# Lake George Deltas Sediment Management/Shoreline Restoration Project - Draft Supplemental Generic Environmental Impact Statement (DSGEIS)

# Prepared as a Supplement to the Lake George Deltas Sediment Management/Shoreline Restoration Project Generic Environmental Impacts Statement (GEIS)

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## 1.0 INTRODUCTION

This document is a Supplemental Generic Environmental Impact Statement (SGEIS). It has been prepared as a supplement to the Lake George Deltas Sediment Management Shoreline Restoration Project Generic Environmental Impact Statement prepared for the Lake George Park Commission. This Supplemental GEIS evaluates *"(w)ater quality and benthic impacts resulting from the construction of in-lake roads built with dredged materials, and from the operation of mechanized excavating and support equipment directly in the lake*" as well as "*creation of an unnatural and fertile lake bed resulting from the dredging activities and subsequent prolonged containment of the work area, adding to the increased potential for colonization by non-native aquatic nuisance species."*[1]

The scope and focus of this SGEIS were defined in the SEQRA Scoping document adopted by the NYSDEC on August 25, 2011. A copy of the scoping document is included in Appendix A. It's important for the reader to understand the history of the planned removal of Lake George stream deltas, the environmental evaluation completed to date and the specific focus of this Supplemental Generic Environmental Impact Statement. The introductory sections that follow provide a brief history of the Lake George Deltas Sediment Management/Shoreline Restoration Project ("Restoration Project"), a synopsis of the Conceptual Delta Management Plans included in the Draft Generic Environmental Impacts Statement for the Restoration Project, and the action(s) that triggered the preparation of this supplement to the GEIS.

### 1.1 Brief Project History

*Lake George Deltas Sediment Management/Shoreline Restoration Project*
*& the Generic Environmental Impact Statement*

The Lake George Deltas Sediment Management/Shoreline Restoration Project ("Restoration Project") was formally initiated by The Lake George Association, Inc. in January of 2000. This decision was preceded by several years of discussion and debate involving the lake community, interested individuals and various stakeholders regarding the need to remove the sediment laden deltas. Ultimately the removal of the deltas to restore navigability was identified as a desirable course of action.

The purpose of the Restoration Project is "*remediate the deltas that have formed along the shoreline areas of Lake George due to excessive sedimentation caused by human activities in upland drainage areas.*"[2] The Lake George Association (LGA) was established as the Project Sponsor on behalf of the various Towns and Village surrounding Lake George and the Lake George Park Commission (LGPC) was established as the Lead Agency for the purpose of conducting the environmental review of the Restoration Project.

The LGPC, in consultation with the involved and interested agencies, decided the preparation of a Generic Environmental Impact Statement (GEIS) was the appropriate method to evaluate the potential

[1] NYSDEC. Final Scope for the Lake George Deltas Sediment Management Shoreline Restoration Project Supplemental Generic Environmental Impact Statement, August 25, 2011.

[2] Lake George Park Commission, September 4, 2002. Lake George Deltas Sediment Management/ Shoreline Restoration Project Draft Generic Environmental Impact Statement, page 7..

environmental impacts associated with the delta sediment removal. A GEIS is more general in scope and detail than a project specific EIS and is often prepared when evaluating a series of actions (i.e., dredging of individual deltas) in a similar geographic area or environment and/or when evaluating the cumulative impacts of a project on a common resource (i.e., Lake George). A GEIS can also be utilized in choosing alternatives as well as evaluating impacts on a resource when projects are being proposed by unrelated project sponsors. At the time the Restoration Project GEIS was prepared, the project sponsors and lead agency had not yet determined who would initiate/execute the dredging, nor had they established a timeline for completing the proposed activities.

The Lake George Deltas Sediment Management Shoreline Restoration Project Draft Generic Environmental Impact Statement was subsequently prepared in satisfaction of the requirements of the New York State Environmental Quality Review Act (SEQRA) and its implementing regulations (6 NYCRR Part 617). The Draft and Final GEIS were issued and positive SEQRA findings were adopted, concluding the SEQRA process. A detailed summary of the SEQRA process is provided below in Section 1.4.

The Lake George Deltas Sediment Management Shoreline Restoration Project Draft Generic Environmental Impact Statement (DGEIS) evaluated impacts to water quality, invasive species, aquatic plants, animals and wetlands, fisheries, terrestrial plants animal and wetlands, and a variety of other resources. The DGEIS evaluated the removal of the stream delta sediments by conventional mechanical and hydraulic dredging techniques. As described in Section 3.0 of the DGEIS "(*t)he delta sediments will be removed from the deltas by utilizing either conventional mechanical or hydraulic sediment removal methods (or an appropriate combination of both methods, as may be determined as part of the subsequent Phase 2 detailed design work)"*[3]

For the purpose of project planning and the environmental evaluation, the Restoration Project DGEIS described the lake delta sediment management activities as occurring in three (3) phases:

> Phase 1: Environmental review, which included the Generic Environmental Impact Statement and the preparation of Conceptual Delta Management Plans (CDMPs); this work was concluded in 2004. Additional discussion on CDMPs is provided in Section 1.3 (that follows).
>
> Phase 2: Preparation of detailed design plans and specifications for the individual deltas as well as any required permit applications/permits, and
>
> Phase 3: Implementation of the approved delta remediation measures for the individual deltas as well as any necessary post-remediation monitoring measures.

In this fashion, the Restoration Project was advanced through the complex environmental review process, the cost of the program could be managed, and flexibility on timing of the project was provided.

Sections 1.2.4 and 20.0 of the Restoration Project DGEIS provided guidance on how the Generic EIS was to be utilized as proposals to dredge an individual delta advanced through subsequent design phases:

> *"In the event that a positive findings statement is issued by the involved agencies for the GEIS, the Towns will be able to proceed with Phase 2 of the Project. Phase 2 will consist of preparation*

[3] Lake George Park Commission, September 4, 2002. Lake George Deltas Sediment Management/ Shoreline Restoration Project Draft Generic Environmental Impact Statement, page 15.

