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May 1, 2013

Mr. David Lederer
Remedial Project Manager
Office of Site Remediation and Restoration
EPA Region 1, Suite 100, OSRR 7-04
5 Post Office Square
Boston, MA 02176

Re: Addition of Blasting to the Final Determination, New Bedford South Terminal Project (New Bedford Marine Commerce Terminal (NBMCT Project)

Dear Mr. Lederer,

This letter is submitted in order to describe in detail the Massachusetts Clean Energy Center's (MassCEC's) petitioning of EPA to include blasting within an amendment to the Final Determination issued for the New Bedford South Terminal Project. The Commonwealth had previously outlined within a letter to EPA, dated October 4, 2012, that it intended to utilize blasting as a rock removal means of "last resort" (letter included as **Attachment A)**. However, since the date of that letter, the Commonwealth has acquired additional information on the subject and conducted detailed acoustic modeling to determine the environmental impact of blasting on marine resources (the final acoustic modeling report is included as **Attachment B)**. Through the process of completing the acoustic modeling, MassCEC has learned that the overall environmental impact from blasting is much smaller than initially estimated and, as outlined below, MassCEC has also determined that the use of blasting prior to the removal of the overburden will significantly minimize impacts to natural resources.

As EPA is aware, MassCEC recently solicited a Contractor for a portion of the construction of the South Terminal Project. Engagement with this Contractor has revealed that blasting is more likely to be required as a rock removal methodology than the Commonwealth had previously anticipated in its October 4, 2012 letter. This new information has prompted MassCEC to re-evaluate both the approach to blasting and its overall environmental impact. In response to this input from the Contractor, MassCEC has re-evaluated all of the acoustic modeling data that has been accumulated in support of this project. Through this process, MassCEC has come to the unanticipated but important conclusion that the environmental impacts of a blast implemented as a "last resort", when the overburden sediments have been removed exposing bedrock, are greater than the environmental impacts of a blast conducted when the overburden is left in place. Therefore, based on this new information (and as further outlined within this document), MassCEC respectfully petitions EPA to allow blasting prior to the removal of the overburden, rather than requiring that blasting be utilized only as a "last resort."

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SDMS Doc ID 540371

Acoustic Modeling

As EPA is aware, the Commonwealth submitted a full Acoustic Modeling Report for its review on November 12, 2012. The full report is included as **Attachment B** to this document. The acoustic modeling was conducted by Jasco Applied Sciences of Nova Scotia, Canada, a respected consultant used by NMFS on similar projects. It was the Commonwealth's understanding in the fall of 2012 that blasting was anticipated to have a significant impact on the resource, and the modeling was intended to outline the impacts, such that engineering controls could be put in place, and/or further restrictions on the blasting could be designed and/or implemented. However, the results of the blasting indicated that the potential impacts were far less than the Commonwealth had originally anticipated. Below, please find as Insert 1 the Figures 20 and 21 from the Acoustic Modeling Report, which show the areal impacts of blasting utilizing bubble curtains:

Insert 1: Figures 20 and 21 from Acoustic Modeling Report – Peak Pressure (Left), Impulse Level Threshold (Right) – (Note Zoom in of Impact Area in Lower Right Corner)

Peak Pressure with Bubble Curtains:

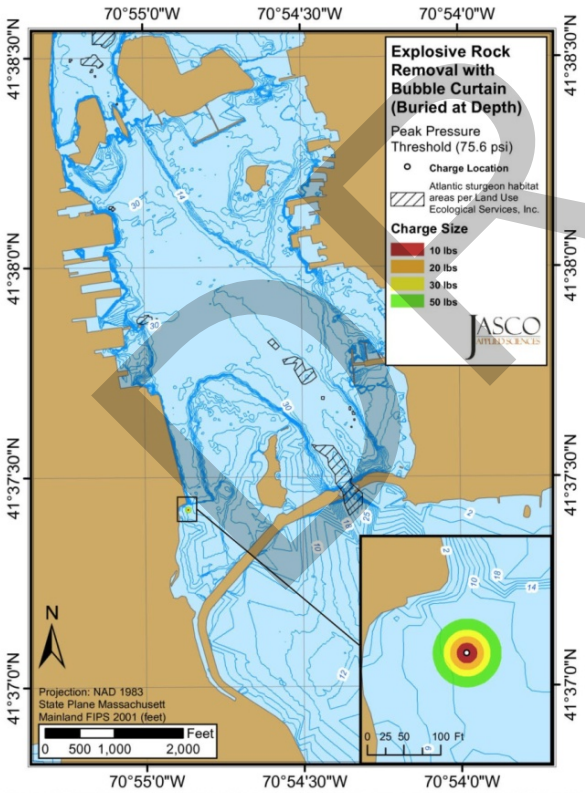

Figure 20. Explosive charge with bubble curtain at Site 2: Peak pressure threshold of 75.6 psi for explosive charges between 10 and 50 lbs. Blue contours indicate water depth in feet.

