department of
Conservation and Recreation

dcr

October 31, 2005

Senator Michael W. Morrissey
State House
Room 413-D
Boston, MA 02133

RE: Project No. 3532-S Study of the Beach Erosion along Merrymount Beach & Black's Creek - Quincy

Dear Senator Morrissey:

Enclosed please find a copy of the final report entitled "Beach Erosion Assessment and Remediation Recommendations for Merrymount Beach, Quincy, Massachusetts" Quincy, MA" dated October 2005; which was developed by Earth Tech for the Office of Waterways. The draft report was presented to the public during a meeting held in Quincy September 22 2005; comments from that meeting have been incorporated into the final document.

The report identified several issues that would need attention including dredging of the effluent of Black's Creek, rehabilitation of the two (2) jetties at Black's Creek, nourishing of the beach including a small protective dune and maintenance plans. The estimated cost of the project is $1,000,000.00.

The biggest issue with the report is if public funds are used to improve Merrymount beach Public Access Easement would have to be granted by the Merrymount Beach Association. This easement does not take away the property rights of the owners, it allows the public to transverse the improved area for the purposes of fishing, fowling, navigation and pedestrian traffic. The only stipulation is that all signs inferring to private properties and no access must be removed. Beach association members could not speak for the entire association and were to go back to the association and discuss further.

All work proposed in the report can be accomplished without the improvements to Merrymount Beach, this would mean that the beach area would stay in its current

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condition with normal erosion or the beach association can perform the improvements to the beach without public funding, the cost of the improvements would be approximately $250,000.00.

At this time, the report's submission concludes the current project. No further work will be performed without additional funding. Once funding has been established, the next step will be preliminary design and permitting. If you have any questions or concerns please contact the project manager, Mr. Kevin P. Mooney, who can be reached at (781) 740-1600 x 103.

Sincerely,

Michael D. Misslin
Deputy Chief Engineer
Planning & Engineering Division

MDM/KPM/kpm

Enclosures

CC: Representative Steve A. Tobin
Distribution list (attached)
Bethany Steiner Boer

4 RECOMMENDATIONS

Upon analyzing the site characteristics, four options were developed and assessed: (1) No-Build, (2) Dredging, (3) Beach Nourishment, (4) Dredging and Beach Nourishment, and (5) Jetty Reconstruction. Each option is discussed below in detail. In addition to these options, (1) maintaining regular flushing through the tide gates and (2) a scour analysis of the culvert vicinity is recommended.

The shoreline has been eroding significantly and no sign of equilibrium state is present. If a "No-Build" option is selected, monitoring of the beach is needed. Monitoring is especially important for the erosion that has taken place near the culvert structure, which is causing undermining of the southern revetment. In No-Build case, monitoring during and after each storm event is crucial. In case of critical scour at the culvert, the road should be closed and the area around the culvert should be secured. Erosion may also cause further loss of beach and adjacent park property. If the No-Build option is selected a detailed risk-based analysis is recommended. Such an analysis is described in USACE Coastal Engineering Manual.

Dredging is an option to attempt to redirect the jet coming out of the culvert by providing a more direct route of flow; however, it was noted that dredging was performed in the early 1970s and does not appear to be a sustainable solution over the long term. The dredging option has the potential to reduce erosion along the beach caused by the high velocity flow coming through the culvert; however, it will not decrease the risk of erosion that might be caused by waves as derived from FEMA study. This suggests that a similar type of beach monitoring program as described above will be needed. Furthermore, the historical aerial photographs from 1974 to 1984 suggest that dredging would not be a permanent solution and that a more long term program of beach maintenance will be required to ensure the long term success of the dredging option. If dredging is selected, a risk-based analysis is recommended, since, periodic maintenance dredging will most likely be needed.

Beach nourishment is another alternative. By replenishing the beach with compatible sediment, the level of protection against waves can be increased. Beach nourishment will also reduce the loss of property around the beach. Nourishment will be more cost-effective if it is done in conjunction with dredging, since the dredged material could potentially be used as material for the nourishment, assuming compatibility in grain size between the beach and the dredged sediment. However, as shown from the 1974-1979 pair of photographs, a significant amount of beach sediment was lost during a short period of time, and by 1984 a new channel hugging the shoreline had developed instead of the straight channel aligned with the culvert. Beach

nourishment or the combination of dredging/nourishment will be needed periodically. As with the dredging option previously discussed, a long term program of beach maintenance will likely also be required to ensure success of the beach nourishment alternative.

The only option that has proven in time to present stable conditions is a jetty on the southern side of the culvert that would simulate similar effects of the jetty that existed just before the alterations prior to 1974. A jetty south of the culvert will not only guide the jet coming out of the culvert towards the bay without carving into the beach, but also it will trap sediment just like the jetty located on the northern side of the culvert. The effectiveness of this solution was proven with time prior to 1971-1974 alterations. Moreover, the hypothesized solution of the site inspection also dovetails with this option. Reconstruction of the southern jetty will not bring back the exact same conditions prior to 1974. However, it has the greatest potential among the alternatives discussed above to provide stability without requiring frequent significant maintenance. Also, when combined with dredging and beach nourishment (including the reconstruction of the eastern groin on Merrymount Beach as well as a long term annual beach maintenance program) this option could restore the pre-1970's stable beach profiles.

4.1 Environmental Permitting Considerations

Environmental permitting considerations vary for the four options previously discussed in this report. This section outlines the various environmental permitting issues in general and as associated with each of the four options.