*of detailed design plans and specifications and regulatory permit applications for the individual delta remedial projects. In concert with preparation of this detailed project information, the involved agencies will be required to confirm continuing compliance of the proposed detailed delta remedial measures with SEQR. The requirements of SEQR in this regard for the Project are as follows:*

*(1) No further SEQR compliance will be required if the more detailed proposed delta remedial measures will be carried out consistently with the specific conditions and thresholds established in the GEIS and the findings statements.*

*(2) An amended findings statement must be prepared by the appropriate involved agency if the more detailed proposed delta remedial measures were adequately addressed in the GEIS but were not addressed or were not adequately addressed in the findings statements.*

*(3) A negative declaration must be prepared by the appropriate involved agency if the more detailed proposed delta remedial measures were not addressed or were not adequately addressed in the GEIS and the proposed measures will not result in any significant environmental impacts.*

*(4) A supplement to the GEIS must be prepared if the more detailed proposed delta remedial measures were not addressed or were not adequately addressed in the GEIS and the proposed remedial measures may have one or more significant adverse environmental impacts or if they exceed any of the specific conditions or thresholds established in the GEIS or the findings statements."*[4]

As noted previously, the LGPC ultimately adopted SEQR Findings that acknowledged the series of design measures as identified in the GEIS as well as mitigation measures to effectively minimize any potential adverse impacts on the natural environment. The DGEIS utilized development of Conceptual Delta Management Plans (CDMPs) to explore the project's impacts to develop these measures and illustrate their implementation.

## 1.2 Conceptual Delta Management Plans

The Restoration Project DGEIS included "Conceptual Delta Management Plans" for each of the seven (7) deltas targeted for sediment removal. Conceptual Delta Management Plans (CDMPs) were completed for East Brook and West Brook, English Brook, Finkle Brook, Indian Brook, Hague Brook, and Foster Brook. The CDMPs further described the physical characteristics each of the deltas including known chemical character of the sediments, the substrate, subsurface vegetation, the size (and volume) of the delta as well as the historic rate of growth. The CDMPs included detailed information on the dredging methodologies, measures and provisions to ensure future work would be performed in a way to minimize any adverse impacts on the environment.

The DGEIS describes the dredging methods as follows:

[4] Lake George Park Commission, September 4, 2002. Lake George Deltas Sediment Management/ Shoreline Restoration Project Draft Generic Environmental Impact Statement, Page 4

- *Mechanical sediment removal consists of "excavation" of the sediments directly from the lake bottom using clamshells, hydraulic excavators or similar soil excavation equipment mounted on a barge. For this Project, the sediments will be discharged by the excavation equipment into rolloff boxes positioned on barges staged adjacent to the sediment excavation equipment, within the controlled delta work area. The containerized sediments will be drained of any incidental water (i.e., dewatered) directly within the controlled work area and then transferred onshore for transport to the upland reuse area.*
- *Hydraulic sediment removal consists of pumping of the sediments directly from the lake bottom, using a hydraulic dredge mounted on a barge. Pumping of the sediments from the lake bottom will also result in pumping of a large quantity of water together with the sediments, generating a sediment/water "slurry". The slurry will be pumped from the delta to a temporary onshore pretreatment system that will provide for separation of the entrained sediments and lake water. The separated sediments will be trucked to the upland reuse area and the pretreated Lake water will be returned to the lake*. [5]

The GEIS and the Conceptual Delta Management Plans (CDMP) described the two dredging methods in sufficient detail to conduct the environmental analyses and to describe measures to mitigate potentially significant adverse impacts to the environmental resources. The specific removal method(s) for an individual delta would be selected as part of Phase 2 Detailed Design. The removal method would be determined (in part) based on further site characterization and investigation of the selected delta.

### 1.3 Project Evolution- Phase 2 Detailed Delta Removal Plans

The NYSDEC recently received three (3) separate applications for permit(s) to dredge deltas at Hague, Finkle, and Indian Brooks. These applications, received during 2009-2010, proposed the removal of the deltas by mechanical means generally consistent with those methods identified in the GEIS. However, the removal method included a proposal to construct "access pads" from lake sediments to facilitate access of excavation equipment. Rather than utilize barge mounted or land based mechanical excavation equipment (or other means evaluated in the GEIS), the applicant(s) proposed construction of access pads from the lake sediment to allow excavation equipment access to the deltas off-shore. In this manner the excavation would initially occur from on-shore utilizing a long reach excavator to mound delta sediment, forming the access pad. The excavation equipment would then advance along the access pad allowing the equipment to reach those sediments furthest from the shoreline. Sediment material targeted for removal would be mounded to form the pad and sediments would be carried back to on shore areas for transport off-site to approved upland areas. The original GEIS and the CDMPs did propose the construction of a temporary rock work pad to be located at the shoreline. The rock pad would provide a staging area for an excavator or crane at the shoreline to facilitate the excavation of sediment and/or to facilitate the movement of equipment in and out of the lake. The pad would be constructed of rock or a gabion basket placed directly on the lake bottom.

Upon review of the applications and supporting material, the NYSDEC made a determination that the proposed dredging may have potential significant adverse environmental impacts not previously

[5] Lake George Park Commission, September 4, 2002. Lake George Deltas Sediment Management/ Shoreline Restoration Project Draft Generic Environmental Impact Statement, Page 16

evaluated in the DGEIS. The NYSDEC issued a Positive SEQR Declaration (April 25, 2011) indicating further environmental analysis of the project would be required and that a Supplemental Generic Environmental Impacts Statement shall be prepared. A copy of the Positive Declaration is included in Appendix A. The NYSDEC conducted a public scoping session on May 25, 2011

The NYSDEC identified the potential significant adverse impacts associated with the planned alternative dredging technique (use of access pads/placement of equipment in water) and articulated those issues that required further evaluation in the Positive declaration and Scoping Document. The NYSDEC as lead agency for this supplemental environmental review specified that the

> "*SEIS will be limited to the comparison, evaluation, and recommendation of the different dredging methods, as the dredging itself, and a majority of the impacts from dredging in general have already been considered previously in the duly adopted GEIS. Moreover, the original GEIS previously considered potential environmental impacts on the area within the "controlled work zone" and found that these areas would be impacted and focused the environmental review on impacts outside of the silt curtains and potential impacts post-dredging, once the silt curtain have been removed. To further this discussion, the SGEIS will address practices for reducing the potential for algae blooms and colonization by non-native aquatic species by avoiding the creation of unnatural bed conditions resulting from the dredging and prolonged work area containment. The SGEIS shall analyze all measures to mitigate the impacts from the physical reorganization and biological availability of suspended sediment-bound and soluble nutrients that occurs during the dredging operations, including an analysis of removing the work area containment curtains to disperse nutrients remaining in suspension*."[6]

## 1.4 SEQRA History & Process

*SEQRA History*

A brief summary of key SEQRA milestones for the Lake George Deltas Sediment Management Shoreline Restoration Project:

- January 31, 2000 by LGA's Full Environmental Assessment Form ("Full EAF")
- May 23, 2000 the Lake George Park Commission ("LGPC") accepted the role of SEQR Lead Agency for the Project.
- June 27, 2000 LGPC issued a SEQR Positive Declaration
- June 28, 2000 to August 11, 2000 Scoping period
- March 20, 2001 LGPC issued a final scope for the DGEIS to LGA and the involved agencies
- September 4, 2002 DGEIS accepted by LGPC as complete
- September 23, 2002 public hearing on the DGEIS
- September 4, 2002 to December 23, 2002 written comments on DGEIS accepted