Impulse Level Threshold with Bubble Curtains:

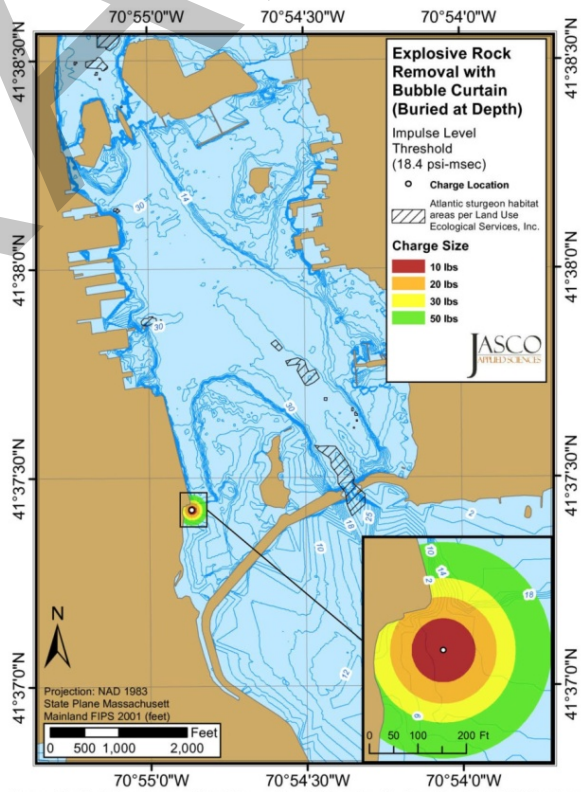

Figure 21. Explosive charge with bubble curtain at Site 2: Impulse level threshold of 18.4 psi·msec for explosive charges between 10 and 50 lbs. Blue contours indicate water depth in feet.

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Figures 20 and 21 form the Commonwealth's Acoustic Modeling Report (**Insert 1** – above) demonstrate the acoustical impacts from a charge size of up to 50 pounds of explosives that are buried under a layer of overburden and rock. [It should be noted that initially, MassCEC's modeling sub-consultant had utilized 100 pounds of explosive charge for their models until MassCEC had suggested that the modelers reduce the charge size to 50 pounds, as requested by the US Army Corps of Engineers in order to minimize impact to the New Bedford Hurricane Barrier]. The two figures show the area that exceeds the Peak Pressure of 75.6 psi (left) and the Impulse Level Threshold of 18.4 psi-msec (right), versus distance from the blast location at various charge sizes up to 50 pounds. As is evident from the drawing, Impulse Level Threshold is the blast characteristic that has a larger impact area than Peak Pressure blast characteristic, and is therefore the controlling characteristic.

Factors Impacting Blast Results

In order to better understand the overall impacts to resources from various blast condition scenarios, MassCEC re-analyzed all of the blasting model runs that were conducted by its acoustic modeling sub-consultant. Upon review, MassCEC found evidence that a blast with the overburden in place is less impactful than blasting as a "last resort" due to the following factors:

- The overburden material acts to absorb a significant portion of the blast energy; and
- Project sequencing would result in blasting at a more sensitive time of year (spring spawning season).

The mechanics of the two scenarios are outlined in more detail within **Insert 2** on the following page:

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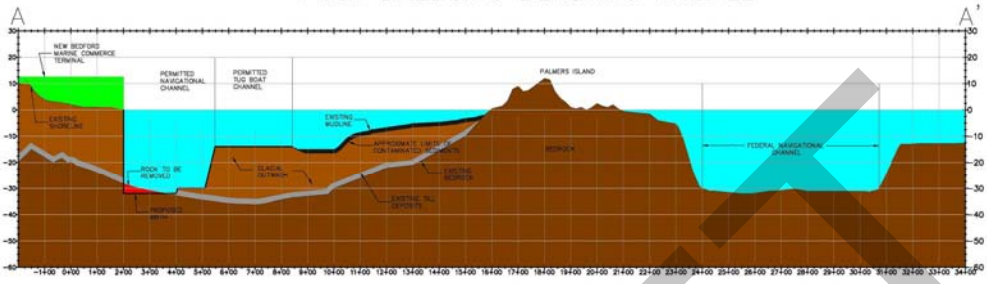
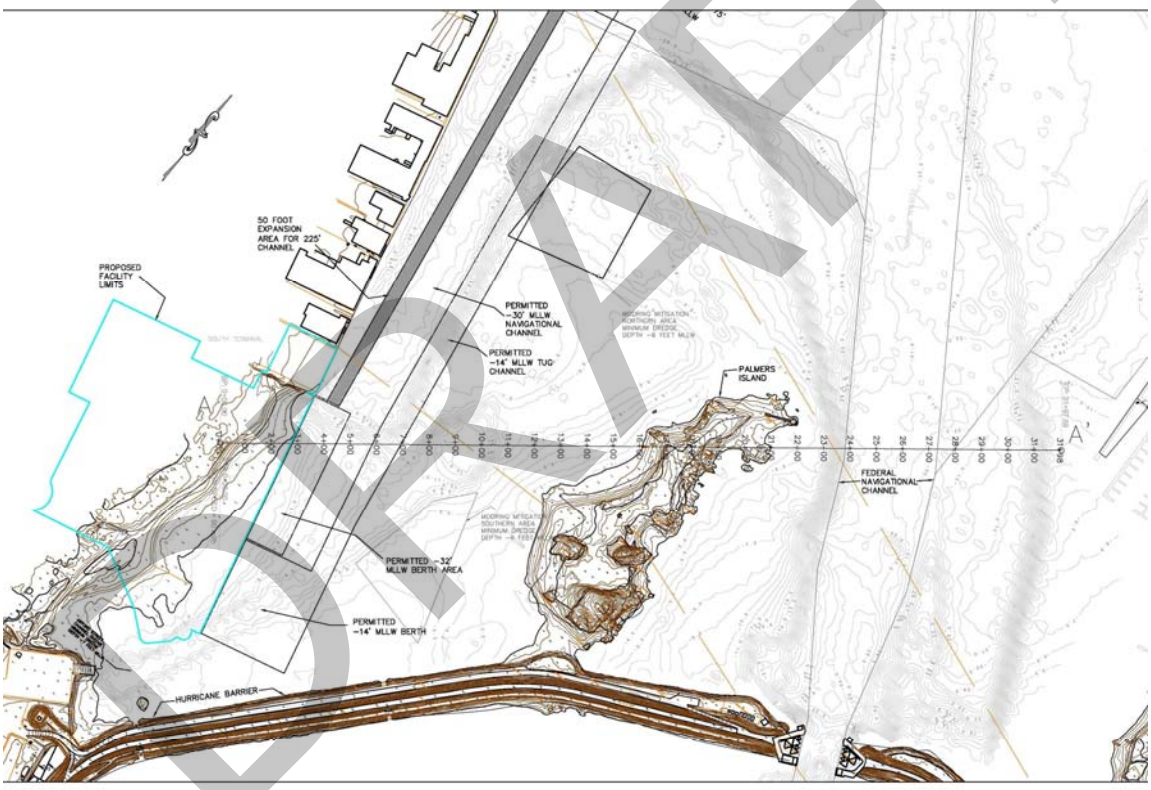
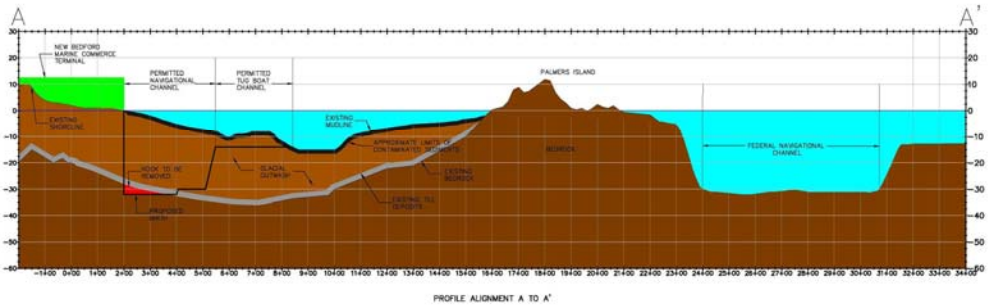
Insert 2: Mechanics of "In Water" (Post-Dredging) Blasting Scenario and Blasting Prior to Overburden Removal (Pre-Dredging) Scenario

POST DREDGING BLASTING PROFILE





PRE DREDGING BLASTING PROFILE



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Insert 2 shows the outline of the facility superimposed over existing bathymetry. A cross-section is outlined through one of the areas requiring blasting and the cross-section is shown for two scenarios: blasting prior to the removal of the majority of the overburden and blasting only as a "last resort", after removal of all of the overburden. *Importantly, please note that contaminated material would be dredged and disposed of into CAD Cell #3 prior to any blasting in either scenario and in no case would contaminated material be left in place during blasting.* Rock is noted on the cross-sections in red.

The "Post-Dredging Blasting Profile" (top of previous page) reflects a use of blasting as a "last resort". Under this scenario the overburden, which would otherwise absorb the energy of the blast, has been removed.

In the "Pre-Dredging Blasting Profile" (bottom of page), the overburden (absent the contaminated dredge material that has already been removed) is still in place. As a result, much of the blast energy is absorbed by the overburden and the resource impact is reduced.

Blasting with Overburden vs. Blasting without Overburden

In order to assess the condition where blasting would occur with the overburden removed, MassCEC re-analyzed the modeling data that represented the "In Water" blast condition, whereby a blast conducted at the bottom of the water column was modeled. In this scenario, the blast is assumed to take place on the bottom of the harbor after the overburden and mechanical rock removal has been attempted (top cross section in **Insert 2**). The two figures below in **Insert 3** show the area that exceeds the Impulse Level Threshold of 18.4 psi-msec at various charge sizes up to 50 pounds for both "Buried at Depth" ("With Overburden") and "In Water" ("No Overburden") scenarios, in order to compare the impact of the two side-by-side.