4.1.1 No-Build

The No-Build option will not require environmental permitting to implement. There is no activity that would trigger permitting thresholds under any state or federal environmental permitting program.

4.1.2 Build Options

As a coastal project, there are numerous state and federal environmental permitting programs that apply to the three Build options. These programs are briefly described below, along with relevant permit activity thresholds associated with the regulations.

It is assumed that any construction activity would be undertaken by the Commonwealth and, therefore, no local permitting requirements would apply to the project.

Federal Environmental Programs

Final Report

Beach Erosion Assessment and Remediation Recommendations for Merrymount Beach

Quincy, Massachusetts

Project No. 3532-S

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October 2005

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1 INTRODUCTION

1.1 Background

Merrymount Beach and its associated park, located south of Wollaston Beach near the mouth of Blacks Creek (Figure 1), are privately owned by the Merrymount Beach Association. Over time, this beach has been subjected to erosion, and the jetty located at the eastern end of the beach has been degrading. The park area is grass covered and is separated from the sand by a small mound. The beach and the small mound areas are showing signs of erosion.

The purpose of this study is to develop options to reverse, restore and/or protect the remaining beach and park areas. Because beaches situated near the mouth of a tidal creek, by nature are very active systems, it is possible to have near equilibrium conditions (i.e. stable), where the rate of erosion/deposition is so low that "No-Build" is the most cost-effective option. Therefore, the No-Build option was compared to the options involving building, while considering Build options may require permitting from government agencies.

1.2 Scope of Services

Earth Tech was retained by Department of Conservation and Recreation (DCR) Office of Waterways under DCR Project No. 3532-S to develop a preliminary beach erosion study and remediation recommendations for the Merrymount Beach.

As part of Task 1, available data sources for information regarding the project and adjacent areas, which generated data for use in the project area, were researched. This research utilized both public and private agencies, and the Internet data areas. A site inspection, performed on May 05, 2005, included a description of the general condition of the project area and the jetty. All readily available information including surveys, studies or reports of this area were obtained and reviewed.

As part of Task 2, this report provides indications of (1) why the area is eroding, (2) options for repairs or remediation, and (3) permitting requirements.

In addition to the original scope, a hydrographic and water surface elevation (WSE) monitoring surveys were conducted. The hydrographic surveys of the beach vicinity was conducted by Bourne Consulting Engineering June 16 and17, 2005. The WSE sensor was installed in the enclosed bay area near the concrete dock located in Merrymount Park on May 18, 2005 and was recovered on June 2, 2005 by Earth Tech.

All work was performed in accordance with the Office of Waterways' Master Service Agreement for Design and Engineering Services and the December 2002 Office of Waterways' "Guidelines for Consultants".

2 METHODOLOGY

In order to provide an assessment of the current conditions a site characterization was needed which then can be used to develop options to repair or remediate. The methodology of completing the site characterization consisted of four steps: (1) Preliminary Research and Review, (2) Site Inspection, (3) Survey, and (4) Historical Aerial Photograph Analysis. The following sections describe the methodology used to perform each step.

2.1 Preliminary Research and Review

As stated in the DCR's February 17, 2005 request for proposal letter, very limited information is available for the project site. Therefore, sources including United States Geological Survey (USGS), National Oceanic Atmospheric Administration (NOAA), Federal Emergency Management Agency (FEMA), United States Army Corps of Engineers (USACE) and local universities were utilized to review possible existing hydrologic, hydraulic and morphologic studies/data. Records of any significant man-made alterations (i.e., dredging, construction of jetties/groins/breakwaters, etc.) with potential to change the hydraulics and the rate of sediment transport in the area were also considered. All information used as part of the sources for this study is summarized in Table 1.

Obtaining available historical aerial photographs was the key aspect of this study in order to gain an understanding on the progression of sediment with time and the causes of the transport. Hence, analysis of historical aerial photographs is discussed in further detail in a separate section.

2.2 Site Inspection

A site inspection was conducted on May 5, 2005 by an ocean scientist and a hydraulic engineer. The site inspection was conducted during a spring low tide in order to observe the maximum amount of inter-tidal areas. The site inspection included visual inspection of Merrymount Beach, the groin located at the eastern end of the beach, the jetty located in the north, and the Black's Creek culvert including the abutments. The following is the list of the observations from the survey:

- A high-velocity exiting jet was observed at the culvert during low tide (Appendix 3 – Photo 1).
- Sediment has deposited and formed a spit over the northern jetty, resulting in failure of the jetty (Appendix 3 – Photo 6).
- The beach and spit are comprised primarily of coarse sand (Appendix 3 – Photo 7).

- The spit located in front of the culvert is redirecting the outflow towards the beach, and the redirected jet moves along the beach before making a final turn and moving into Quincy Bay (Appendix 3 – Photo 5).
- The tide gate at the southern barrel of the culvert under the Quincy Shore Drive was lowered and dangling metal cables were observed (Appendix 3 – Photo 3).
- The southeastern revetment of the culvert is being undermined (Appendix 3 – Figure 4, and Photo 4).
- The groin located at the eastern end of the beach is in poor repair and there are large voids between rocks (Appendix 3 – Photo 8).

From the site inspection it was hypothesized that a groin on the western end of the beach would be beneficial. However, at that time, no data was available to assess the potential long-term impacts of such a groin.