[6] NYSDEC. Final Scope for the Lake George Deltas Sediment Management Shoreline Restoration Project Supplemental Generic Environmental Impact Statement

- Public information sessions on the DGEIS conducted on September 23, 2002 at the Lake George Town Center and on September 24, 2002 at the Hague Community Center
- December 2003 Final GEIS ("FGEIS") presented to LGPC
- April 20, 2004 FGEIS accepted by LGPC as complete
- May 25, 2004 SEQRA Findings adopted by LGPC

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- February 18, 2012 NYSDEC declared itself lead agency
- April 25, 2011 The NYSDEC issued a Positive Declaration determining that the Finkle Brook, Hague Brook, and Indian Brook delta dredging projects may have a significant adverse environmental impacts and that a Draft (Supplemental) Environmental Impact Statement
- May 25, 2011 Public Scoping Session at Town of Bolton Town Hall
- June 6, 2011 Close of Comment on Scoping
- August 25, 2011 NYSDEC adopts scoping document

A copy of the Scoping Document is included in Appendix A.

*SEQRA Process*

Once this DSGEIS is deemed complete and adequate by the NYSDEC, the document will be made available for public review and comment. A public hearing will be conducted to solicit comments during the public comment period. At the conclusion of the public comment period, the NYSDEC will direct preparation of a Final Supplemental Generic Environmental Impact Statement (FSGEIS). The FSGEIS will respond to substantive comments received by the NYSDEC on the DSGEIS. Consistent with the requirements of SEQRA, comments on the DSGEIS should be limited to new issues identified and discussed in the supplement, and not on elements already addressed in the original Restoration Project GEIS.

Upon completion and acceptance of the FSGEIS, the NYSDEC will prepare a findings statement. The findings statement documents that the requirements of SEQR have been met. A positive findings statement means that the project is approvable after consideration of the EIS and determines that the project will minimize or avoid environmental impacts to the maximum extent practicable. If the project is not approvable, a negative findings statement documenting the reasons for the denial must be prepared. In findings either supporting or denying a project, the reasons must be given in the form of facts and conclusions that are derived from the EIS.

The Restoration Project GEIS and the associated SEQRA Findings established criteria under which the future dredging actions will be specifically undertaken or approved, including requirements for any subsequent SEQR compliance.

Prior to proceeding with actual remediation of the individual deltas, the NYSDEC (or whoever has appropriate jurisdiction) will evaluate the consistency of the actual proposed delta remediation measures with the DGEIS, the FGEIS, the SEIS and the findings statement (collectively the SEQR Record).

Any significant inconsistencies that may exist between the actual proposed delta remedial measures and the SEQR Record will be subjected to further review under SEQR and may be the subject of a negative declaration of significance, a supplement to the FGEIS, or a modified findings statement, as appropriate.

## 1.5 Organization of the Document

- Section 1 describes the purpose and scope of this SGEIS and summarizes the SEQR process as it will apply to the Project.
- Section 2 provides a description of the Project purpose and the public need and benefit that will be addressed by implementation of the Project.
- Section 3 provides a general description of the Project, including an identification of the various regulatory permits and approvals that will (or may) be required to be issued in order for the individual delta remedial measures to proceed.
- Section 4 provides a discussion of the existing environmental setting, analysis of the potential adverse environmental impacts as they may relate to evaluating additional methods of dredging, and proposed mitigation measures for those areas not previously evaluated in the Draft GEIS.

# 2.0 PROJECT PURPOSE & NEED

The purpose, need, and benefits related to the currently proposed project remain the same as those of the project evaluated in the Restoration Project DGEIS and FGEIS. As stated in the SEQR Findings Statement prepared for the Restoration Project:

> "*The purpose is to remediate the deltas that have formed in Lake George due to excessive sedimentation caused by human activities in upland drainage basins. This will be achieved by the removal of delta sediments from the Lake and disposal of those sediments in upland locations, for possible reuse.*
>
> *The need for the Project derives from interference with navigation and safety hazards caused by delta sediments creating shallow areas in the Lake that are too shallow for customary navigation in the affected areas. The deltas also affect the aesthetics of the affected areas of the Lake by creating a brownish shallow water look instead of the natural blue color of deeper water. The deltas are also believed to interfere with fish spawning in tributary brooks.*
>
> *The anticipated benefits of the Project include restoring navigability to areas where deltas currently impede navigation, restoring access to shoreline properties and docks, reducing the need for offshore docks or longer docks, preserving the assessed value of impacted onshore properties, improving safety of navigation, restoring aesthetics in those areas, improving the accessibility of tributary streams for fish spawning, improving DEC's fish netting program at Hague Brook, and providing reusable sediment materials for use by the participating municipalities*."[7]

As stated in NYCRR Part 617.1, "SEQR requires that all agencies determine whether the actions they directly undertake, fund or approve may have a significant impact on the environment, and, if it is determined that the action may have a significant adverse impact, prepare or request an environmental impact statement." The notable phrase in this preamble to the enabling legislation is the determination of a potentially "significant adverse impact." In compliance with SEQR, the DEIS and this Supplemental DEIS focus on the potentially "significant adverse impacts" of the proposed dredging. However, in determining if the risk of adverse impacts is appropriate, the positive aspects of the proposed action must be weighed. In this case, the removal of shallow, nutrient loaded sediments is believed to reduce the pool of available phosphorus to shallow sediments. As discussed in Section 4.1.1, these shallow sediments can support blooms of algae that lower water quality. In addition, the shallow sediments represent a hazard to navigation and a safety issue, particularly for the numerous small craft that use Lake George.

In the time that has passed since the Restoration Project GEIS was issued, the project purpose, need and benefits have not diminished.

[7] Lake George Park Commission, May 25, 2004. Lake George Deltas Sediment Management/ Shoreline Restoration Project Draft Generic Environmental Impact Statement - Findings Statement.

# 3.0 DESCRIPTION OF THE PROPOSED ACTION

## 3.1 General Project Description

The proposed action is the removal of deltas that have formed at the tributary waters to Lake George. This Supplemental GEIS does not modify or alter the proposed "Action" as described in the DGEIS, rather the intent of the Supplemental GEIS is to further describe the range of dredging (or sediment management) methodologies that may be employed in the removal of the deltas, and to evaluate the potential adverse environmental impacts of those methods not previously explored and as identified in the scoping document.