Comparison of these two figures in **Insert 3**, demonstrates that the overall acoustical impact of blasting with "No Overburden" (right) is noticeably larger than "With Overburden" in place (left). For Impulse Level Threshold, the radial distance between the detonation point and the outer rim of the impact for the 50 pound charge level with "No Overburden" is approximately 390 feet. The radial distance between the detonation point and the outer rim of the impact for the 50 pound charge level "With Overburden" is approximately 210 feet.

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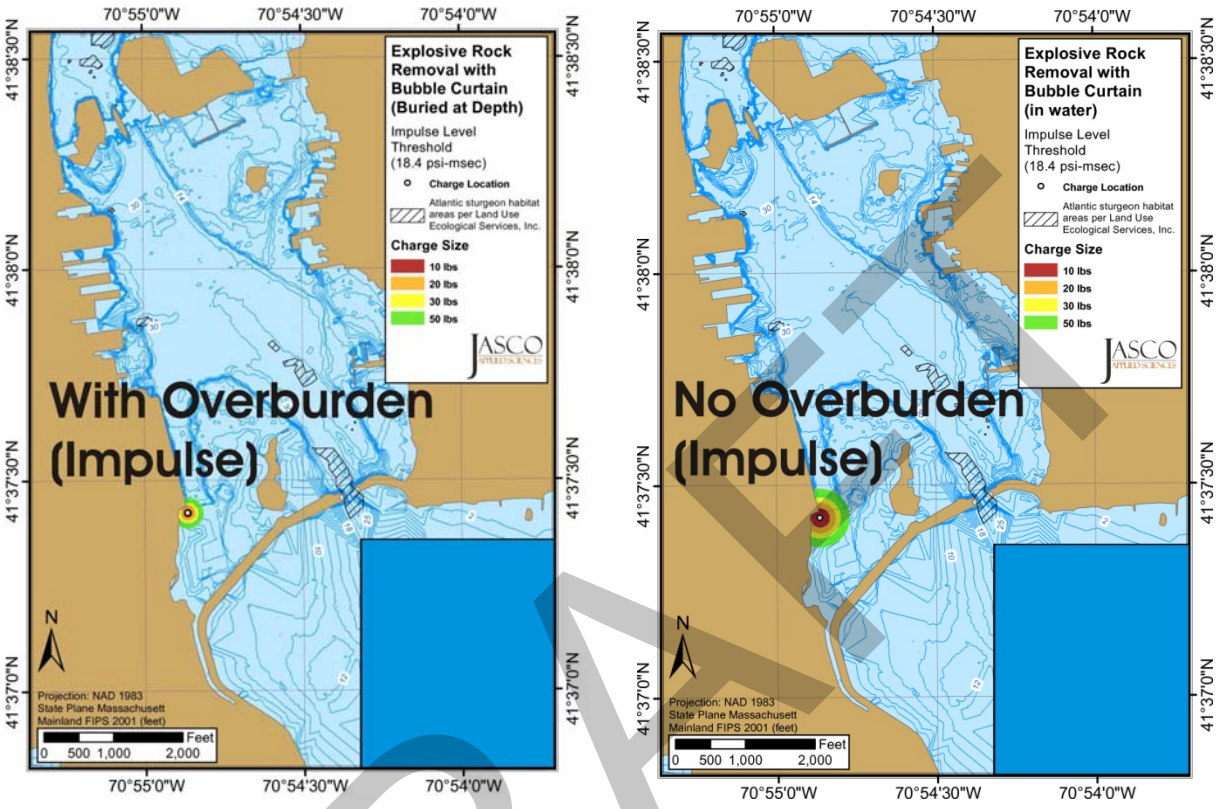
Insert 3: Comparison of "Buried at Depth" (Left) and "In Water" (Right) Modeling Results



As the model results shown above indicate, compared to the "Buried at Depth" ("With Overburden") modeling scenario (which would have a 100% environmental impact within a 210 foot radius), the "In Water" ("No Overburden") scenario has a 345% ($390^2/210^2$) areal impact by comparison. Please note that this larger acoustical impact would be compounded further by the noise and turbidity impacts of extended mechanical rock removal efforts that would be required in a "last resort" scenario before blasting is attempted.

Blasting Time of Year Issues

In addition, the implementation of blasting as a "last resort" also may force MassCEC to initiate blasting at a more unfavorable time of year than if blasting were to occur prior to the exposure of bedrock. As shown in the updated schedule obtained from the selected contractor, the earliest blasting as a "last resort" scenario could take place is January of 2014. We anticipate non-blasting rock removal efforts would take several months, with blasting as a "last resort" occurring throughout the spring season of 2014. However, pre-blasting with the overburden in place would occur in mid September 2013. Again, please note that the "Top of Dredge" layer will be completely removed prior to any blasting. Some of the "Intermediate Dredge Layer" may also be removed, leaving between 5-7 and 15-20 feet of overburden in place prior to blasting.