2.3 Survey

A topographic and a hydrographic survey of the beach vicinity were conducted by Bourne Consulting Engineering on April 20-21, 2005 and June 16-17, 2005, respectively. The undermining of the southeastern revetment of the Quincy Shore Drive culvert was identified during the topographic survey, and scour holes in either side of the culvert were observed during the hydrographic survey. While the approximately 150-feet-wide 18-feet-deep scour hole on the west side of the culvert was surveyed without a problem, the hydrographic survey crew had difficulty with gathering data around the observed scour hole on the east side due to the currents. Full size prints of the topographic and hydrographic surveys are included in Appendix 4.

In order to characterize the hydraulics of the culvert under Quincy Shore Drive, the relation of the water levels on either side of the culvert needed to be determined. To establish the water level characteristics of the bay side of the culvert, a pressure sensor was installed in the enclosed bay area by Earth Tech survey-crew. The sensor was installed near the concrete dock located in Merrymount Park, and WSE in 6-minute intervals were recorded beginning on May 18, 2005. The sensor was recovered on June 2, 2005. The photographs from the sensor installation are shown in Appendix 5.

The WSE on the ocean side of the culvert was approximated from the nearest NOAA tide station (NOAA Boston Harbor Station #8443970). The relation of the WSE on either side is regulated by

the culvert, and further complicated by the manual operation of the tide gates. Figure 2 shows the WSE of the bay and ocean side of the culvert in time.

Using the WSE records and the culvert geometry, the flow through the culvert was approximated. Figure 3 shows the flow rate and the velocity fluctuations through the culvert derived from the WSE fluctuations shown in Figure 2.

The operation of tide gates was captured during the WSE survey. During the Nor'easter that coincided with the survey period, the gates were appeared to be lowered for 9 days (May 23 – June 1), and the flushing through the culvert was reduced to the flow exiting the gates around or on the outgoing tides. The operation of tide gates during this period was also verified by the tide gate operator [Source: City of Quincy tide gate operator]. Tide gates are generally lowered during incoming (flood) tides to prevent tidal waters from moving up into Blacks Creek. They are raised (opened) during outgoing (ebb) tides to allow water from Blacks Creek to flow through the culvert and into Quincy Bay.

2.4 Historical Aerial Photograph Analysis

A list of researched aerial photographs is shown in Table 2. A more extensive list of contacted aerial photography resources is shown in Table 1. From this list, the historical photographs of adequate quality for this analysis were chosen. Photograph quality was determined from a combination of several factors including the resolution/scale of the photograph, tidal stage at the time it was taken, and the date of the photograph. Ideally, the aerial photograph would be of large-scale (i.e. focused on the Merrymount Beach), and taken on a clear day at a low-tide with good lighting for maximum bottom-sediment visibility. Selected aerial photographs were spatially registered in Massachusetts State Plane Coordinate System using AutoCAD Map® for a trued comparison (Appendix 2).

3 SITE CHARACTERIZATION

Merrymount Beach, located in Quincy Bay, is connected to Atlantic Ocean through Boston Harbor. With Quincy Shore Drive to the west and Wollaston Beach to the north, Merrymount beach is a curved-shape, approximately 1,000 foot-long shoreline. The location of the project area is shown in Figure 1.

The site characteristics are grouped under four major sections: (1) Hydrodynamic Processes, (2) Manmade Alterations, (3) Historical Aerial Photograph Analysis Results, and (4) Shoreline Change Trends. The following sections describe each group of characteristics in detail.

3.1 Hydrodynamic Processes

The hydrodynamics in the area are influenced by (1) the tidal waters of the Quincy Bay and (2) the flows from the Quincy Shore Drive culvert. The mean tidal range in the area is 9.4 foot and increases above 10.2 foot during spring tides. The major meteorological events causing sediment transport in the area are Nor'easters. FEMA flood insurance rate map (City of Quincy, Massachusetts – Norfolk County – Panel 4 of 20) shows that the beach lies in the 100-year coastal flood with velocity (wave action) zone. The base flood (100-year flood) elevation at the beach is indicated as 15 foot (NGVD 29), which is below the elevation of Quincy Shore Drive in the vicinity of the culvert.

As for the flows from the culvert, the drainage area of the Blacks Creek impacts the hydraulics of the culvert due to precipitation runoff. While the impact of freshwater discharge of Blacks Creek varies due to the seasonal changes of the rainfall, compared to the tidal flow shown in Figure 3 freshwater discharge is a minor effect.

Rainfall of greater than 3 inches per 12 hours and/or tides in excess of 10.5 foot NGVD 29 (approximately mean higher high water) triggers the lowering of the tidal gates. Stop logs are used to artificially raise the water elevation in Blacks Creek during the summer months for sailing activities in the creek and the tide gates are opened on the outgoing tides.

The manually operated tide-gates control the flow dynamics of the culvert, therefore, their operation impacts the hydrodynamics at the site. Cables controlling the gates appear to need repairs and this also affects gate operation consistency. The variability of the gate opening translates into variability of the flow through the culvert and also the tidal flushing.

During the WSE survey, the tide gates were lowered for 9 days (May 23 – June 1) or about 17 tidal cycles, a period which encompassed a Nor'easter. Having the tide gates lowered during a

tidal cycle disrupts the ability of the system to flush sediment that gets carried by hydrodynamic forces (i.e. waves and currents). These hydrodynamic forces are especially elevated during large tidal fluctuations and significant atmospheric events (e.g. Nor'easters). During these events sediment carried by hydrodynamic forces tend to settle in areas with low movement. A protected embayment with a single opening is an example where relatively low movement typically can be observed. By closing the tide gates for duration of several tidal cycles, a protected embayment with a single opening is created for that duration. This situation promotes settling of sediment in front of the culvert adjacent to the northern jetty. The newly settled sediment upon reopening the tide gates further redirects the ebbing culvert flow, and the redirected flow, in turn, causes further erosion at the beach.

