Town of Mashpee
Waterways Commission
16 Great Neck Road North
Mashpee, Massachusetts 02649

Telephone: 508-477-0147
Manual Fax: 477-0147

What will it take to dredge the Mashpee River?

Update 11 Jan 06

Update 7 Feb 2006

The following is an update to the attached copy of a letter to the Board of Selectmen dated 13 July 2004 (attached) to which is attached a discussion of what it will take to dredge the Mashpee River. That document explores the alternatives and pitfalls of the different alternatives. The following is an update to those documents.

Recently Glen Santos and Glen Harrington discussed placing the material to be dredged from the Mashpee River in a depression in the transfer station.

Salinity / conductivity issues.

I discussed this with Glen Harrington, and advised him of the DEP requirement that material deposited in a lined land fill must not have a conductivity of greater than 8,000 Micromhos per centimeter, and for an unlined land fill, and no greater than 4,000 Micromhos per centimeter.

We have looked into how to test for this property, and who can do it. Neither the Barnstable County Health Department does this, nor does the University of Mass Dartmouth SMAST. We were advised that Groundwater Analytical in Bourne does these tests. We learned that the cost for each sample analysis is $12.50.

Another issue is where the salt would leach to, if it leached, and the answer is the Mashpee River. Part of the flow according to Dr Howes goes to the river above the Route 28 bridge in the vicinity of where there is some brown iron oxide staining on the bank

Dredge technique implications

If the material is to be deposited in the landfill, it must pass a paint filter test for adequate dryness before it can be transported over the highway.

Two techniques lend themselves to this scenario:

1. Mechanical dredging and de-watering on the Mashpee Neck Ramp, which is very small, or,

2. Belt filter press technique which dries the material in the process. We plan to re-visit the belt filter press technique, as it involves the use of fresh water in the process, hence may further reduce conductivity of the sediment.

Interest in having the County Dredge Department is not very high among the Cape towns. No strong sales pitch has been used, however.

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COPY 7 FEB 06

Board of Selectmen
Town of Mashpee
16 Great Neck Road North
Mashpee, MA 02649

Dear Selectmen:

Dredging the Mashpee River has been one of the Town's waterway improvement objectives since 1995. Although we have done a lot of work toward obtaining permits, we remain stuck with the problem of how to get rid of the material to be dredged. We are still exploring all the possible alternatives.

Attached is a document that explores the various dredging techniques and their implications on disposing of dredged material, looks at dredged material disposal site options, and evaluates the alternatives to see what can be done to complete the project.

As a result of this exercise, we conclude the following:

1. We need to find a dredging technology that will allow us to dredge in shallow water, and,

2. find a way to dispose of fine silty material.

These two conclusions are intertwined depending on the dredging method used.

We recommend that we:

1. explore forming a mechanical dredging operation for the County Dredge Department. The cost of hydraulic dredging by private enterprise ranges from about $12 to $15 per yard. The County Dredge, on the other hand, costs $6:55 to $11.50 per cubic yard depending on the distance the material is to be used. The higher cost is for moving material a distance greater than 4000 feet.

The cost of mechanical dredging by private enterprise ranges from about $17 to $60 per yard. The question to be answered is: can the County put together a mechanical dredging operation that is lower cost than commercially available services?

2. further develop the concept of burying the material in the Mashpee River or Popponesset Bay (as discussed under confined aquatic disposal in the attached), and work on determining feasibility of implementing the idea.

We plan to follow this course of action unless you direct otherwise.

Very Truly Yours
James P. Hanks
Vice-Chairman, Waterways Commission

jph

cc: Town Manager
Conservation Agent
Harbormaster
Shellfish Constable
County Dredge Superintendent
Regional Office, CZM
Dr. Brian Howes, SMAST

What will it take to dredge the Mashpee River?

13 July 2004

Introduction

Dredging the Mashpee River has been one of the Town's waterway improvement objectives since 1995. Although we have done a lot of work toward obtaining permits, we are stuck with the problem of how to get rid of the material to be dredged. We are still exploring all the possible alternatives, but have not yet found something that will work. Environmental rules make the task very difficult nowadays compared to several years ago. Further, the regulators keep raising the bar each year.

Dredging Needs

The Mashpee River is not the only water body that would benefit from dredging. Next in priority is Ockway Bay which is extremely shallow, yet ironically there is a public boat ramp at the head of the bay off Great Neck Road South. Several years ago the Coast Guard prohibited us from setting planing channel markers in the bay because it was too shallow. Shoestring Bay is barely navigable above Simons Narrows, and also there is a large flood tide delta in Popponesset Bay that impedes navigation and may restrict the flushing action of tidal ebb and flow. This delta may have sediment suitable for beach nourishment, but we haven't determined that yet. To meet these several dredging needs, Mashpee requires a long-term solution to the problem of disposing of fine sediment.

Dredging Benefits

There are several benefits that accrue from dredging. The obvious benefit is improving or maintaining the ability to navigate, but there are other benefits as well, such as creating mooring fields. Dredging the shallow waters of Popponesset Bay and its tributaries will result in more desirable waterways and in addition to attracting tourists and other transient boaters, will increase property values of those living along the shores. Increased property values mean increased tax revenue (without a need for increased infrastructure), and that is a good thing for the whole town.