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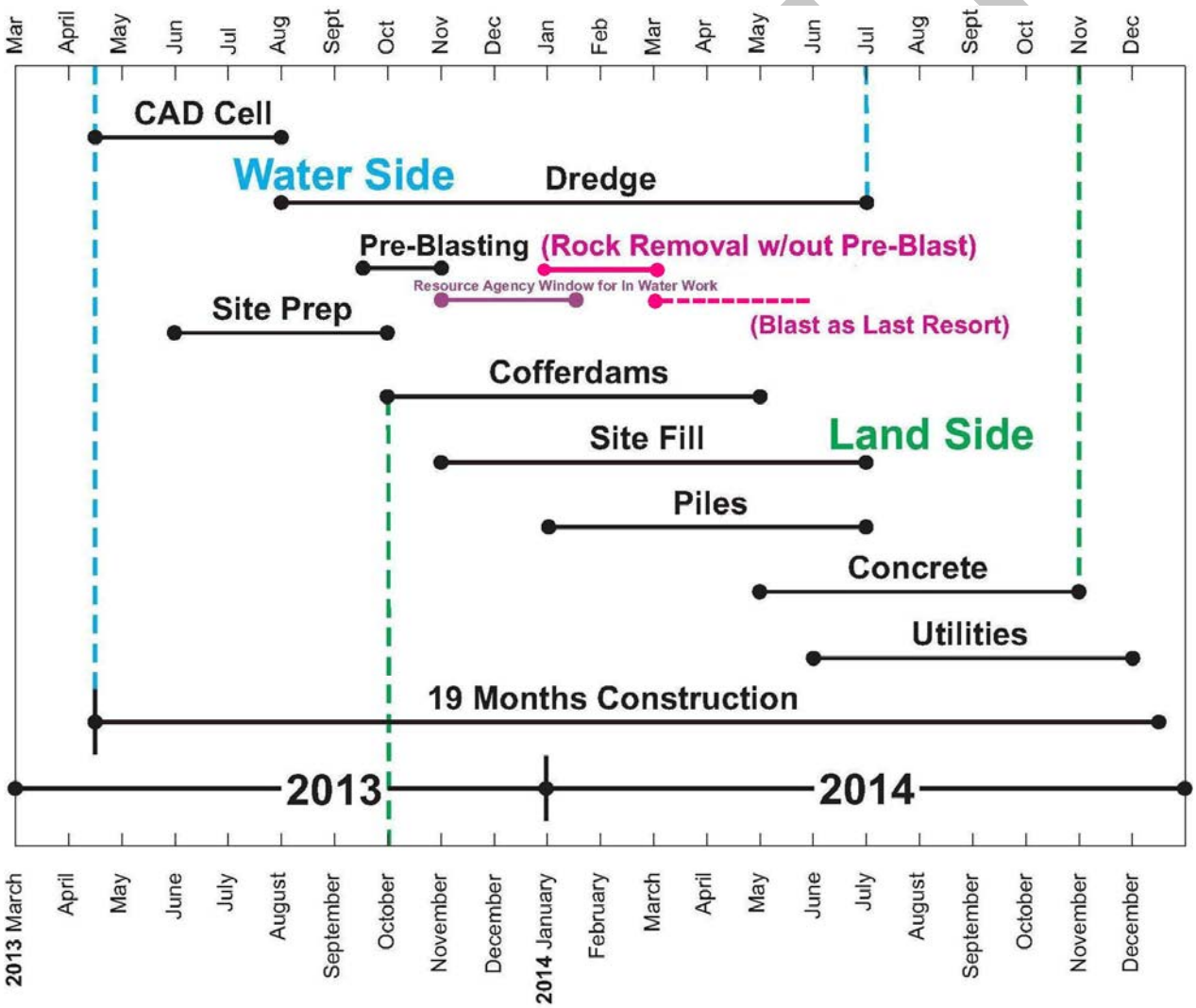
The following **Insert 4** outlines MassCEC's anticipated schedule, and shows how the two rock removal scenarios impact the schedule of various activities:

- "Pre-Blasting" represents blasting with the overburden in place;
- "Rock Removal w/out Pre-Blast" represents mechanical efforts to remove rock, and
- "Blast as Last Resort" represents a time period where blasting is initiated after mechanical rock removal has proven inadequate.

Insert 4: MassCEC's Anticipated Schedule



Thus, due to the timing of project construction, and the uncertainty with regard to the use of blasting as a "last resort", the "rock removal without pre-blast" would begin in the early winter, and blasting as a "last resort" would likely occur in early spring to the early summer, in the middle of the spawning season for many types of piscine resources. However, blasting prior to

the removal of overburden, or "pre-blasting", would likely occur in the late fall, within an approximately one month window beginning no sooner than September 15th and ending no later than January 15th. As a result, blasting prior to the removal of the overburden is a less impactful activity.