Two scour holes, either side of the culvert, were observed during the hydrographic survey of the beach. While the west side scour hole, approximately 150-feet-wide and 18-feet-deep, was quantified, the scour hole on the east side was observed, however, not measured due to the currents. The dimensions of this scour hole on the west side and the unknown scour extend of the east side scour indicates that the culvert needs to be evaluated for scour. Federal Highway Administration (FHWA) Hydraulic Engineering Circular No. 18 (HEC18) Evaluating Scour at Bridges provides guidance on how to conduct such a scour analysis.

3.2 Man-made Alterations

Most significant alterations were observed between the aerial photographs of 1971 and 1974: (1) the culvert under the Quincy Shore Drive was relocated to the north, (2) the jetty attached to the southern revetment of the culvert was apparently removed, (3) a new and approximately 300 feet-long jetty was built about 100 feet north of the new culvert, (4) a new and approximately 100 foot-long groin was built at the eastern end of the beach.

3.3 Historical Aerial Photograph Analysis Results

Upon spatially registering the aerial photographs and focusing on the area of concern for a trued comparison, the following observations have been made. All aerial photographs discussed below are shown in Appendix 2.

1952-1971:

- The culvert was located south of its current location.
- A southern jetty, aligned with the southeast edge of the culvert, was in place.

- The jetty located on the north side of the culvert and the groin located on the east end of the beach did not exist.
- The beach appeared significantly wider (approximately 150') than the current beach.
- No signs of significant erosion or accretion were observed between these dates.

1974:

- The culvert was relocated to the north.
- The jetty attached to the southern revetment of the culvert was apparently removed or buried.
- Northern jetty: A new jetty was built about 100 feet north of the new culvert parallel to the culvert centerline.
- Eastern groin: A new groin was built at the eastern end of the beach, aligned approximately perpendicular to the culvert centerline.
- The culvert outflow appeared to be moving in a straight line towards the bay.
- The sand bar paralleling the northern jetty on the southern side of the culvert showed signs of erosion.

1979:

- A sediment buildup was forming a spit at the northern tip of the northern jetty.
- Sediment was also building-up on the shore side adjacent to the northern jetty.
- The spit was pushing the culvert outflow channel towards the beach.
- The beach appeared significantly narrower (approximately 100') than the 1974 photo.
- Significant erosion took place around the southern jetty.
- A channel formation, terminating at the sand bar paralleling the northern jetty on the other side of the culvert, started to develop.

1984:

- Sediment build-up on the shore side adjacent to the northern jetty (i.e., the spit) grew substantially (i.e., approximately from 25' to 100'). The spit started to obstruct the direct flow path of the culvert outflow.

- The secondary channel, running adjacent to the shore, broke through the sand bar paralleling the northern jetty on the other side of the culvert.
- Erosion around the southern jetty and at the beach continued.

1990-1991:

- Sediment build-up on the shore side adjacent to the northern jetty (i.e., the spit) grew.
- The secondary channel, running adjacent to the shore, shifted more towards the beach.
- The sand bar paralleling the northern jetty on the southern side of the culvert eroded completely.
- Erosion around the southern jetty and at the beach continued.

1992-1994:

- The spit adjacent to the northern jetty grew to approximately 125 feet in length towards the beach.
- The secondary channel, running adjacent to the shore, became the only primary channel. The entire culvert outflow was redirected towards the beach by the spit.
- An approximately 200 feet-long sand bar, running from the spit adjacent to the northern jetty towards the eastern groin was noticed.
- Sediment started to build up on the beach side adjacent to the sand bar, which was attached to the spit.
- In addition to the erosion around the southern jetty and at the beach, sediment around the southern revetment of the culvert started to erode.

1996-2005:

- The sediment buildup, on the beach side of the sand bar attached to the spit, became a part of the spit pushing the culvert outflow further towards the beach.
- The beach appears significantly narrower (i.e., approximately 75') in 2005 compared to 1991 photo, especially on the eastern half, where the new extension of the spit shifted the channel towards the beach.
- Erosion, in addition to at the beach, continued around the eastern groin and the southern revetment of the culvert.

3.4 Shoreline Change Trends

Long-term shoreline changes were studied during the Massachusetts Office of Coastal Zone Management (CZM) Shoreline Change Project. The project groups the shoreline change results under three time periods: 1892-1938, 1938-1969, and 1969-1994. While during the first two periods (i.e. 1892 to 1969) the shoreline changes in the center of the Merrymount Beach has been small (i.e. <1' per year) and in the form of accretion, during the last period (1969-1994) the accretion has been replaced by significant erosion. The loss of shoreline in the center of the beach has been 5-6 feet per year during the last time period studied (1969-1994).

The results of this study are also verified with the historical aerial photographs. Between 1951 and 1974, the beach sediment appeared to be stable. Immediately after 1974, when the significant alterations described above took place, the shoreline and the bathymetry in the vicinity experienced significant changes in a relatively rapid fashion.