Another side benefit of dredging is using the dredged material for beach nourishment. When we annually dredge the current channels in the Popponesset Bay area, the material is used to build up low spots on Popponesset Spit. Maintaining the barrier beach function of the spit is vital to protecting the area from storm activity. A good portion of the Town's tax base is situated along the shores of the Popponesset Bay area, and loss of the barrier beach protection would adversely affect tax revenues as property values declined. Any dredging approach that provides beach nourishment is a benefit to the Town.

Disposing of Material

The Mashpee River bottom is fine silt and sand, and does not meet the criteria for beach nourishment. Neither can it be side-cast and left in the river due to environmental rules (314CMR9). It therefore must be disposed of by other means.

Several other Cape towns also face this problem of disposing of fine silty material. They also have waterways that would benefit from dredging, but they have not been dredged either due to the lack of a way to dispose of the material. Dredging and disposing of sandy material without fine content is much easier, as it can be used for beach nourishment. The county dredge, a hydraulic dredge, was set up for this purpose and has been successful in providing lower cost maintenance dredging since 1997. (Maintenance-dredging means dredging areas that were dredged under permit previously). In a few cases where there is a suitable de-watering and disposal facility available, it is also used to dredge fine material.

The problem of disposing of fine material, however, has not been addressed by government agencies other than Towns until recently when both the State and the Federal Government started looking into providing offshore disposal sites. The Army Corps of Engineers is looking for a site to accommodate the needs of Massachusetts and Rhode Island, and the Commonwealth of Massachusetts Coastal Zone Management is working on re-activating the site in Buzzards Bay. Both of these efforts are a few years away from being completed. The only trouble is that many bays, including Popponesset Bay, are too shallow to accommodate the deep-draft barges needed to transport the material to the dumpsite.

Also, many more analytical steps are now required by environmental regulations both for activating dumpsites and permitting projects planning to use them. Further compounding the difficulty of permitting the Mashpee River is the fact that to permit dredging of areas that have not been dredged under permit before is more difficult, and a more detailed analysis is required.

Therefore, Mashpee needs a dredging technology that will allow us to dredge in shallow water and dispose of fine silty material. If we can figure that out, we are then in a position to resume our permitting activities. If we solve that problem, then we will have the means to dredge other water bodies with fine silty bottoms, such as Ockway Bay.

Dredging Technique Options

There are several dredging techniques, and each has advantages and disadvantages. Each technique has an influence on disposal options. The purpose of this document is to explore those techniques and their pros and cons to see if we can find the best approach to solving our problem for the long term.

<u>Hydraulic Dredging and Disposal</u>

Hydraulic dredging is the most economical technique for moving dredged material from one place to another. The dredge is a barge mounted pump with an intake pipe that has a rotating cutter head that digs through the sediment. As the intake pipe sweeps back and forth, the material is vacuumed up and sent out a discharge pipe by the pump. By mixing the material with a lot of water (70 to 90 percent), it can be pumped thousands of feet. However, the drawback is that there is a need for a sizeable containment area for de-watering the material unless it is suitable for beach nourishment. Also, the material doubles in bulk during the process, further increasing the volume required for the disposal site.

If the material is not used for beach nourishment, a basin must be constructed to hold it while the water drains out. Then the material can either be moved elsewhere or the area covered and restored to an acceptable characteristic – grassland, park, wildlife habitat, etc.

If it is to be moved it must be de-watered until it is dry enough to be transported over the highway to a disposal area. (Solid Waste Management rules.)

De-watering salty material is allowed only in a location where the runoff or leachate will not adversely affect any potable water supply or freshwater wetland. Typically such locations must be near a similar salt-water body. If it is not the same water body from which the material originated, then a National Pollutant Discharge Elimination System (NPDES) permit is required.

If there is no disposal site near the water, disposal of salty material upland may be allowed in a location where, again, the runoff or leachate will not adversely affect any potable water supply or freshwater wetland. In some cases it can be disposed of in a lined land fill area, and the only[1] facility near Cape Cod is the Bourne landfill. That facility may or may not take additional material in the future. Even if they do, their disposal fee is very expensive –$40 to $65 per ton and a cubic yard of the material will weigh about 1.3 tons. That translates into a cost of over a million dollars just to dump the 24000 cubic yards of material. De-watering site construction, dredging, and transportation are all additional costs.

De-watering Site and Disposal Site Alternatives for Hydraulic Dredging in the Mashpee River

There are no technically suitable de-watering sites near the Mashpee River except on conservation land. We have investigated several parcels, and have ruled out using most of them because of deed restrictions on their use. One exception is the land parcels north of the Wampanoag Tribal Council and south of the Greenwood development west of Great Neck Road South. This area is desirable because it has two natural depressions (glacial kettle holes) that would minimize the amount of material that would have to be excavated and disposed of. The de-watering pit constructed from the two holes would cover up to 8 acres and would provide a basin large enough to make the dredging operation efficient. There is enough volume available that we can consider placing Ockway Bay material (approximately 26000 cubic yards) at that site. If people agree, this site could serve as a long-term solution to our dredging needs for some time into the future.

At the same time this site may not work because conservation land is protected from conversion to other uses by state law (Article 97 of the Constitution of the Commonwealth of Massachusetts). To convert its use requires Conservation

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[1] Another location, a recycling center in Sandwich, was recently used for disposal of material from the Centerville River but the operators are no longer interested in taking any material due to the environmental headaches involved. That is too bad, because their tipping fee was inexpensive.