Please also note that due to the timing and sequencing requirements of the construction process, MassCEC has little flexibility to allow its contractor to delay implementation of the blasting in the "pre-blasting" scenario. The necessary sequencing of work requires that the CAD Cell be constructed and the contaminated surface layer in the blast zone be removed (and placed into the CAD Cell) prior to blasting. These activities will be completed by approximately the middle of September of 2013, at which time the pre-blasting could commence. The project cannot afford to have the Contractor wait until November to commence pre-blasting, as this delay in the sequencing would have the effect of delaying the start of the installation of the sheet pile wall by several months. The installation of the sheet pile wall is the most critical time element within the construction sequence, and a delay of several months would cause MassCEC to miss the end-of-construction deadline for the first user of the terminal.

Necessity and Likelihood of Blasting

Although MassCEC determined that blasting in a "last resort" scenario would be more impactful than blasting prior to the removal of the overburden, it was not clear to MassCEC whether the same quantity of blasting would be required in a "last resort" scenario vs. a scenario in which the overburden were left in place. Therefore, MassCEC researched the likelihood of the need for blasting in either scenario, as outlined below.

MassCEC met with Cashman-Weeks NB and discussed the likelihood of blasting in association with the South Terminal Project. Cashman-Weeks NB's experience is significant in this area. Cashman-Weeks NB indicated that it is very confident that blasting will be required based on the existing rock data and past experience with similar jobs. MassCEC asked Cashman-Weeks NB to provide evidence that blasting would be required (as the Commonwealth had previously believed that blasting may not be required as stipulated within its October 4, 2012 letter, and would likely be utilized only as a "last resort"), and the Contractor forwarded the following figure which outlines an "excavatability classification system" generated within following paper: "Franklin J.A,. Broch E, Walton G (1971). Logging the mechanical character of rock. Transactions of the Institute. Min. Metallurgy. 80: A1-9." (see **Attachment C** for the original paper). Please note that the following figure has (since first publication) been refined to include information quantifying values on the main axes in order to facilitate the use of laboratory data when utilizing the table.

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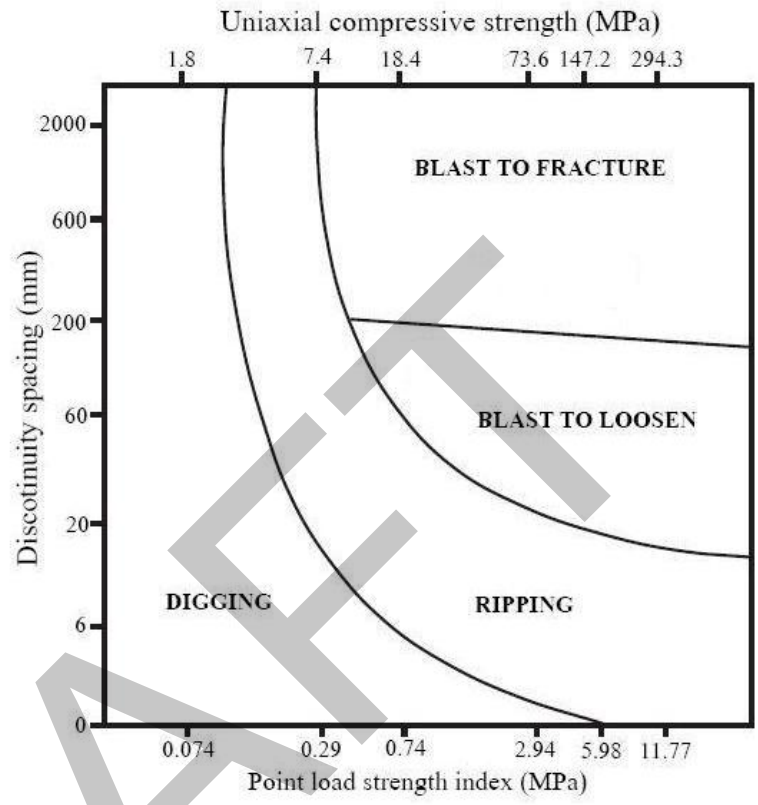
Insert 5: Excavatability Classification System From Franklin et a. (1971)



Assesment of rock masses with reference to excavatability classification system of Franklin et al. (1971).