4 RECOMMENDATIONS

Upon analyzing the site characteristics, four options were developed and assessed: (1) No-Build, (2) Dredging, (3) Beach Nourishment, and (4) Dredging and Beach Nourishment, and (5) Jetty Reconstruction. Each option is discussed below in detail. In addition to these options, (1) maintaining regular flushing through the tide gates and (2) a scour analysis of the culvert vicinity is recommended.

The shoreline has been eroding significantly and no sign of equilibrium state is present. If a "No-Build" option is selected, monitoring of the beach is needed. Monitoring is especially important for the erosion that has taken place near the culvert structure, which is causing undermining of the southern revetment. In No-Build case, monitoring during and after each storm event is crucial. In case of critical scour at the culvert, the road should be closed and the area around the culvert should be secured. Erosion may also cause further loss of beach and adjacent park property. If the No-Build option is selected a detailed risk-based analysis is recommended. Such an analysis is described in USACE Coastal Engineering Manual.

Dredging is an option to attempt to redirect the jet coming out of the culvert by providing a more direct route of flow; however, it was noted that dredging was performed in the early 1970s and does not appear to be a sustainable solution over the long term. The dredging option has the potential to reduce erosion along the beach caused by the high velocity flow coming through the culvert; however, it will not decrease the risk of erosion that might be caused by waves as derived from FEMA study. This suggests that a similar type of beach monitoring program as described above will be needed. Furthermore, the historical aerial photographs from 1974 to 1984 suggest that dredging would not be a permanent solution and that a more long term program of beach maintenance will be required to ensure the long term success of the dredging option. If dredging is selected, a risk-based analysis is recommended, since, periodic maintenance dredging will most likely be needed.

Beach nourishment is another alternative. By replenishing the beach with compatible sediment, the level of protection against waves can be increased. Beach nourishment will also reduce the loss of property around the beach. Nourishment will be more cost-effective if it is done in conjunction with dredging, since the dredged material could potentially be used as material for the nourishment, assuming compatibility in grain size between the beach and the dredged sediment. However, as shown from the 1974-1979 pair of photographs, a significant amount of beach sediment was lost during a short period of time, and by 1984 a new channel hugging the shoreline had developed instead of the straight channel aligned with the culvert. Beach

nourishment or the combination of dredging/nourishment will be needed periodically. As with the dredging option previously discussed, a long term program of beach maintenance will likely also be required to ensure success of the beach nourishment alternative.

The only option that has proven in time to present stable conditions is a jetty on the southern side of the culvert that would simulate similar effects of the jetty that existed just before the alterations prior to 1974. A jetty south of the culvert will not only guide the jet coming out of the culvert towards the bay without carving into the beach, but also it will trap sediment just like the jetty located on the northern side of the culvert. The effectiveness of this solution was proven with time prior to 1971-1974 alterations. Moreover, the hypothesized solution of the site inspection also dovetails with this option. Reconstruction of the southern jetty will not bring back the exact same conditions prior to 1974. However, it has the greatest potential among the alternatives discussed above to provide stability without requiring frequent significant maintenance. Also, when combined with dredging and beach nourishment (including the reconstruction of the eastern groin on Merrymount Beach as well as a long term annual beach maintenance program) this option could restore the pre-1970's stable beach profiles.

Recommended Option -

4.1 Environmental Permitting Considerations

Environmental permitting considerations vary for the four options previously discussed in this report. This section outlines the various environmental permitting issues in general and as associated with each of the four options.

4.1.1 No-Build

The No-Build option will not require environmental permitting to implement. There is no activity that would trigger permitting thresholds under any state or federal environmental permitting program.

4.1.2 Build Options

As a coastal project, there are numerous state and federal environmental permitting programs that apply to the three Build options. These programs are briefly described below, along with relevant permit activity thresholds associated with the regulations.

It is assumed that any construction activity would be undertaken by the Commonwealth and, therefore, no local permitting requirements would apply to the project.

Federal Environmental Programs

Two federal environmental programs would apply to any of the Build options, including the United States Army Corps of Engineers (USACE) regulatory program and the federal Coastal Zone Management (CZM) consistency review process.

USACE

The USACE is the lead federal agency for permitting activities under several federal statutes, including under Section 404 of the Clean Water Act, Section 10 of the Rivers and Harbors Act of 1899, and Section 103 of the Marine Protection, Research and Sanctuaries Act.

Section 404 permits are required for activities affecting "waters of the United States" and associated wetlands, which include coastal areas to the Highest Annual Tide Line or the limits of adjacent wetlands; Section 10 permits are required for placement of structures and work in navigable waters, including tidal waters to the Mean High Tide line; and Section 103 permits are required for the transportation of dredged material to an approved unconfined ocean dumping site. Of the three regulatory programs administered by the Corps, the Section 404 and Section 10 processes are applicable for the build options. The Corps issues a single consolidated permit in instances where a permitted activity is jurisdictional under two or more of the regulatory programs listed above.

The Regulatory Office of the New England District of the Corps of Engineers has issued a Programmatic General Permit (PGP) for Massachusetts. The PGP includes three levels of permit application review. Category I activities are those activities with minimal impact and have been determined to be approvable without review by the Corps and other federal resource agencies, it functions a "permit-by-rule" for the activities listed in the Massachusetts PGP. Category II activities are those activities that have been determined to require a "screening" level review by the Corps and federal resource agencies, these activities are generally approved with or without special conditions within three to four weeks of submittal of a permit application. Category III activities require an individual permit from the Corps, undergo a public review in addition to the Corps and federal resource agency screening review, and may require a public hearing.