There was a possibility that Robert Childs Incorporated in Dennis could take the material, but they only handle small amounts (approximately 1000 cubic yards per year).

Commission approval, Selectmen approval, a Town meeting vote in approval, and a 2/3-majority vote of the legislature.

A land swap of other Town Land has been proposed, to solve the conservation issue, but abutters oppose the use of this site. During discussion of a Town Meeting article in October of 2003, which proposed an 8-acre land swap to allow use of these parcels, members of the Wampanoag Tribal Council and the Greenwood homeowners association raised objections. Their concerns were over the unknown effects of the leachate on the groundwater and the fear of odors. The article was defeated, but a similar advisory article submitted by petition (that proposed a 5-acre land swap involving the same site) was approved. Subsequent discussions with the Wampanoag Tribal Council president lead us to believe that the same objections pertain to the petition article site, and the concerns would have to be addressed in either case. Assuming the concerns can be overcome, there is still a need for the Conservation Commission to approve the swap, a Town Meeting Vote, and possibly a 2/3 vote of the legislature to allow conversion of this conservation land to another purpose.

In earlier discussions of several proposals with the Conservation Commission and Conservation agent, it is clear that there is opposition to any conversion of this land. The only possible way this could work is if an evaluation of the land to be swapped shows that it has higher conservation value than the portions of the parcels being considered.

The parcel is undesirable in another sense because the dredge pipe would have to be placed along the paths in the portion of conservation land East of Great Neck Road South that includes the memorial to Harry Desrosiers. The pipe would have to be dragged over the path through the woods using mechanical equipment, and a structure would have to be built to bridge over the narrow strip of wetlands along the bank of the Mashpee River. (That "bridge" structure could be made into a kayak-launching site if desired). The 14-inch pipes (1 to fill and 1 or 2 to drain the pit) would have to be placed under Great Neck Road South. The engineering concept is to install 30-inch culverts through which the pipes would be run. After dredging, the culverts would be capped (for public safety reasons) and left in place because we propose to use them again in the future for added maintenance dredging.

Assuming that agreement can be reached and legislation approved to effect a land swap, there is also considerable analysis that will be required to determine the specific groundwater flow in the area and assess the potential impact on water supplies and fresh water wetlands. We know without detailed measurements that the residents in the Bayberry development, who are on well water, are likely to be affected. That is based on groundwater contour maps provided by the Cape Cod Commission. In such case the Town might have to provide Town water to those affected.

In summary, to use this land will require:
1. Overcoming the objections of abutters,
2. Conservation Commission approval to pass the pipe through conservation land,
3. Agreement to install two (or 3) culverts under Great Neck Road South,
4. A land swap.
5. Insuring that no potable water supply is affected, and if it would be, providing town water to those affected.

Near Shore Disposal
Given that upland disposal is fraught with difficulties, we have considered alternatives such as de-watering the material in cofferdams in Popponesset Bay or Ockway Bay. One approach for disposal is to convert the cofferdam to a wetland or upland island using the dredged material. Because of the large volume of water involved with hydraulic dredging, this technique is not practical, so we will consider it under mechanical dredging.

Yet another idea is to create an underwater disposal pit (called a Confined Aquatic Disposal (CAD)) and then bury the fine material with some of the clean sand removed to create the pit. Again, because of the volume of water using hydraulic dredging, we will consider this technique under mechanical dredging.

Mechanical Dredging and Disposal

Mechanical dredging is accomplished by having a crane with a clamshell bucket mounted on a barge. The crane digs out the material and places it on another barge for transport to:

a. shore for de-watering and upland disposal,
b. a Confined Aquatic Disposal site,
c. an upland or wetland island construction site, or,
d. to the ocean for ocean disposal in a designated offshore dumpsite.

Unlike hydraulically dredged material, the material contains only about 10%water, and also does not double in volume as it does when hydraulically dredged. Therefore, the de-watering/disposal area required is considerably smaller.

Upland Disposal
Transporting the dredged material to an upland de-watering site is more costly than hydraulic dredging because the material must be moved from the barge to an upland de-watering area, and then when it is dry enough, moved to a disposal area. On the plus side, there is less water to contend with, so the de-watering area can be smaller than what is required for hydraulic dredging. But, we already know there is a lack of suitable de-watering areas in the vicinity of the Mashpee River.

One approach is to put the material in a pit or containment area near the water and let it drain until it is dry enough for transport[2]. This means the transport barge must be able to get close enough to shore to allow earth moving equipment to lift the material off the barge and move it to a de-watering pit. The equipment could be a crane or a front loader that could drive onto the barge over a ramp, remove the material, and place it in the de-watering pit.

Another way to solve this transportation need is to place roll-off containers on the barge, fill them, push the barge to a landing, and move them off the barge to shore to dewater, then transport the containers to the disposal site. This approach saves handling costs, but there is a container rental cost to consider. No details have been worked out yet on this concept.

[2] Solid waste disposal regulations require that the material pass a "paint filter test". That means that when the material is placed into a paint filter, it does not drip any water.

Near Shore De-watering and Disposal

Near shore disposal includes building wetland (marsh) or upland islands, or confined aquatic disposal. From a permitting perspective, it is not the same as ocean dumping because a different set of sediment analysis requirements pertains. In this case, material would be barged to the disposal site and offloaded by the best means available.