The project as described in the DGEIS *"…consists of remediation of deltas that have formed along shoreline areas of Lake George due to excessive sedimentation caused by human activities in upland drainage areas, consistent with the Project purpose, needs and benefits. Most typically, the deltas have formed where tributary brooks enter the Lake but the Project is intended by LGA to also encompass deltas that may also occur where engineered drainage structures, such as culverts, empty into the Lake. In general, the Project is primarily intended to address existing deltas that have formed due to previous human activities in upland areas."*[8]

No substantive changes to the project are proposed but for the noted modification to sediment removal technique. The Conceptual Delta Management Plans prepared as a component of the DGEIS and provided in Appendix C to the DGEIS identified that the delta sediments would be removed through mechanical or hydraulic dredging methods (see Section 6.1 of the CDMP).

The DGEIS described the dredging methods as follows:

- *Mechanical sediment removal consists of "excavation" of the sediments directly from the lake bottom using clamshells, hydraulic excavators or similar soil excavation equipment mounted on a barge. For this Project, the sediments will be discharged by the excavation equipment into rolloff boxes positioned on barges staged adjacent to the sediment excavation equipment, within the controlled delta work area. The containerized sediments will be drained of any incidental water (i.e., dewatered) directly within the controlled work area and then transferred onshore for transport to the upland reuse area.*
- *Hydraulic sediment removal consists of pumping of the sediments directly from the lake bottom, using a hydraulic dredge mounted on a barge. Pumping of the sediments from the lake bottom will also result in pumping of a large quantity of water together with the sediments, generating a sediment/water "slurry". The slurry will be pumped from the delta to a temporary onshore pretreatment system that will provide for separation of the entrained sediments and lake water. The separated*

[8] Lake George Park Commission, September 4, 2002. Lake George Deltas Sediment Management/ Shoreline Restoration Project Draft Generic Environmental Impact Statement. Page 14.

*sediments will be trucked to the upland reuse area and the pretreated Lake water will be returned to the lake*. [9]

The DGEIS indicates that excavation equipment would operate from the adjacent upland area, from gabions placed in the water, or from sectional barges. A copy of "Conceptual Delta Management Plan - Finkle Brook & Indian Brook Deltas" is provided in Appendix B of this document as a convenience to the reader and an example of the document include in the DGEIS. We refer the reader to Section 6 of the CDMP as well as Section 3.0 of the DGEIS for a complete description of the methodologies.

## 3.2 Alternative Dredging Methods

### *3.2.1 Common Components*

The Conceptual Delta Management Plan (CDMP) identified common components to the two general methods of dredging (mechanical and hydraulic). These common components remain largely unchanged and are applicable to the alternative methods described below in Sections 3.2.2 through 3.2.4. Project components that will be common to all sediment removal methods include the following:

- *Seasonal Scheduling* The sediment removal activities will occur in the late summer and Fall (i.e., in-Lake work commencing after Labor Day). The sediment removal activities as summarized above will require mobilization by the contractor prior to commencement of the active sediment removal activities. In-lake mobilization will commence only after Labor Day, while mobilization for onshore or upland project work may commence prior to Labor Day, following review and approval by the Town. The contractor will be allowed to work as far into the fall as necessary, weather permitting.

- *Daily Work Scheduling* Subject to review and approval by the Town, the sediment removal contractor will work six days per week (Monday through Saturday), commencing no earlier than 7:00 a.m. The contractor will generally be allowed to work until dusk; no work will occur after dusk.

- *In-Lake Equipment Mobilization* Sediment removal activities may require use of various heavy equipment pieces in the lake, such as dredges, sectional barges, cranes, tugboats and workboats, etc. Since the lake is "landlocked", with respect to movement of heavy equipment into the lake, the equipment will be mobilized to the lake via the local roadway system. The equipment will be moved into the lake using either existing available docks or boat launching ramps or it can be "swung " into the Lake using land-based cranes, etc. The specific locations and logistics for mobilizing the project equipment into the Lake will be determined during Phase 2, as part of the detailed project design.

- *Lake-bottom Vegetation Removal* In the event that Eurasian Watermilfoil (Section 7 of the DGEIS) is present in or immediately adjacent to the proposed limit of

[9] Lake George Park Commission, September 4, 2002. Lake George Deltas Sediment Management/ Shoreline Restoration Project Draft Generic Environmental Impact Statement. Page 16

disturbance for the sediment removal activities, these plants will be removed by hand prior to beginning the sediment removal activities. The plants will be removed from the Lake and appropriately disposed of upland. Remaining existing Lake-bottom plants may be removed prior to beginning the sediment removal activities, depending on the actual density of plant growth and the actual sediment removal methodology to be used. Removal of bottom vegetation would likely not be necessary in advance of mechanical sediment removal activities, while it may likely be appropriate for hydraulic sediment removal activities, to prevent fouling of the hydraulic slurry lines and equipment. The specific need and actual method for removing Lake-bottom vegetation prior to commencing sediment removal will be investigated and confirmed as part of the Phase 2 detailed design phase.

- *Use of Silt Curtains and Floating Oil Booms* Silt curtains and floating oil booms will be positioned and maintained around critical working areas, to contain and control turbidity and incidental oils generated by the work activities. (Note that the original DGEIS and this document use the terms silt curtain and turbidity curtain interchangeably.) For mechanical sediment removal, the "loaded" rolloff boxes will be retained at the delta within a work area encircled by silt curtains and a floating oils boom until the in-box dewatering process is complete; at this point the rolloff box will be "released" from the silt curtain area. Similarly, silt curtains and floating oil boom will encircle any excavation equipment operating on an access road or operating directly on a delta. The general use of silt curtains and floating oil booms is further described in Section 6.3 of the DGEIS. Typical types of silt curtains that will be utilized are depicted in Figure 6 of the CDMP. Floating material and vegetative material contained by the silt curtain and floating oil boom will be removed and discharged onshore to rolloff boxes. When full the rolloff boxes will be disposed of at an appropriate permitted disposal facility.

- *Turbidity Monitoring Program* A turbidity monitoring program will be implemented during the active sediment removal activities. The turbidity monitoring program that will be provided as summarized in Section 6.3 of the DGEIS. Visual inspection of turbidity is required as described in the CDMPs.

- *Erosion and Sediment Control Measures* Appropriate erosion and sediment control measures and structures will be provided for all onshore work areas. During construction activities soil erosion control will be accomplished by sequencing site disturbance activities, establishing erosion controls, minimize disturbed areas, maintain existing vegetation as much as possible, and stabilize newly disturbed areas as soon as possible. Stormwater pollutant controls that will be utilized during construction will include erosion and sediment barriers designed in accordance with the *NYS Standards and Specifications for Erosion and Sediment Control*. For example, as shown on Figure 4 of the CDMP, silt fence and/or hay bales will be installed around the perimeter of the hydraulic slurry pretreatment system (or any temporary soil staging areas), to contain and control drainage from the active work areas, etc. Complete erosion and sediment control measures will be developed as part of the Phase 2 detailed design work.