The Franklin, et Al. system utilizes either the Uniaxial Compressive Strength or the Point Load Strength Index and the Discontinuity Spacing (i.e. spacing of fractures) to determine the likelihood of the need for blasting. In layman's terms, the need for blasting relates directly to how hard the rock is, and how highly fractured the rock. The data collected to date regarding the compressive strength of rock at the site is attached as **Attachment D** and is shown below:

Table 1: Summary of Rock Core Strength Testing

Rock Core	Compressive Strength (psi)	Compressive Strength (MPa)	Point Load Strength (psi)	Point Load Strength (MPa)
A-2010-B2/C1	N/A	N/A	403	2.8
A-2010-B3/C1	15,510	106.9	N/A	N/A
A-2010-B4/C2	12,926	87.1	N/A	N/A
A-2010-B9/C1	14,656	101.1	N/A	N/A
A-2010-B9A/C1	15,159	104.5	N/A	N/A
A-2011-B11/C1	7,575	52.2	N/A	N/A
A-2011-B18/C1	N/A	N/A	1025	7.1
A-2011-B19/C1	15,429	106.4	N/A	N/A
A-2011-B31/C2	36,367	250.7	N/A	N/A
A-2011-B32/C1	11,542	79.6	N/A	N/A

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Based on the schematic shown in **Insert 5**, rock with compressive strengths greater than approximately 73.6 MPa, and/or Point Load Strength greater than 2.94 MPa will require blasting either to loosen the rock to allow mechanical removal and/or to fracture the rock to allow subsequent mechanical removal if the "Discontinuity Spacing" or fracture spacing is greater than 20 mm. Please note that 20 mm is less than one inch in length. Photographs of the rock cores are included in **Attachment E** to this document, which indicate that most of the fracture spacing within the cores collected from areas where rock blasting may be required indicate greater than 1-inch spacing for the majority of the cores. As a result, Cashman-Weeks NB has concluded that the rock removal required for this project will ultimately require blasting over a fairly large percentage of the in-situ rock removal area.

It is also Cashman-Weeks NB's experience that it is unlikely (as the Commonwealth had previously presumed within its October 4, 2012 letter) that some of the rock may be removed mechanically, leaving only a little to be blasted. Cashman-Weeks NB instead believes, based on their analysis of the rock composition, that, since rock quality and type does not vary significantly over the footprint of the work, rock will either be able to be removed mechanically or not (i.e. difficult to remove rock will not suddenly become easy to remove in some locations). Additionally, partial removal of rock will not eliminate the need for blasting (for example, if four feet of rock must be removed, and three feet of rock can be removed mechanically, blasting will still be required for the remaining foot of rock).

As a result, the following estimate has been produced (based on the total area estimated to require blasting) as to the percent likelihood that the blasting will be required as follows:

Table 2: Likelihood of Blasting Based on Percent of Total Area Requiring Blasting

Percent of Total Area Estimated to Require Blasting	Estimated Chance that Blasting Will Be Required
50%	90%
18.8%	80%
21.2%	50%

Relative Environmental Impact

Although the modeling conducted by MassCEC reveals that the environmental impacts of a blast implemented as a "last resort" appear to be greater than the environmental impacts of a blast conducted prior to removal of overburden and the exposure of bedrock, and the information generated by Cashman-Weeks NB has indicated that blasting is far more likely than previously estimated, MassCEC required a quantitative measure to be able to determine the least environmentally impactful scenario.

In order to provide a method to quantify the relative environmental impacts, MassCEC proposes the following analysis:

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- MassCEC proposes a "Total Relative Environmental Impact" variable that represents the comparable impact of two different scenarios. The variable consists of the percent of area to be blasted times the chance that blasting will be necessary, times a relative environmental impact factor, as follows:

Percent of Area Requiring Blasting	**X**	**Chance of Blasting**	**X**	**Relative Environmental Impact**	**=**	**Total Relative Environmental Impact**

Where:

Percent of Area Requiring Blasting is the portion of the total area that may require blasting calculated by subtracting the known rock elevation and the target dredge elevation.

Chance of Blasting is the estimate based on the rock type, quality, and thickness that blasting will be required.

Relative Environmental Impact Factor is a factor that gauges the proportional increase or decrease per area blasted in the probable environmental impact associated with blasting based on the measured distance of the impact Impulse Threshold Level, compared to a blasting scenario that leaves the overburden in place.

Total Relative Environmental Impact is the relative environmental impact as compared to a blasting scenario that leaves the overburden in place.

These Total Relative Environmental Impact values has been calculated based on the following methodology:

- The Percent of Area Requiring Blasting and the Chance of Blasting were gathered based on advice and recommendations outlined by Cashman-Weeks NB, and as shown within **Table 2**.

- The Relative Environmental Impact Factor is based on the relative difference in impact associated with acoustical impacts (as quantified by the Impulse Threshold Level) between a scenario in which the overburden is left in place prior to blasting and a scenario in which bedrock is exposed and blasting is utilized as a "last resort". The values utilized for this factor are 1.00 (representing 100% environmental impact) for when the overburden is left in place and 3.45 (representing 345% areal environmental impact) when bedrock is exposed and blasting is utilized as a "last resort".