Wetland or Upland Islands -The idea is to build up islands from dredged material. One of the requirements is that the material must not become re-suspended in the water column. This can be achieved by building a containment wall that will protect the fine material from wind and wave action.

One approach to building the retaining wall is to use plastic sheet piling. Initially the height of the wall can be set so that the material is stacked up above the water level, which will promote more rapid de-watering and settling. Height can be adjusted after settling and de-watering is complete by either driving the sheet piles further, or by simply sawing them off to the desired height.

A drawback to sheet piling is that it will create a sheer wall that will reflect waves rather than dissipating the energy, as would a sloping beach. The advantage is that it will last a long time and effectively contain the material. Sandy material (grain-size compatible with beach areas in the vicinity) can be used to fill in around the sheer walls to creating a sloping beach, and in some cases the sand can be contained in "geotubes" (synthetic woven material that is sewn into bags to retain the sand). The tubes, which flatten out under gravitational force, can be planted by making holes in the fabric and transplanting vegetation into the holes. If over time the sloping foreshore is destroyed, the tubes can be replaced. Height of the island will govern whether it is wetland or upland habitat. Height can be easily controlled using sheet piling. It is possible to use geotubes alone, but it is harder to achieve the height needed to contain the material during the de-watering and settling process, and harder to adjust it to the desired height when settling is complete

Confined Aquatic Disposal (CAD) - Assuming a site in the bay can be found that has sand that can be used for beach nourishment, the idea is to excavate an underwater pit and dispose of the sand either on the beach or by side casting it. The dredged material would then be placed in the pit and when finished, buried with a layer of the original bottom sediment or sand[3]. This approach is good for a one-time use of a site, but a new site is needed when maintenance dredging is required. That is not really a problem because Popponesset Bay covers a large area.

Wayne Jaedtke, County Dredge Superintendent, has suggested an innovative approach. The concept is that we could scrape off the mud from the sand below some part of the Mashpee River, dredge the sand hydraulically and use it to nourish the spit, then mechanically dig the channel and deposit the material in the pit. That could be covered with sand or the same bottom material that was scraped off as desired. When he heard of this concept, Mashpee Conservation Agent Bob Sherman stated he had no philosophical problems with it, but that we would have to answer a lot of detailed questions. That is encouraging.

[3] Discussion with Dr. Brian Howes reveals that covering the material with sand would have two benefits: 1. The fine sediment would no longer be available to recycle nutrients from the surface layer, and 2. The sandy surface would restore habitat that is now gone due to eutrophication.

Wayne said that, among other things such as another barge, he would need to get a 2-yard mud bucket for his 20-ton crane. A representative of Cablearm clamshell says that they can build one. We supplied him with the specifications for the crane the county has now, but we do not have any price or other information back from Cablearm.

There is also sufficient area in the Mashpee River near Gooseberry Island to hold the material. For example if we construct a cylindrical pit 8 feet deep and 175 feet in diameter, it will hold 28,507 cubic yards. A desirable area would be on the north side of Gooseberry Island, which may be within the Wampanoag Tribal Council shellfish grant. If so, the capping of material with clean sand would improve the shellfish habitat in that area, but we would have out work that out with the Council. If the Council does not wish to have that area altered, there is still sufficient room northeast of the grant area. Another idea to consider is having more than one CAD site in the River to reduce handling time.

Offshore Disposal

Offshore disposal may avoid all the pitfalls of obtaining permits for upland disposal, but there are different and more difficult permitting and construction hurdles to overcome. The Army Corps of Engineers just recently published the new rules for sediment evaluation for offshore disposal[4]. An extensive set of tests is required, more so than for upland disposal, and that implies additional expense.

Offshore disposal is usually accomplished using ocean-going barges, which typically draw 8 feet of water. The problem facing many Cape towns is that the water bodies that need to be dredged cannot accommodate the deep draft (8-ft. minimum) ocean going barges needed to safely transport material to the dumpsite. Popponesset Bay for instance is only 2 to 5 feet deep, except for a few holes about 9 feet deep. Further, the channel outside Popponesset Bay is only dredged to 5 feet (6 feet overdredge) and portions are typically 4.5 feet as the sand moves around. Deep draft barges can't even get into the Bay.

One idea is to use shallow draft barges to shuttle the material out to the sound, then transfer it to an ocean going barge. We have been advised by a person who is experienced in mechanical dredging and barge operations that this is not a good thing to do because it is a very sloppy process. You can't avoid spilling material over the side, and that is not allowed environmentally. The alternative remaining is to try to negotiate the ocean with shallow draft barges from Popponesset to the dumping site. Even if the site turns out to be in Buzzards Bay, that trip can be treacherous during the dredging time window (nominally 1 October to 15 January because of fish migration and spawning considerations).

The EPA is scheduled to select the federal offshore site for the ACOE by December of 04, and CZM expects to release an Environmental Impact Statement soon, so each site is likely to be at least a year off from activation. Since Rhode Island initiated the effort to get a Federal site activated, it is logical to expect it will be nearer Rhode Island than the south coast of Cape Cod, but time will tell.

[4] Regional Implementation Manual, for the Evaluation of Dredged Material Proposed for Disposal in New England Waters

Subsidence Deepening

An innovative approach to solving the disposal problem has been developed by K - V associates of Mashpee. They use a hydraulic dredging technique whereby water is injected down into sandy sediment below the fine sediment, and slurry of sand and water is pumped out to be disposed of as beach nourishment. Conceptually, this is an attractive approach, but it is still somewhat experimental in nature, and is a very slow process because of the small-scale equipment used. Also, the technique has only had limited use so far, so there are kinks yet to be worked out. .