- *Upland Transport and Reuse* From the onshore material staging area the dewatered sediments will be trucked to the designated upland reuse area, where they will be either directly used onsite for grading purposes or temporarily stockpiled for subsequent reuse by the Town. Appropriate stormwater management controls and erosion and sedimentation control measures will be provided and maintained for this activity at the upland reuse location.

### *3.2.2 Mechanical Dredging from In-Lake Temporary Access Pads*

This method of dredging was identified in the Dredging Plan and Logistics for Hague Brook prepared by the Warren County Soil and Water Conservation District in November 2009. Similarly this method was also identified in the Dredging Plan and Logistics for Finkle Brook and the Indian Brook Dredging Plan. This method of sediment removal is similar to the mechanical dredging method identified in the Conceptual Delta Management Plan Section 6.1, except that instead of excavators working from a barge and loading material into roll-off containers, the equipment would work from an temporary access pad constructed in-lake of dredged material moved by the excavator to form the pad and/or on material placed in the lake to raise the elevation adequate to create an access pad where the top is above the summer water elevation.

A description of this mechanical dredging method is provided below.

- Sediments will be excavated directly from the Lake bottom using conventional long reach excavation equipment traveling on temporary access pads constructed of lake sediments or clean stone or similar material staged on geotextile fabric.

- The access pad would be constructed by an excavator working first from shore and using excavated sediment material to form the access pad. As a pad is formed/created, the excavator would access the lake from the pad, and would continue to form the pad out to the outer limits of the planned dredging. The access pad will project approximately one foot above the lake elevation.

- The excavator equipment would proceed to the furthest end of the temporary access pad, generally a maximum of 300 feet from shore to initiate sediment removal. Sediments within reach of the equipment would be collected, moving material toward shore/landward along the access pad. Work would proceed from the deeper parts of the lake (and the thinnest portion of the delta) towards the near shore area consolidating and moving the excavated material from both the lake and the access pad back to the upland area. Sediments will be removed in this fashion until the access pad and delta sediments are removed to the target excavation depth.

- Where the delta sediments do not provide a suitable platform for the excavator equipment, alternative 'clean' materials may be utilized to complement or form the access pad. This material may include clean washed stone, crane mats (i.e., wood/timber mats constructed for exaction purposes), gabion baskets or similar structures. Any material must be cleaned/washed to ensure that no foreign substances or invasive species are introduced into the lake.

- In order to allow initial access to the lake (and as a means of staging excavation equipment, barges, or other sediment handling equipment) a temporary rock work pad may be constructed as described in the DGEIS.

- Consistent with the dredging methods described in the Conceptual Delta Management Plans, excavation equipment could also gain access to the lake via light weight sectional barges. Equipment may be loaded onto a barge or directly access the barge from the shoreline via the temporary rock work pad. The use of sectional barges could be conducted in concert with the use of temporary access pads.

- Sediment forming the access pad and lying above the waterline will naturally (gravity) dewater allowing removal directly to the temporary staging area within the controlled work zone, consistent with the dewatering for mechanical dredging contained in the original DGEIS.

- Alternatively, sediments collected by the excavation bucket may be placed into 20-cubic yard roll off boxes (adapted for this purpose) staged on segmented barges or the temporary access pad. Similarly, excavated material can be loaded directly into truck body capable of carrying soils. Under this method, a portion of the haul truck may enter the lake – although no part of any equipment not specifically design for submersion in water will enter the lake. Dewatering of these sediments will occur through those means previously described in the original DGEIS (incidental decanting, manual pumping, and draining of boxes fitted with a drainage port and filter basket/media). Dewatering and the handling of roll-off boxes and barges will be performed consistent with those methods described in the DGEIS.

- Based on the size of the delta, multiple access pads may be constructed. The area to be dredged may be divided up into smaller sections as determined during detailed design (Phase 2).

- Where the excavator can reach sediments directly from shore, access pads may not be required.

- Excavated sediments may be temporary placed in a temporary staging area. The temporary sediment stockpile would be removed daily, assuming the sediment is sufficiently drained for on-road transportation (i.e. no free liquids in trucks on public roads).

- Trucks would receive material from the temporary stockpile or directly from the excavator and move that material to the final disposal location.

### *3.2.3 Mechanical Dredging From Equipment Operating Directly On the Deltas*

This method would be very similar to the method described in Section 3.2.2 (above), including dewatering of sediments as discussed in the original DGEIS. However, instead of excavators working from barges or from temporary access pads, they would work directly in the water on the deltas. A description of this mechanical dredging method is provided below.

- Excavators would track directly on the delta sediment surface, subject to the operational limitations of water depth with the proposed equipment.
- Temporary access pads may still be utilized to provide access for haul trucks to the active dredge areas. Temporary access pads would be built and utilized as described above.
- Alternatively, haul trucks would back out into the water, driving on the delta sediments in the same manner as the tracked excavators. In the scenario, the haul trucks would be loaded directly by the excavator without the need for temporary access pads.

### *3.2.4 Conveyor System to Transport Material into Roll-Off Containers*

This method would be very similar to the method described in Section 3.2.2. However, instead of excavators loading material onto roll-off containers, the excavator would place the material onto a conveyor system located on barges which would move the material to the shoreline for loading into trucks. A description of this alternate soil conveyance method is provided below.

- The sediments will be excavated directly from the lake bottom as described above or in the Conceptual Delta Management Plans.

- Sectional Barges may be tied together to form an extension of the shoreline, similar in appearance to an access pad. A mechanical conveyor belt will be staged on the sectional barge to allow transport of sediments from far shore to on shore (or near shore) locations. The sediments collected by excavating bucket will be discharged onto a conveyor belt.

- The conveyor belt will transport the sediments to the shoreline where they will be unloaded into an interim stockpile and/or waiting haul trucks.

- Where sediments require additional dewatering prior to transport, they will be stockpiled in the interim stockpile area or a specially adapted rolloff box that will provide for sufficient dewatering of the containerized sediments, consistent with those methods described in the original DGEIS.

- The active in-Lake work area, including the interim stockpile area for completion of dewatering, will be encircled by silt curtain to control and contain turbidity (i.e., referred to as the "controlled work zone"). The general use of silt curtains and floating oil booms is further described in Section 6.3 of the DGEIS.