- The Total Relative Environmental Impact is the sum of the Subtotal of Relative Environmental Impacts for the different areas of blasting under consideration. The

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higher number represents a larger relative environmental impact, and is calculated as shown in **Table 3** as follows:

Table 3: Estimate of Relative Environmental Impact In Pre-Blast vs. Blast as "Last Resort" Scenarios

Scenario	Blast Prior to Exposure of Bedrock	Blast as "Last Resort"		
Percent of Area Requiring Blasting	100%	50%	18.8%	21.2%
Chance of Blasting	100%	90%	80%	50%
Relative Environmental Impact Factor	1.00	3.45	3.45	3.45
Subtotal of Relative Environmental Impact	1.00	1.55	0.52	0.37
Total Relative Environmental Impact (sum of all subtotal items)	1.00	2.44		

The result of MassCEC's analysis is that blasting as a "Last Resort" is 144% more impactful than blasting prior to the exposure of bedrock.

Again, please note that this larger impact would be compounded by the noise and turbidity impacts of mechanical rock removal efforts (not included in the Total Relative Environmental Impact calculation) that will be required in a "last resort" scenario before blasting is even attempted. Although the noise and turbidity impacts of mechanical rock removal have previously been determined to be acceptable by EPA, if blasting is likely in either scenario, mechanical rock removal creates additional cumulative noise.

Based on this analysis and the information presented previously, we conclude that, even when considering the potential that blasting may not be required in some areas, blasting prior to the removal of the overburden will be the least impactful alternative.

Therefore, MassCEC petitions that EPA allow the use of blasting prior to the removal of the overburden in order to minimize impacts to natural resources.

Blasting Protections To Be Put In Place

MassCEC understands that the EPA is concerned with the potential impact to fish communities due to blasting, primarily as a result of issues that were generated during blasting that was overseen by the USACE during 2007. MassCEC has reviewed a paper forwarded by EPA entitled "AFTER ACTION REPORT ON THE FISH KILLS RESULTING FROM BLASTING IN SUPPORT OF ROCK REMOVAL FROM THE FEDERAL NAVIGATION PROJECT -BOSTON HARBOR, MASSACHUSETTS- (FALL 2007), by the USACE, dated June 2008" (included as **Attachment F**).

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MassCEC is aware that communication problems between the fish observers and the contractors appear to have been a large source of the issues that resulted in large quantities of fish being killed within New Bedford Harbor during this project. MassCEC has discussed this issue with Cashman-Weeks NB, and the Contractor has prepared the following operation and communication plan (see **Attachment G**) that is intended to minimize the chance that such a miscommunication will take place in association with the South Terminal Project.

Prior to blasting, MassCEC proposes to isolate the blast areas in a similar method as has previously been successful in association with the Fish Deterrent System. It is MassCEC's understanding that flatfish will not be as high a concern as during the conventional implementation of the Fish Deterrent System; therefore fish weirs will not be installed as part of this effort. Silt curtains will be installed to prevent fish from entering the potential blast areas. The acoustic modeling conducted to date clearly indicates the areas that have the greatest likelihood of being affected by the blasting (i.e. the radius as noted previously around each blast site), and therefore will also be the areas within which fish exclusion efforts will be focused. Prior to the initiation of blasting, a fish inspection (similar to those associated with the Fish Deterrent System) will be undertaken to determine if fish are present in the blast area. MassCEC will perform the fish inspection in compliance with Fish Deterrent System protocols. If necessary, "fish scaring" or "fish startling" will be used to clear the area of fish. The historic effectiveness of this methodology indicates that multiple "fish startling/scaring" efforts will not be necessary. Subsequent to the clearing of the area, drilling and preparation of the area for blasting will begin.

Due to the human and public safety risk involved with placing explosives, the Contractor is constrained by a time limit with regard to how long the holes may stay open with explosives in place, prior to blasting. In order to make the most efficient use of this time, the Contractor proposes to work diligently to drill and install explosives in the shortest time possible, in order to leave sufficient time once the blast is prepared to monitoring for the presence of schools of fish. In addition, the Contractor has outlined its communication plans associated with the work to demonstrate how clear lines of communication will be maintained. The details of the Contractor's plan are included within **Attachment G**.

As outlined within MassCEC's specification section 02900 – BLASTING, a dedicated marine observer will be on hand to ensure that a concerted effort is being undertaken to inspect for the presence of schools of fish. This extra time will also allow for "fish scaring" should fish be observed prior to the actuation of any blasting. However, please note that worker safety will take precedence over inspection and scaring operations if necessary in the blasting area.

MassCEC believes that these measures will ensure that the impacts observed in Boston Harbor are not repeated on the South Terminal Project.

Please note that Cashman-Weeks NB has informed MassCEC that they will need to know which method will be utilized by June 1, 2013 in order to be able to prepare for the logistical, administrative and permitting aspects of a blasting program, if approved.

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MassCEC sincerely appreciates your consideration of this very important matter. If you have any questions related to this proposed modification to the Final Determination, please do not hesitate to contact me at 617-315-9330.

Sincerely,

Bill White

Bill White
Director, Offshore Wind Sector Development

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