One requirement for this to be viable is that the sediment underlying the area to be dredged must be suitable for beach nourishment. Although we rejected this approach early in the permitting process because of its limited capacity and high expense, we could re-evaluate it in light of our difficulties finding a place to deposit the material.

One of the drawbacks to this approach is the lack of precision in establishing a channel. The overlying sediment has to collapse into the vacated chamber below. Getting it to conform to an approved channel configuration will be difficult. Hydraulic dredging can create a channel matching specifications within inches, where as this technique will likely be within several feet.

We contacted K-V Associates to get an update on Subsidence Deepening technology. Bill Kearfott related their experience at Red Lily Pond. He thinks the process was highly successful in that the pond was deepened, the sand removed, and they raised a parking lot as desired by the owners. Also, EPA is happy with the process.

He also noted that with the sand capping the deepened area, the sub aquatic vegetation (SAV) is not re-growing as fast as it is in the areas that still have the nutrient laden muck bottom. They did use a 10-inch pipe rather than the 6-inch pipe we were briefed on some time ago, and throughput was greater. There is a problem with accuracy of shaping the dredged area, but he has some ideas of how to improve that. They also learned that the sand under the pond was not a uniform consistency, and now recommend a more extensive coring program so you know more precisely what you dealing with. He would be happy to come to our meeting and give us a 30-minute update if we like.

Another opinion on the project from an unidentified source is that it was a financial disaster. It allegedly cost over 1 million dollars, and did not achieve the desired effect.

Conclusions

After all this deliberation we conclude the following:

Upland disposal in Mashpee is desirable but may not be attainable considering the obstacles involved.

Hydraulic dredging is inappropriate for nearshore and offshore disposal.

Mechanical dredging is preferred for upland disposal if the material is to be transported any distance over land, and is appropriate for nearshore and offshore disposal.

Confined Aquatic Disposal may be the best option if the cost of mechanical dredging can be lowered.

Subsidence Deepening, while an appealing concept, is not yet developed to point where it provides a practical solution to the Mashpee River situation.

Suggested Action

We should:

1. Explore forming a mechanical dredging operation for the County Dredge Department. The cost of mechanical dredging by private enterprise ranges from about $17 to $60 per yard. The question to be answered is: can the County put together a mechanical dredging operation that is lower cost than commercially available services?

2. Further develop the concept of burying the material in the Mashpee River or Popponesset Bay (as discussed under confined aquatic disposal above), and work on determining feasibility of implementing the idea.

Waterways Commission

Telephone: 508-477-0147
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Date: 13 July 2004

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16 Great Neck Road North
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1. We need to find a dredging technology that will allow us to dredge in shallow water, and,

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These two conclusions are intertwined depending on the dredging method used.

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Vice-Chairman, Waterways Commission

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cc: Town Manager
Conservation Agent
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The Mashpee River bottom is fine silt and sand, and does not meet the criteria for beach nourishment. Neither can it be side-cast and left in the river due to environmental rules (314CMR9). It therefore must be disposed of by other means.

Several other Cape towns also face this problem of disposing of fine silty material. They also have waterways that would benefit from dredging, but they have not been dredged

either due to the lack of a way to dispose of the material. Dredging and disposing of sandy material without fine content is much easier, as it can be used for beach nourishment. The county dredge, a hydraulic dredge, was set up for this purpose and has been successful in providing lower cost maintenance-dredging since 1997. (Maintenance-dredging means dredging areas that were dredged under permit previously). In a few cases where there is a suitable de-watering and disposal facility available, it is also used to dredge fine material.

The problem of disposing of fine material, however, has not been addressed by government agencies other than Towns until recently when both the State and the Federal Government started looking into providing offshore disposal sites. The Army Corps of Engineers is looking for a site to accommodate the needs of Massachusetts and Rhode Island, and the Commonwealth of Massachusetts Coastal Zone Management is working on re-activating the site in Buzzards Bay. Both of these efforts are a few years away from being completed. The only trouble is that many bays, including Popponesset Bay, are too shallow to accommodate the deep-draft barges needed to transport the material to the dumpsite.

Also, many more analytical steps are now required by environmental regulations both for activating dumpsites and permitting projects planning to use them. Further compounding the difficulty of permitting the Mashpee River is the fact that to permit dredging of areas that have not been dredged under permit before is more difficult, and a more detailed analysis is required.

Therefore, Mashpee needs a dredging technology that will allow us to dredge in shallow water and dispose of fine silty material. If we can figure that out, we are then in a position to resume our permitting activities. If we solve that problem, then we will have the means to dredge other water bodies with fine silty bottoms, such as Ockway Bay.

Dredging Technique Options

There are several dredging techniques, and each has advantages and disadvantages. Each technique has an influence on disposal options. The purpose of this document is to explore those techniques and their pros and cons to see if we can find the best approach to solving our problem for the long term.