*A typical soil conveyance system (conveyor), actual systems may vary based on specific application.*

# 4.0 ENVIRONMENTAL SETTING, POTENTIAL IMPACTS AND MITIGATION

## 4.1 Water Quality

### *4.1.1 Environmental Setting*

The Darrin Fresh Water Institute has conducted water quality measurements in Lake George since the 1970's, and they reported a decline in water quality between 1970 and 1990, as reported in the DGEIS and in Boylen, et al. (1992)[10]. More recent monitoring data from the Darrin Fresh Water Institute have reported variable conditions but no clear trend in water quality measurements[11]. The Lake continues to enjoy high quality water, but the south basin is consistently enriched with nutrients and with more sediments than the northern basin. This report attributes most of the nutrient inputs to urban runoff in the southern basin. The deep water near Tea Island in the southern basin is depleted in oxygen, which can impact the deep water fishery for which Lake George is well known. The latest available data from the 2008 season[11] reported that the deepest water near Tea Island (30 m, ~100 ft.), declined in oxygen saturation seasonally. In early July, this deep water was just below 80% saturated. Oxygen concentrations declined through the summer and reached 12% (1.4 mg/l) by late October. When the surface water, which remained oxygen-rich, chilled to the same temperature as the deep water in November, the entire water column was free to mix and oxygen saturation was restored. This trend is attributed to nutrients (phosphorus) washed in from developed areas in the southern basin and sediments from runoff. The nutrients promote the growth of algae in the shallower water. When the algae settle into deeper water they consume oxygen.

In addition to the Fresh Water Institute reports, the Citizen's Statewide Lake Assessment Program (CSLAP)[12] has released monitoring data from selected locations around Lake George that confirm the water quality conditions remain oligotrophic. This report describes changes in water quality from year to year but does not report any clear trend.

The picture that is painted of Lake George water quality is one of a very high quality resource that is threatened by runoff from development. Runoff contains nutrients, and the nutrient that is in shortest supply in Lake George is phosphorus. Phosphorus is readily bound to sediments, and the continued inputs of phosphorus from land and the availability of the phosphorus in shallow sediments may be the mechanism that has promoted the growth of blooms of algae associated with sediments.

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[10] Boylen, C.W., L.W. Eichler, T.B. Clear, and C.D. Collins. 1992. Report on the Lake George Chemical Monitoring Program, 1980-1990. Rensselaer Fresh Water Institute, Rensselaer Polytechnic Institute, Troy, NY.

[11] L.W. Eichler, L. Aherns, and C.W. Boylen 2010. Report on The Lake George Offshore Chemical Monitoring Program: 2009. DFWI Tech. Report # 2010-4. Darrin Fresh Water Institute.

[12] CITIZENS STATEWIDE LAKE ASSESSMENT PROGRAM, CITED BY LAKE GEORGE ASSOCIATION, http://www.lakegeorgeassociation.org/what-we-do/Citizen-Science/documents/2011summary.pdf, retrieved 8/13/12

### *4.1.2 Potential Impacts*

#### 4.1.2.1 Impacts Common to All Alternatives

The potential impacts to water quality from mechanical dredging and from hydraulic dredging were described in the DGEIS in Section 6.2. The DGEIS fully discussed the potential impacts to water quality from three distinct mechanisms:

1. Potential water turbidity and associated clarity impacts arising from physical re-suspension of bottom sediments into the ambient water column.
2. Potential nutrient loading impacts to the ambient water column, arising from disturbance of sediments and sediment interstitial water containing elevated levels of nutrients.
3. Potential release to the ambient water column of toxic or other deleterious constituents that may be associated with the disturbed or exposed sediments.

These mechanisms would also apply to any of the alternatives considered in the SGEIS. The differences in potential impacts to water quality between the alternatives described in Section 3.2 of this document are described in this section, and any impacts not presented in the DGEIS are also evaluated here.

Water quality impacts can be described as those that could occur in the following two zones:

- The controlled work zone within the silt curtain barrier; and
- The zone outside of the silt curtain.

In addition, potential impacts include:

- Temporary, short-term impacts on the order of a week or two; and
- Longer-term or permanent impacts.

Potential impacts in both zones (the controlled work zone within the silt curtain and outside the silt curtain) need to be considered in the event of an accident during construction. Mitigation measures for these potential risks are described in Section 4.1.3. Some accident scenarios that were considered include:

1. Fuel or oil releases from equipment. All the alternatives require heavy equipment to be operated either near shore, on temporary fill over the water, in the water, or from barges in the water. This equipment has large moving parts that require frequent lubrication. Small amounts of lubricants may be discharged from the equipment. In addition, there is a risk of accidental release or spilling of diesel fuel and hydraulic fluid if the equipment fails. The potential impacts to water quality from these hydrocarbons are described in the DGEIS;

2. Release of turbidity from a failure of a silt curtain. Silt curtains can be breached by equipment, wave action, boats that enter the work zone that are unaware of the activity, or heavy rain that creates an increase in water pressure on the landward side of the curtain if the curtain is anchored;

3. Introduction of fill. The alternative that uses temporary pads in the water may require the introduction of fill. All fill material would be tested to determine that it conforms at a minimum to standards for non-hazardous waste material set forth in the Toxic Characteristic Leaching Procedure (TCLP).[13] This testing would extend to the sediments removed from Lake George. In the event that any of the dredge material fails to meet TCLP screening, it would be treated like hazardous material and would not be used for any in-lake construction of pads;

4. Disturbance of existing contaminated sediments. If toxic materials reside in the sediments, the removal of this material could release toxic materials to the water column. In addition, the removal of the sediments would release nutrients into the water column. As described in the previous statement, all material would be tested;

5. Runoff of contaminated material from onshore activities. The movement of heavy equipment of soft soils on land, the dewatering activities, and other construction activities could result in uncontrolled runoff of nutrients, grease, fuel, and other materials back into the water. Any onshore activities would be conducted in accordance with Best Management Practices that would include the protection of the work areas with hay bales or other sorbent materials and silt fences to control runoff back to the Lake.

6. Removal of delta sediments in the near-shore portions of the deltas could result in increased wave action in these areas, which in turn could provide increased erosive energy on the shoreline. Suspension of eroded soils may affect water quality.

7. Introduction or movement of invasive species. Invasive species in the controlled work zone could be released and relocated, or if dredging were to take place at multiple sites movement from one site to another could introduce invasive species.

