existence of a return flow into the bay.

For Figures 4and 5, the drogue paths were primarily along the south side of the inner bay and are seen to be in good agreement with the model predictions.

In summary, the following overall patterns can be seen:

- In the early stages of the falling tide, flow enters both bays along the central axis and exits the southern boundary of the bays. There is a small gyre set up on the northern boundary of the bay.
- Later on in the falling tide stage, the flow along the central axis splits, with the majority returning along the south boundary to exit the bay, but with a strong gyre being generated on the north boundary.

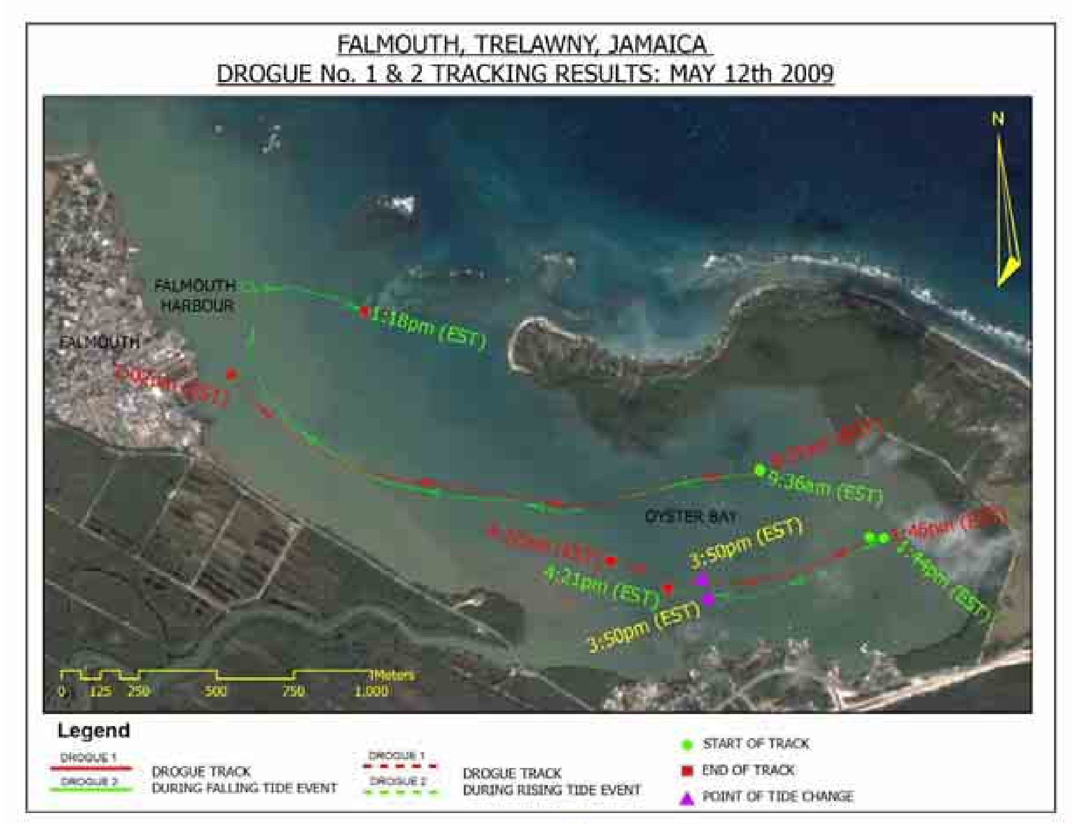

Figure 1

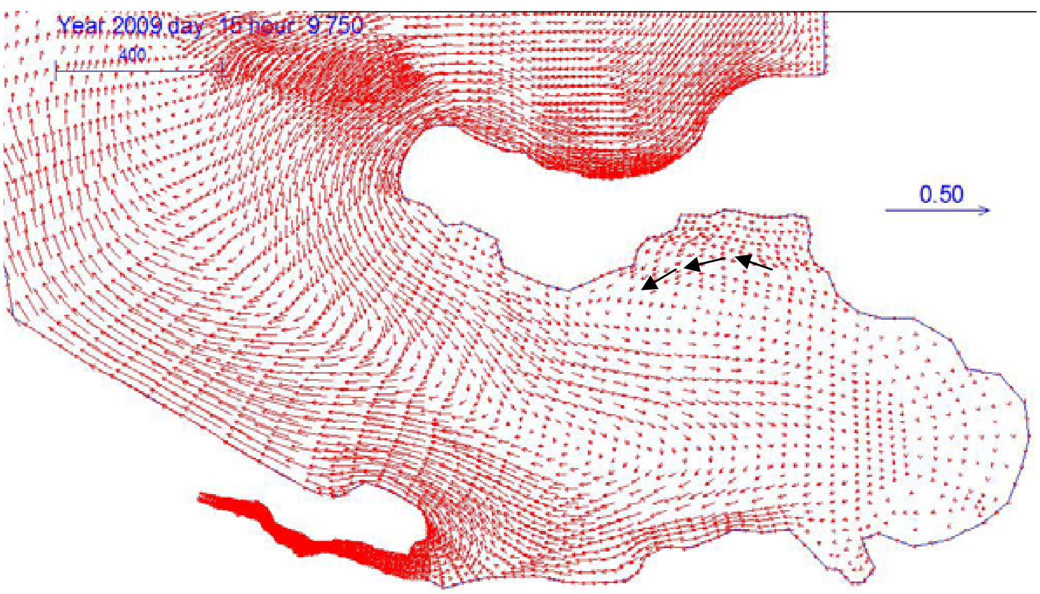

Figure 2 **Current tracks at 9:45 am.**

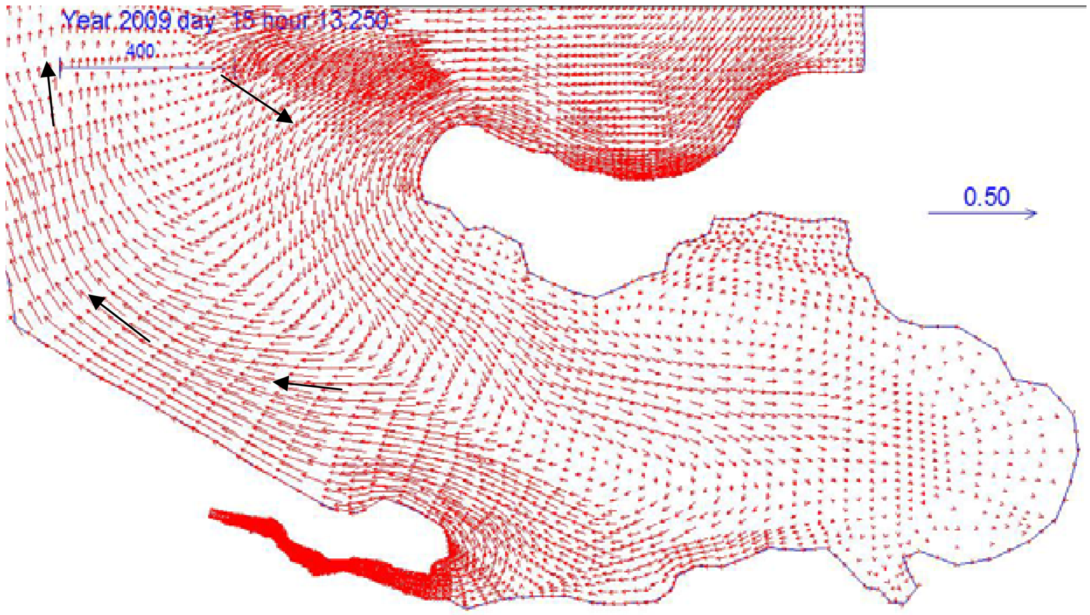

Figure 3 Current tracks at 1:15 pm

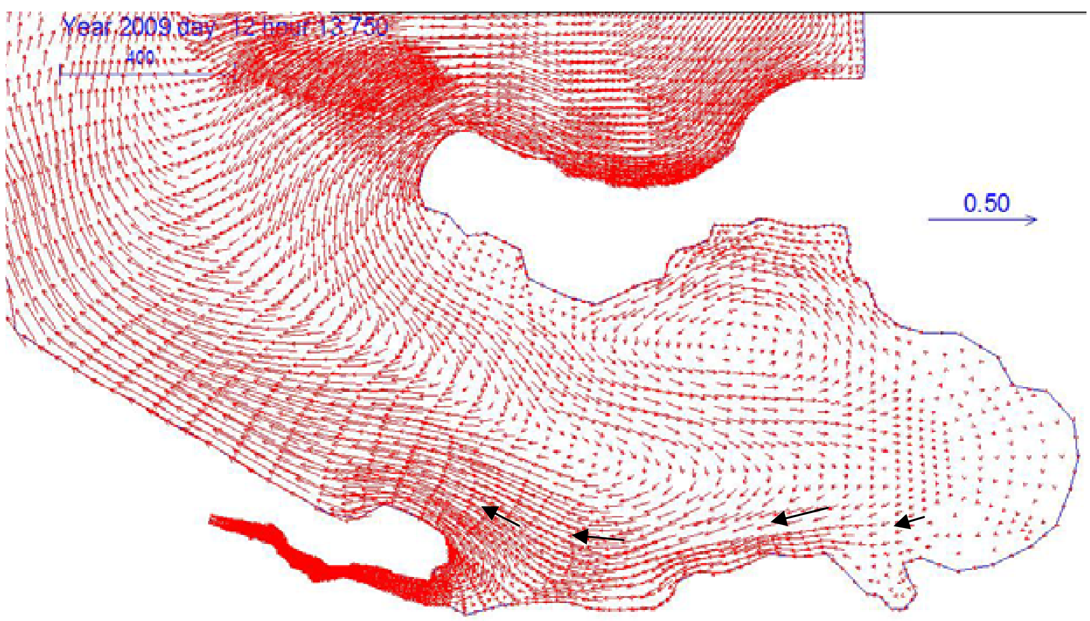

Figure 4 Current tracks at 1:45pm

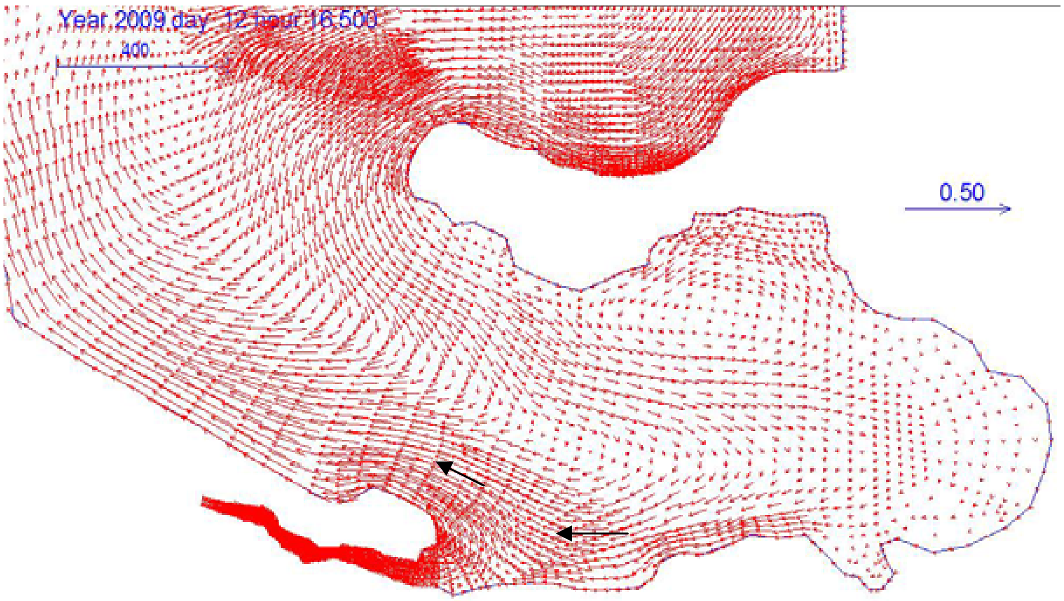

Figure 5 Current tracks at 4:30pm

3. JET states that the modelled and measured salinity values vary by up to 20% at the water surface as shown in Figure 14 in the report.

Response

The measured results shown in Figure 14 were collected in 2008, whereas the modelled results show a typical, but hypothetical scenario in which the river-bay system goes through a cycle of normal (low) flows, followed by flood flows, then a return to low flow conditions. The model scenario was intended to confirm that the numerical model is capable of simulating this type of variance in river flow conditions, including the expected stratification that could occur. In this context, the comparison of the two data sets, measured versus modelled, show generally good correlation, with similar levels of salinity being reached at a depth of 1 metre below the water surface. It is important to note that the salinity levels within the first metre of the water surface will be a function of the river flow conditions, which vary on a seasonal basis.