CZM Federal Consistency Review

Massachusetts CZM implements the federal CZM Act federal consistency review process in Massachusetts. Federal consistency review is required for project proposals that are in or can reasonably be expected to affect the resources or land or water uses of the Massachusetts coastal zone; and require a federal license or permit, are federally funded or are a direct activity of a federal agency. Massachusetts has developed its coastal zone management plan. Included in that

plan, as amended, are enforceable CZM program policies with their underlying statutory and regulatory authorities, which articulate Massachusetts priorities for protection and management of its coastal resources.

Project proponents must demonstrate that the proposed activity is consistent with enforceable CZM program policies.

Massachusetts Environmental Programs

Massachusetts Environmental Policy Act (MEPA)

MEPA is the environmental impact review program for the Commonwealth. Any project that requires state agency permits or funding may be required to undergo environmental impact review. The MEPA regulations establish review thresholds that determine the extent of MEPA review. These thresholds apply to projects that require certain state permits and exceed the thresholds established in the regulations. With some exceptions, all smaller projects that are not state funded, require certain state environmental permits, and do not exceed the review thresholds associated with those permits, are exempt from review. Other projects that require certain permits AND exceed the regulatory review thresholds fall into two additional categories: 1) those projects that require only a 30-day Environmental Notification Form (ENF) review (these projects may be required to prepare an Environmental Impact Report (EIR)); and 2) those projects that exceed the Mandatory EIR thresholds and require an ENF and Draft and Final EIR review. The MEPA review thresholds are specified at 301 Code of Massachusetts Regulation (CMR) 11.03.

No state agency may issue a permit or release funding for a project subject to MEPA review until the conclusion of the MEPA review process for that project.

Massachusetts Wetlands Protection Act

The Wetlands Protection Act and wetlands regulations (310 CMR 10.00) are locally administered by the Quincy Conservation Commission. Activities affecting coastal wetland resource areas at Merrymount Beach, including Land Under the Ocean, Coastal Beach, Coastal Bank, Land Containing Shellfish, Land Subject to Coastal Storm Flowage, and the 100-foot Buffer Zone to beach and/or bank are subject to certain performance standards specified in the wetlands regulations.

Massachusetts Public Waterfront Act (MGL Chapter 91)

The oldest program of its kind in the nation, Chapter 91 regulates activities on both coastal and inland waterways, including construction, dredging and filling in tidelands, great ponds and

certain rivers and streams. Certain activities in flowed or filled tidelands are regulated by DEP under Chapter 91 and the Waterways regulations at 310 CMR 9.00, including: placement or construction of any structure, including groins and jetties; filling or placement of any unconsolidated materials including material placed for the purposes of shoreline protection, beach nourishment, or subaqueous disposal of dredged spoils; and dredging activities in any waterway in the Commonwealth.

Permanent or temporary structures require the issuance of a license which is required to be recorded in the chain of title for the property at the appropriate Registry of Deeds. Dredging and beach nourishment activities can be authorized by a permit, which does not require recording in the registry.

Section 401 Water Quality Certification

Section 401 of the federal Clean Water Act is administered in Massachusetts by the DEP and regulates the discharge of dredged or fill material, dredging, and dredged material disposal activities in waters of the United States within the Commonwealth which require federal licenses or permits and which are subject to state water quality certification under 33 U.S.C. 1251, et seq.. Therefore, any activity requiring a federal permit, such as a Corps of Engineers permit, is required to obtain a Water Quality Certification from DEP.

4.1.2.1 Dredging

Dredging of Quincy Bay and the outlet of Blacks Creek in the vicinity of Merrymount Beach will trigger review under all of the federal and state permitting programs listed above. As the area has been dredged in the past, additional dredging will be considered as maintenance dredging.

Maintenance dredging activities generally undergo a less strict environmental review under several permitting programs. Applicable thresholds for dredging activities include: the Army Corps (less than 1,000 cubic yards (CY) with upland disposal authorized under Category I of the PGP; up to 25,000 CY authorized under Category II); Wetlands Protection Act regulations (alteration of Land Under the Ocean, maintenance dredging activities subject to less strict performance standards than improvement dredging activities); Chapter 91 (any amount of dredging, beach nourishment on public beaches required for compatible material); MEPA (10,000 CY or more of dredging requires an ENF, alteration of more than 10 acres of Land Under the Ocean requires an EIR) and Section 401 Water Quality Certification (dredging greater than 100 CY requires an individual WQC).

Physical and chemical characterization of the dredged material must be completed under the WQC process and the quality of the dredged material drives the disposal options and ultimate cost of the dredging activity. Clean sandy material is generally approvable for a wide range of disposal options, contaminated silty material is greatly restricted for disposal.

4.1.2.2 Beach Nourishment

Beach nourishment of public beaches is the established disposal option for public dredging projects and is greatly preferred by permitting agencies when compared to a hard engineering solution such as a groin or jetty. Relevant issues for beach nourishment activities include:

- Physical and chemical characterization of the dredged material. Contaminated and fine grained sediments are not approvable for beach nourishment.
- Grain size compatibility of the dredged sediment with the sediments existing on Merrymount Beach. The dredged sand must be compatible with the sand on the beach in order to ensure long-term success of the beach nourishment.
- Impacts to a total of 10 acres or more of Land Under the Ocean, Coastal Beach and any other wetland resource area will trigger the Mandatory EIR provisions of the MEPA regulations. A waiver of the EIR requirement would be required in order to avoid the time and expense of EIR preparation.
- Beach nourishment by a public agency to a beach in the Commonwealth is approvable under the Chapter 91 Waterways regulations for publicly-owned eroding beaches. The rights of broad public access to the beach will need to be ensured in order for beach nourishment to be approvable, unless paid for by private funds.