<u>Hydraulic Dredging and Disposal</u>

Hydraulic dredging is the most economical technique for moving dredged material from one place to another. The dredge is a barge mounted pump with an intake pipe that has a rotating cutter head that digs through the sediment. As the intake pipe sweeps back and forth, the material is vacuumed up and sent out a discharge pipe by the pump. By mixing the material with a lot of water (70 to 90 percent), it can be pumped thousands of feet. However, the drawback is that there is a need for a sizeable containment area for de-watering the material unless it is suitable for beach nourishment. Also, the material doubles in bulk during the process, further increasing the volume required for the disposal site.

If the material is not used for beach nourishment, a basin must be constructed to hold it while the water drains out. Then the material can either be moved elsewhere or the area

covered and restored to an acceptable characteristic – grassland, park, wildlife habitat, etc.

If it is to be moved it must be de-watered until it is dry enough to be transported over the highway to a disposal area. (Solid Waste Management rules.)

De-watering salty material is allowed only in a location where the runoff or leachate will not adversely affect any potable water supply or freshwater wetland. Typically such locations must be near a similar salt-water body. If it is not the same water body from which the material originated, then a National Pollutant Discharge Elimination System (NPDES) permit is required.

If there is no disposal site near the water, disposal of salty material upland may be allowed in a location where, again, the runoff or leachate will not adversely affect any potable water supply or freshwater wetland. In some cases it can be disposed of in a lined land fill area, and the only[5] facility near Cape Cod is the Bourne landfill. That facility may or may not take additional material in the future. Even if they do, their disposal fee is very expensive –$40 to $65 per ton and a cubic yard of the material will weigh about 1.3 tons. That translates into a cost of over a million dollars just to dump the 24000 cubic yards of material. De-watering site construction, dredging, and transportation are all additional costs.

De-watering Site and Disposal Site Alternatives for Hydraulic Dredging in the Mashpee River

There are no technically suitable de-watering sites near the Mashpee River except on conservation land. We have investigated several parcels, and have ruled out using most of them because of deed restrictions on their use. One exception is the land parcels north of the Wampanoag Tribal Council and south of the Greenwood development west of Great Neck Road South. This area is desirable because it has two natural depressions (glacial kettle holes) that would minimize the amount of material that would have to be excavated and disposed of. The de-watering pit constructed from the two holes would cover up to 8 acres and would provide a basin large enough to make the dredging operation efficient. There is enough volume available that we can consider placing Ockway Bay material (approximately 26000 cubic yards) at that site. If people agree, this site could serve as a long-term solution to our dredging needs for some time into the future.

At the same time this site may not work because conservation land is protected from conversion to other uses by state law (Article 97 of the Constitution of the Commonwealth of Massachusetts). To convert its use requires Conservation Commission approval, Selectmen approval, a Town meeting vote in approval, and a 2/3-majority vote of the legislature.

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[5] Another location, a recycling center in Sandwich, was recently used for disposal of material from the Centerville River but the operators are no longer interested in taking any material due to the environmental headaches involved. That is too bad, because their tipping fee was inexpensive.

There was a possibility that Robert Childs Incorporated in Dennis could take the material, but they only handle small amounts (approximately 1000 cubic yards per year).

A land swap of other Town Land has been proposed, to solve the conservation issue, but abutters oppose the use of this site. During discussion of a Town Meeting article in October of 2003, which proposed an 8-acre land swap to allow use of these parcels, members of the Wampanoag Tribal Council and the Greenwood homeowners association raised objections. Their concerns were over the unknown effects of the leachate on the groundwater and the fear of odors. The article was defeated, but a similar advisory article submitted by petition that proposed a 5-acre land swap involving the same site was approved. Subsequent discussions with the Wampanoag Tribal Council president lead us to believe that the same objections pertain to the petition article site, and the concerns would have to be addressed in either case. Assuming the concerns can be overcome, there is still a need for the Conservation Commission to approve the swap, a Town Meeting Vote, and possibly a 2/3 vote of the legislature to allow conversion of this conservation land to another purpose.

In earlier discussions of several proposals with the Conservation Commission and Conservation agent, it is clear that there is opposition to any conversion of this land. The only possible way this could work is if an evaluation of the land to be swapped shows that it has higher conservation value than the portions of the parcels being considered.

The parcel is undesirable in another sense because the dredge pipe would have to be placed along the paths in the portion of conservation land East of Great Neck Road South that includes the memorial to Harry Desrosiers. The pipe would have to be dragged over the path through the woods using mechanical equipment, and a structure would have to be built to bridge over the narrow strip of wetlands along the bank of the Mashpee River. (That "bridge" structure could be made into a kayak-launching site if desired). The 14-inch pipes (1 to fill and 1 or 2 to drain the pit) would have to be placed under Great Neck Road South. The engineering concept is to install 30-inch culverts through which the pipes would be run. After dredging, the culverts would be capped (for public safety reasons) and left in place because we propose to use them again in the future for added maintenance dredging.

Assuming that agreement can be reached and legislation approved to effect a land swap, there is also considerable analysis that will be required to determine the specific groundwater flow in the area and assess the potential impact on water supplies and fresh water wetlands. We know without detailed measurements that the residents in the Bayberry development, who are on well water, are likely to be affected. That is based on groundwater contour maps provided by the Cape Cod Commission. In such case the Town might have to provide Town water to those affected.

In summary, to use this land will require:
1. Overcoming the objections of abutters,
2. Conservation Commission approval to pass the pipe through conservation land,
3. Agreement to install two (or 3) culverts under Great Neck Road South,
4. A land swap.
5. Insuring that no potable water supply is affected, and if it would be, providing town water to those affected.