In addition to the discussion of the potential impacts that was conducted in the DGEIS, this supplemental analysis reviewed additional literature. The most likely source of impacts to water quality relate to the resuspension of sediments during the dredging operation. All of the alternative methods of dredging could result in the resuspension of materials that could lead to all three of the impacts listed above under 4.1.2.1. Unless there is a failure of a silt curtain or an accident, these impacts would be limited to the area within the work zone*, not affecting lake water quality and would be temporary in nature.*

Sediments in the shallow deltas proposed for dredging in Lake George are composed mainly of clean sands that settle quickly after being suspended. The worst case would be if the sediments were fine and laden with contaminants. A study that addressed this issue was by Grimes (1980)[14]. In this landmark study Mississippi River sediments consisting of sandy clay that contained high levels of total and fecal coliform bacteria, as well as fecal streptococci, were hydraulically dredged and deposited in the river outside of the shipping channel without containment. Predictably, water around the dredge pipe

[13] USEPA. SW-846. Solid Waste Test Methods for Compliance with RCRA. http://www.epa.gov/epawaste/hazard/testmethods/sw846/

[14] Grimes, D.J. 1980. Bacteriological Water Quality Effects of HydraulicallyDredging Contaminated Upper Mississippi River Bottom Sediment. Applied And Environmental Microbiology, Apr. 1980, p. 782-789.

effluent had high levels of bacteria and high turbidity. The upstream river water had a turbidity of 17.7 NTU[15] and the turbidity in the river at the dredge effluent discharge was 151.4 NTU. However, 2 km downstream the turbidity and the bacterial level were down to pre-impact levels. At the mean flow rate of 0.15 m/s this represents a settling of suspended material in 222 minutes, or under 4 hours. In the controlled and isolated conditions anticipated in Lake George it is reasonable to assume that any suspended material would settle at a similar or more rapid rate within the containment zone. Lake Tahoe, California and Nevada, is similar in many ways to Lake George. It has very high water quality, and a relatively small watershed that is experiencing rapid growth and inputs of nutrients from human activities. In a review of the water quality issues of Lake Tahoe, Reuter and Miller[16] summarized past studies on nutrients released from dredging around marinas and put those impacts in context with other inputs. They concluded that the bioavailability of phosphorus and nitrogen varied from marina to marina, but generally only 1-6% of the total phosphorus was biologically available. Phosphorus is known to bind to clay minerals in sediments and not be available to support algal growth in the water column. Reuter and Miller summarized another study by Hackley, et al. (1996) that placed the impacts from dredging of a single marina on the order of 1-10 kg of total phosphorus (TP) as "comparable to other inputs from human activities. For instance, release of five kg of TN or TP was calculated to be roughly equivalent to the load in urban runoff from five acres of medium-developed residential or two to three acres of tourist-commercial property." Utilization of the best management practices proscribed in the DGEIS, including the use of double layers of silt curtains, would reduce these potential inputs of nutrients to the water column.

Data collected in Lake George at Hague Brook, Finkle Brook, and Indian Brook (Appendix D) indicate that the composition of the sediments to be removed in the deltas is predominantly coarse and medium-grained sands, low in organic material. This is consistent with the typical deposition of material near the mouth of deltas, where the coarsest materials would have been deposited. Thus, the material proposed for dredging is likely to settle rapidly and not be associated with a high level of fine material or organics that would be associated with turbidity and nutrient issues found when dredging under conditions such as the marinas studied in Lake Tahoe. Thus, the conditions described above in Lake Tahoe represent a worst case scenario.

[15] Nephelometric Turbidity Units

[16] John E. Reuter and Wally W. Miller. Chapter Four: Aquatic Resources, Water Quality, and Limnology Of Lake Tahoe And Its Upland Watershed In Dennis D. Murhy and Christopher M. Knopp, Editors. Lake Tahoe Watershed Assessment. US Department of Agriculture Forest Service. Accessed 9-23-12: http://www.fs.fed.us/psw/publications/documents/gtr-175/

**Table 4-1: Potential Significant Adverse Impacts of All Dredging Alternatives**

| | **Within the Work Zone** | **Outside the Work Zone** |
|---|---|---|
| Accidental release of diesel fuel and grease | Some small amount of contamination likely; larger releases unlikely. | Would require a breach of the silt curtain barriers and failure of containment booms. |
| Potential significant Impacts | Small releases not significant; large spills would require clean-up response | Small releases would not affect conditions outside the work zone. Larger spills would be cleaned up within the work zone. If the silt curtain were also breached, a large spill would result in the spread of hydrocarbons on the surface. This could adversely impact fishing, recreation, and the ecosystem in general through toxicity and reduction in gas exchange. An emergency response would be activated to contain the spill with containment booms and removal of material with sorbents to mitigate potentially significant impacts. |
| Release of turbidity | Would happen within the Work Zone | Would require a breach of the silt curtains. Some turbidity would be released at project conclusion when the silt curtains would be removed. Turbidity could also result from increase wave energies attributable to alteration of the near shore environment- allowing for further erosion of the shoreline. |
| Potential significant Impacts | Turbidity in the work zone would not cause impacts beyond those resulting from the dredging activity. | A breach of the silt curtain would release turbidity to the surrounding area. The turbidity would be visible, and would temporarily impact recreation. The turbidity would rapidly diminish over a few days as the particles settled and disperse. Nutrients could be released along with the turbidity that might stimulate algal growth in the area. |
| Introduction of contaminated fill | Not likely, screening fill should be adequate to assure quality | Very unlikely |
| Potential significant Impacts | Very unlikely | Very unlikely |

| | | |
|---|---|---|
| Disturbance of existing contaminated fill | No evidence to suggest any contaminated fill, but if any is encountered it could contaminate the Work Zone | Very unlikely |
| Potential significant Impacts | Unlikely, but large volume of water in the work zone would rapidly dilute small amounts of contaminants to safe levels | Very unlikely |
| Runoff from shoreline activities | Plans would capture any runoff within the work zone, where sediments would settle | Very unlikely |
| Potential significant Impacts | Runoff from the shoreline might increase turbidity in the work zone, but this area would already temporarily impacted | Very unlikely |
| Introduction or movement of invasive species | Not likely, work sites would be surveyed prior to construction and any invasive species would be hand harvested or covered with mats. New equipment on site would be power washed | Very unlikely, no more of a risk than the introduction of invasive species elsewhere in the Lake. |
| Potential significant Impacts | Unlikely, see text on invasive species. | Unlikely, activities within the work zone would not release or otherwise encourage the growth of invasive species outside the work zone. |

### 4.1.2.2 Mechanical Dredging from In-Lake Temporary Access Pads

This alternative would potentially have similar impacts to water quality as the other methods outside of the controlled work zone. As is true of all methods of dredging, the controlled work zone within the silt curtain and oil booms would temporarily be impacted by increased turbidity from the dredging. These impacts were addressed in the DGEIS. Since the construction of the temporary pads and their removal after the dredging represents an additional in-water construction activity compared to using barges, the period of disturbance would likely be increased. This method would require the material in the pads to be moved twice (once when the pads are constructed and once when the material would be removed) within the work zone, the length of time that turbidity would be released, and the potential for an accident that could release fuel or oil, or cause a breach in the silt curtains. This method has been used in the lake before at several sites including the Darrin Fresh Water Institute and the Sheriff's dock with success and without significant adverse impacts. It is relatively simple and cost effective. Since heavy excavators would be on the pads, any fuel or oil spilled on the pads could be contained by absorbent mats, booms and other mitigation. All the equipment would include automatic shutoffs to prevent spills. These fluids all float and can be contained on the surface and collected with sorbent material However, if a serious accident did occur, it would likely enter the water and contribute to degraded water quality within the work zone, as delineated by a silt curtain and oil boom zone. Any release of hydraulic fluid or diesel fuel outside the work zone would require an emergency spill response. DEC maintains a spill response team that can be called on a dedicated spill hotline.