4.1.2.3 Dredging and Beach Nourishment

This option includes dredging of both the Blacks Creek outlet channel and beach nourishment of Merrymount Beach with compatible dredged material. The combination dredging and beach nourishment program offers an effective and economical solution to the issue of the disposal of dredged material, and also addresses the Chapter 91 regulatory requirements that clean, compatible dredged material be used for nourishment of nearby public beaches. The regulatory issues associated with this option are the same as gor the individual dredging and beach nourishment options discussed above.

4.1.2.4 Jetty Reconstruction

Relevant environmental permitting issues for the reconstruction of the existing jetty at the southeastern side of the Blacks Creek culvert include:

- Approval of a hard engineering structure is typically more difficult than that of a soft solution, such as beach nourishment; and
- An evaluation of feasible non-structural alternatives is required under the Chapter 91 Waterways regulations.

4.1.2.5 Consolidated Program

An additional option to address the erosion of Merrymount Beach includes a consolidated program including dredging, beach nourishment, jetty reconstruction and the additional elements of reconstruction of the groin at the eastern end and establishment of a beach monitoring and maintenance program along Merrymount Beach.

The permitting considerations for the consolidated program are the same as those identified above.

4.2 Recommended Program

After consideration of the environmental permitting considerations listed in section 4.1, it is recommended that a program combing the major elements of the three build options be implemented to address the issue of beach erosion at Merrymount Beach. This recommended option would include:

- Dredging and reestablishment of the historic Blacks Creek outlet channel in Quincy Bay north of Merrymount Beach;
- Nourishment of Merrymount Beach with compatible dredged sediment from the dredging program;
- Reconstruction of the jetty previously located at the southeastern end of the Blacks Creek outlet channel;
- Reconstruction of the groin located at the eastern end of Merrymount Beach;
- Implementation of periodic maintenance dredging as required to maintain the Blacks Creek channel;

- Maintenance of the existing northern jetty at the southern end of Wollaston Beach and the reconstructed southern jetty to ensure proper functioning of the jetties; and
- Implementation of an annual beach management plan along Merrymount Beach and monitoring of the accumulation of beach sands at the northern jetty on Wollaston Beach.

The consolidated beach dredging/nourishment/jetty reconstruction/beach management program will address the identified causes of the current erosional trends at Merrymount Beach and will ensure the long term effectiveness of the dredging and beach nourishment activities.

Reconstruction of the southern jetty at the Blacks Creek outlet channel will reestablish the outlet channel in its historic location and direct the jet of water exiting Blacks Creek into Quincy Bay and away from Merrymount Beach. This jetty must be monitored periodically and maintained as necessary to maintain its structural integrity and ensure proper functioning. Likewise, the effectiveness of the northern jetty (at the southern end of Wollaston Beach) should be inspected on an annual basis and any accumulated sands should be removed and relocated farther north on Wollaston Beach to prevent overtopping of the jetty into the Blacks Creek outlet channel.

Reconstruction of the failed groin at the eastern end of Merrymount Beach will increase the long term stability of Merrymount Beach and help to maintain the placement of beach nourishment material on the beach.

Beach Management Plan

Implementation of a beach management plan for Merrymount Beach will maximize the long term effectiveness of a consolidated dredging/beach nourishment/jetty and groin reconstruction program. The major elements of a beach management plan include:

- An annual springtime survey of Merrymount Beach to determine areas of accretion and/or erosion. The southern end of Wollaston Beach (in the vicinity of the northern jetty) should also be surveyed.
- Annual relocation of beach material from areas of accretion to areas of erosion as determined by the survey. This will function to maintain the profile of the nourished beach and ensure the long term effectiveness of the northern jetty and the eastern groin.
- Maintenance of the reconstructed jetties and the eastern groin. The jetties and the groin should be inspected periodically and any identified necessary maintenance and repairs should be undertaken.

- Periodic cleaning of Merrymount Beach – tidal debris and other foreign material should be cleaned from the beach on a frequent basis. For example, Wollaston Beach is mechanically raked by machine on a frequent basis.

Construction Issues

Construction of the consolidated program will most likely include hydraulic dredging of the accumulated sediments in the Blacks Creek outlet channel as hydraulic dredging is the most cost-effective dredging option. Hydraulic dredging does however generate a large volume of water along with the dredged material and a sufficient area for dewatering of the dredge "slurry" must be identified in the project area. The most likely area for construction of a dewatering basin is the current playground area located just upland of Merrymount Beach. This area would be excavated and a bermed pit would be constructed to accommodate the dredged material which would be pumped into the pit and allowed to dewater. Dried dredged sand would then be excavated from the dewatering basin and mechanically spread along the beach. Once the dredging is completed, the playground area would be restored. It is recommended that the area be raised from its current elevation to provide additional protection to the upland areas and vegetated bank at the southern edge of the park.