Near Shore Disposal
Given that upland disposal is fraught with difficulties, we have considered alternatives

such as de-watering the material in cofferdams in Popponesset Bay or Ockway Bay. One approach for disposal is to convert the cofferdam to a wetland or upland island using the dredged material. Because of the large volume of water involved with hydraulic dredging, this technique is not practical, so we will consider it under mechanical dredging.

Yet another idea is to create an underwater disposal pit (called a Confined Aquatic Disposal (CAD)) and then bury the fine material with some of the clean sand removed to create the pit. Again, because of the volume of water using hydraulic dredging, we will consider this technique under mechanical dredging.

Mechanical Dredging and Disposal

Mechanical dredging is accomplished by having a crane with a clamshell bucket mounted on a barge. The crane digs out the material and places it on another barge for transport to:
a. shore for de-watering and upland disposal,
b. a Confined Aquatic Disposal site,
c. an upland or wetland island construction site, or,
d. to the ocean for ocean disposal in a designated offshore dumpsite.

Unlike hydraulically dredged material, the material contains only about 10%water, and also does not double in volume as it does when hydraulically dredged. Therefore, the de-watering/disposal area required is considerably smaller.

Upland Disposal
Transporting the dredged material to an upland de-watering site is more costly than hydraulic dredging because the material must be moved from the barge to an upland de-watering area, and then when it is dry enough, moved to a disposal area. On the plus side, there is less water to contend with, so the de-watering area can be smaller than what is required for hydraulic dredging. But, we already know there is a lack of suitable de-watering areas in the vicinity of the Mashpee River.

One approach is to put the material in a pit or containment area near the water and let it drain until it is dry enough for transport[6]. This means the transport barge must be able to get close enough to shore to allow earth moving equipment to lift the material off the barge and move it to a de-watering pit. The equipment could be a crane or a front loader that could drive onto the barge over a ramp, remove the material, and place it in the de-watering pit.

Another way to solve this transportation need is to place roll-off containers on the barge, fill them, push the barge to a landing, and move them off the barge to shore to dewater, then transport the containers to the disposal site. This approach saves handling costs, but there is a container rental cost to consider. No details have been worked out yet on this concept.

Near Shore De-watering and Disposal
Near shore disposal includes building wetland (marsh) or upland islands, or confined

[6] Solid waste disposal regulations require that the material pass a "paint filter test". That means that when the material is placed into a paint filter, it does not drip any water.

aquatic disposal. From a permitting perspective, it is not the same as ocean dumping because a different set of sediment analysis requirements pertains. In this case, material would be barged to the disposal site and offloaded by the best means available.

Wetland or Upland Islands -The idea is to build up islands from dredged material. One of the requirements is that the material must not become re-suspended in the water column. This can be achieved by building a containment wall that will protect the fine material from wind and wave action.

One approach to building the retaining wall is to use plastic sheet piling. Initially the height of the wall can be set so that the material is stacked up above the water level, which will promote more rapid de-watering and settling. Height can be adjusted after settling and de-watering is complete by either driving the sheet piles further, or by simply sawing them off to the desired height.

A drawback to sheet piling is that it will create a sheer wall that will reflect waves rather than dissipating the energy, as would a sloping beach. The advantage is that it will last a long time and effectively contain the material. Sandy material (grain-size compatible with beach areas in the vicinity) can be used to fill in around the sheer walls to creating a sloping beach, and in some cases the sand can be contained in "geotubes" (synthetic woven material that is sewn into bags to retain the sand). The tubes, which flatten out under gravitational force, can be planted by making holes in the fabric and transplanting vegetation into the holes. If over time the sloping foreshore is destroyed, the tubes can be replaced. Height of the island will govern whether it is wetland or upland habitat. Height can be easily controlled using sheet piling. It is possible to use geotubes alone, but it is harder to achieve the height needed to contain the material during the de-watering and settling process, and harder to adjust it to the desired height when settling is complete

Confined Aquatic Disposal (CAD) - Assuming a site in the bay can be found that has sand that can be used for beach nourishment, the idea is to excavate an underwater pit and dispose of the sand either on the beach or by side casting it. The dredged material would then be placed in the pit and when finished, buried with a layer of the original bottom sediment or sand[7]. This approach is good for a one-time use of a site, but a new site is needed when maintenance dredging is required. That is not really a problem because Popponesset Bay covers a large area.

Wayne Jaedtke, County Dredge Superintendent, has suggested an innovative approach. The concept is that we could scrape off the mud from the sand below some part of the Mashpee River, dredge the sand hydraulically and use it to nourish the spit, then mechanically dig the channel and deposit the material in the pit. That could be covered with sand or the same bottom material that was scraped off as desired. When he heard of this concept, Mashpee Conservation Agent Bob Sherman stated he had no philosophical problems with it, but that we would have to answer a lot of detailed questions. That is encouraging.

Wayne said that, among other things such as another barge, he would need to get a 2-yard mud bucket for his 20-ton crane. A representative of Cablearm clamshell says that they

[7] Discussion with Dr. Brian Howes reveals that covering the material with sand would have two benefits: 1. The fine sediment would no longer be available to recycle nutrients from the surface layer, and 2. The sandy surface would restore habitat that is now gone due to eutrophication.

can build one. We supplied him with the specifications for the crane the county has now, but we do not have any price or other information back from Cablearm.

There is also sufficient area in the Mashpee River near Gooseberry Island to hold the material. For example if we construct a cylindrical pit 8 feet deep and 175 feet in diameter, it will hold 28,507 cubic yards. A desirable area would be on the north side of Gooseberry Island, which may be within the Wampanoag Tribal Council shellfish grant. If so, the capping of material with clean sand would improve the shellfish habitat in that area, but we would have out work that out with the Council. If the Council does not wish to have that area altered, there is still sufficient room northeast of the grant area. Another idea to consider is having more than one CAD site in the River to reduce handling time.

Offshore Disposal

Offshore disposal may avoid all the pitfalls of obtaining permits for upland disposal, but there are different and more difficult permitting and construction hurdles to overcome. The Army Corps of Engineers just recently published the new rules for sediment evaluation for offshore disposal[8]. An extensive set of tests is required, more so than for upland disposal, and that implies additional expense.

Offshore disposal is usually accomplished using ocean-going barges, which typically draw 8 feet of water. The problem facing many Cape towns is that the water bodies that need to be dredged cannot accommodate the deep draft (8-ft. minimum) ocean going barges needed to safely transport material to the dumpsite. Popponesset Bay for instance is only 2 to 5 feet deep, except for a few holes about 9 feet deep. Further, the channel outside Popponesset Bay is only dredged to 5 feet (6 feet overdredge) and portions are typically 4.5 feet as the sand moves around. Deep draft barges can't even get into the Bay.

One idea is to use shallow draft barges to shuttle the material out to the sound, then transfer it to an ocean going barge. We have been advised by a person who is experienced in mechanical dredging and barge operations that this is not a good thing to do because it is a very sloppy process. You can't avoid spilling material over the side, and that is not allowed environmentally. The alternative remaining is to try to negotiate the ocean with shallow draft barges from Popponesset to the dumping site. Even if the site turns out to be in Buzzards Bay, that trip can be treacherous during the dredging time window (nominally 1 October to 15 January because of fish migration and spawning considerations).

The EPA is scheduled to select the federal offshore site for the ACOE by December of 04, and CZM expects to release an Environmental Impact Statement soon, so each site is likely to be at least a year off from activation. Since Rhode Island initiated the effort to get a Federal site activated, it is logical to expect it will be nearer Rhode Island than the south coast of Cape Cod, but time will tell.

<u>Subsidence Deepening</u>

An innovative approach to solving the disposal problem has been developed by K - V

[8] Regional Implementation Manual, for the Evaluation of Dredged Material Proposed for Disposal in New England Waters

associates of Mashpee. They use a hydraulic dredging technique whereby water is injected down into sandy sediment below the fine sediment, and a slurry of sand and water is pumped out to be disposed of as beach nourishment. Conceptually, this is an attractive approach, but it is still somewhat experimental in nature, and is a very slow process because of the small-scale equipment used. Also, the technique has only had limited use so far, so there are kinks yet to be worked out. .

One requirement for this to be viable is that the sediment underlying the area to be dredged must be suitable for beach nourishment. Although we rejected this approach early in the permitting process because of its limited capacity and high expense, we could re-evaluate it in light of our difficulties finding a place to deposit the material.

One of the drawbacks to this approach is the lack of precision in establishing a channel. The overlying sediment has to collapse into the vacated chamber below. Getting it to conform to an approved channel configuration will be difficult. Hydraulic dredging can create a channel matching specifications within inches, where as this technique will likely be within several feet.

We contacted K-V Associates to get an update on Subsidence Deepening technology. Bill Kearfott related their experience at Red Lily Pond. He thinks the process was highly successful in that the pond was deepened, the sand removed, and they raised a parking lot as desired by the owners. Also, EPA is happy with the process.

He also noted that with the sand capping the deepened area, the sub aquatic vegetation (SAV) is not re-growing as fast as it is in the areas that still have the nutrient laden muck bottom. They did use a 10-inch pipe rather than the 6-inch pipe we were briefed on some time ago, and throughput was greater. There is a problem with accuracy of shaping the dredged area, but he has some ideas of how to improve that. They also learned that the sand under the pond was not a uniform consistency, and now recommend a more extensive coring program so you know more precisely what you dealing with. He would be happy to come to our meeting and give us a 30-minute update if we like.

Another opinion on the project from an unidentified source is that it was a financial disaster. It allegedly cost over 1 million dollars, and did not achieve the desired effect.

Conclusions

After all this deliberation we conclude the following:

Upland disposal in Mashpee is desirable but may not be attainable considering the obstacles involved.

Hydraulic dredging is inappropriate for nearshore and offshore disposal.

Mechanical dredging is preferred for upland disposal if the material is to be transported any distance over land, and is appropriate for nearshore and offshore disposal.

Confined Aquatic Disposal may be the best option if the cost of mechanical dredging can be lowered.

Subsidence Deepening, while an appealing concept, is not yet developed to point where it provides a practical solution to the Mashpee River situation.

Suggested Action

We should:

1. Explore forming a mechanical dredging operation for the County Dredge Department. The cost of mechanical dredging by private enterprise ranges from about $17 to $60 per yard. The question to be answered is: can the County put together a mechanical dredging operation that is lower cost than commercially available services?

2. further develop the concept of burying the material in the Mashpee River or Popponesset Bay (as discussed under confined aquatic disposal above), and work on determining feasibility of implementing the idea.