Schedule

Additional steps necessary to implement the consolidated program include: the preparation of a dredged material sampling and analysis plan; dredge material testing; environmental permitting; MEPA Environmental Impact Report (if required); Final Design and Construction Documents; and Bidding. Construction activities would be undertaken during winter months due to required dredging and construction windows (generally dredging activities can only be undertaken from early November through early or mid-February in Quincy Bay due to fisheries migration). The estimated schedule for project completion is outlined on the following page:

Activity	Duration
Condition Survey:	Completed
Sampling Plan:	3 Months
Testing:	4 Months
Environmental Permitting:	2 Months
EIR (if required):	8 Months
Final Design/Bid Documents:	2 Months
Bid Process:	2 ½ Months
Construction (Phase I Dredging, Fall/Winter Window)	1 Month
Construction (Phase II Jetties, Fall/Winter Window)	3 Months
Construction (Phase III Beach/Playground)	1 Month

References

1. Massachusetts Office of CZM Shoreline Change Project, www.mass.gov/czm
2. FEMA, www.fema.gov
3. Massachusetts Geographical Information System (MassGIS), www.massgis.gov
4. USGS, www.usgs.gov
5. NOAA, www.noaa.gov
6. University of Massachusetts (UMASS), www.umass.edu
7. USACE, Coastal Engineering Manual, 2002

Table 1. List of Data Sources

Organization	Topic
USACE	Dredging permit for Wollaston Beach
	Dredging projects for Wollaston & Squantum Yacht Club Dredging
	Coastal modeling projects in Quincy vicinity
	Permit records & present projects near Quincy
	Permit history & state resources
CZM	Merrymount Beach history, littoral drift, hydrodynamics of the area, sediment transport characteristics
City of Quincy	History/facts of gate, typical operation, rational for control
	Town history research of Merrymount Beach Permits
	Town History & Records of Merrymount Beach
	Local Merrymount Beach history
	Projects in Merrymount Beach Area
	Projects & local history in Merrymount Beach Area
	Permit history & projects in Merrymount Beach area
Woods Hole Science Center	USGS Research in Quincy Area
	Study of sediment transport characteristics in Boston Harbor. Hydrodynamic forcing mechanisms.
DCR	Nantasket Beach project research & related info Wollaston Beach project research & related info Black Creek flood gates project Historical data in DCR Library
MIT	Hydrodynamic and sediment transport modeling in the area.
Chapter 91 Waterways	Archives of Massachusetts waterways licenses and plans
Aerographics, Inc.	Aerial Photo Archives
Chas. H. Sells	Aerial Photo Archives
Massachusetts Highway Dept.	Aerial Photo Archives
James W. Sewall Company	Aerial Photo Archives
Land Care Aviation, Inc.	Aerial Photo Archives
University of California, Santa Barbara	Aerial Photo Research
Col-East, Inc.	Aerial Photo Archives
Eastern Topographics, Inc	Aerial Photo Archives
Keystone Areial Surveys, Inc	Aerial Photo Archives
Four Star Aviation	Aerial Photo Archives
UMass	Aerial Photo Archives

Table 2. Historical Aerial Photograph Research Results

Year	Month	Type	Photo Scale	Resolution	Source	Tidal Stage
1938	November	B/W	1"=1000'	-	EDR	High
1951	-	B/W	1"=20000"	2400 dpi	UMass	High
1955	December	B/W	1"=750'	-	EDR	High
1960	May	B/W	1"=1000'	-	EDR	Low
1968	-	B/W	1"=3000'	-	Aerographics	-
1971	-	B/W	1"=20000"	2400 dpi	UMass	Low
1972	-	B/W	1"=3000'	-	Aerographics	-
1974	-	B/W	1"=800'	2116 dpi	Col-East	Low
1978	April	B/W	1"=750'	-	EDR	High
1979	-	B/W	1"=600'	2116 dpi	Col-East	Low
1984	-	Infrared	1"=25000"	2400 dpi	UMass	Low
1985	April	B/W	1"=1000'	-	EDR	High
1990	-	B/W	1"=480'	2116 dpi	Col-East	High
1991	April	Color	-	1200 dpi	USGS	-
1991	-	Infrared	1"=25000"	2400 dpi	UMass	High
1991	-	B/W	1"=500'	300-1000 dpi	E-Topo	-
1992	April	B/W	1"=5000"	-	MGIS	Low
1992	-	B/W	1"=500'	300-1000 dpi	E-Topo	-
1993	-	B/W	1"=600-1700'	-	James W. Sewall	-
1994	-	B/W	1"=600-1700'	-	James W. Sewall	-
1994	-	B/W	-	-	MGIS	High
1995	April	B/W	-	1200 dpi	USGS	-
1995	April	B/W	1"=833'	-	EDR	Low
1996	May	B/W	-	1200 dpi	USGS	Low
1996	May	B/W	-	-	TerraServer-USA	Low
1996	-	B/W	1"=600-1700'	-	James W. Sewall	-
1998	March	B/W	1"=500'	2116 dpi	Col-East	High
1999	-	Infrared	1"=25000"	2400 dpi	UMass	Low
2000	-	Infrared	1"=600-1700'	-	James W. Sewall	-
2001	April	Color	1"=5000"	-	mgis	Low
2001	-	Color	-	1200 dpi	USGS	High
2003	December	Color	1"=600'	2000 dpi	Chas. H. Sells	-

Year	Month	Type	Photo Scale	Resolution	Source	Tidal Stage
2003	May	B/W	1"=1200'	2116 dpi	Col-East	Low
2003	May	B/W	1"=500'	300-1000 dpi	E-Topo	-
2005	April	B/W	1"=500'	2116 dpi	Col-East	Low

B/W: Black and white photograph.

EDR: Environmental Data Resources, Inc.

DPI: Dots per inch.

UMASS: University of Massachusetts

MGIS: Massachusetts Geographical Information System