If the pads were to become unstable and settle there is a risk of a failure of the pad that could result in an excavator becoming unstable. This equipment is designed to federal standards to work in wet and harsh conditions, and all fluid reservoirs are sealed. Caps for the hydraulic reservoir and fuel tanks are all above the turntable on which the equipment pivots. An excavator or truck would have to completely tip over to release more than a few drops of hydraulic fluid and grease. This accidental scenario, although unlikely, could result in a discharge of oil and fuel into the water within the silt curtain and oil boom zone. If the failure were near the edge of the silt curtain and oil boom barrier there is a chance that a piece of equipment could slide or fall into the silt curtain, releasing the contaminated water and turbidity outside of the containment zone. Another potential upset condition would occur if during the multiple movements of excavated sediment some of the sediment from an excavator, a barge, or a temporary stockpile were to be spilled back into the water. This would probably take place within the zone contained by the oil booms and sediment curtain. This released sediment would settle quickly and could be re-excavated, but for the duration of the project turbidity within the containment zone would be elevated.

**Table 4-2: Potential Significant Adverse Impacts Specific to the Mechanical Dredging from In-Lake Pads Alternative**

| | Within the Work Zone | Outside the Work Zone |
|---|---|---|
| Accidental release of diesel fuel and grease | Movement of material twice, longer work time and more equipment raise risk of releases, but operating equipment on dry fill with containment would reduce risks. | Construction of pads near silt curtains could increase the risk of a release outside the work zone. |
| Potential significant Impacts | Small spills would be easily seen and quickly contained; large spills would also be quickly seen, remediation begun immediately with a clean-up response. | Small releases would not affect conditions outside the work zone. Larger spills would be cleaned up within the work zone. If the silt curtain were also breached, a large spill would result in the spread of hydrocarbons on the surface. This could adversely impact fishing, recreation, and the ecosystem in general through toxicity and reduction in gas exchange. An emergency response would be activated to contain the spill with containment booms and removal of material with sorbents to mitigate potentially significant impacts. |
| Release of turbidity | Movement of material twice, longer work time and more equipment potentially raises the amount and duration of turbidity in the work zone. | Construction of pads near silt curtains could increase the risk of a release outside the work zone. |
| Potential significant Impacts | Turbidity in the work zone would not cause impacts beyond those resulting from the dredging activity. | A breach of the silt curtain would release turbidity to the surrounding area. The turbidity would be visible, and would temporarily impact recreation. The turbidity would rapidly diminish over a few days as the particles settled and disperse. Nutrients could be released along with the turbidity that might stimulate algal growth in the area. |

| | Within the Work Zone | Outside the Work Zone |
|---|---|---|
| Introduction of contaminated fill | This is the only alternative where fill would be brought in from outside. All of the fill would be tested for contamination before being used. This is a low risk, but it is only associated with this alternative. | Very unlikely |
| Potential significant Impacts | Very unlikely | Very unlikely |
| Disturbance of existing contaminated fill | No evidence to suggest any contaminated fill, but if any is encountered it could contaminate the Work Zone | Very unlikely |
| Potential significant Impacts | | Very unlikely |
| Runoff from shoreline activities | Plans would capture any runoff within the work zone, where sediments would settle. | Very unlikely |
| Potential significant Impacts | Very unlikely | Very unlikely |
| Introduction or movement of invasive species | Not likely, work sites would be surveyed prior to construction and any invasive species would be hand harvested or covered with mats. New equipment on site would be power washed | Very unlikely, no more of a risk than the introduction of invasive species elsewhere in the Lake. |
| Potential significant Impacts | Very unlikely | Unlikely, activities within the work zone would not release or otherwise encourage the growth of invasive species outside the work zone. |

#### 4.1.2.3 Mechanical Dredging From Equipment Operating Directly On the Deltas

There would be no significant differences in potential impacts to the water quality outside of the work zone if this alternative were implemented. This alternative method would temporarily place excavators and trucks in shallow water in the zone contained by oil booms and silt curtains. This alternative does not permit the capture of potential minor leaks and spills from equipment as described above in Section 4.1.2.2 for the alternative in which the equipment would be on constructed pads. Besides the temporary water quality impacts resulting from the dredging described in the DGEIS, small leaks from equipment would result in the discharge of oil and fuel into the work zone. Containment booms and sorbent barriers would help mitigate these impacts. Using equipment directly in the lake would reduce the risk of spilling sediment from multiple movements of material, the extra complexity, and the extra time required to build in-water pads. Risks from equipment tipping and other accident scenarios are similar to those described above in Section 4.1.2.2.

**Table 4-3: Potential Significant Adverse Impacts Specific to the Mechanical Dredging from Equipment Directly on the Deltas Alternative**

| | Within the Work Zone | Outside the Work Zone |
|---|---|---|
| Accidental releases of diesel fuel and grease | Some small amount of contamination likely; larger releases unlikely | Would require a breach of the silt curtain barriers and failure of containment booms. |
| Potential significant Impacts | Small releases not significant; large spills would require clean-up response | Small releases would not affect conditions outside the work zone. Larger spills would be cleaned up within the work zone. If the silt curtain were also breached, a large spill would result in the spread of hydrocarbons on the surface. This could adversely impact fishing, recreation, and the ecosystem in general through toxicity and reduction in gas exchange. An emergency response would be activated to contain the spill with containment booms and removal of material with sorbents to mitigate potentially significant impacts. |
| Release of turbidity | Would happen within the work zone | Would require a breach of the silt curtains. Some turbidity would be released at project conclusion when the silt curtains would be removed |
| Potential significant Impacts | Turbidity in the work zone would not cause impacts beyond those resulting from the dredging activity. | A breach of the silt curtain would release turbidity to the surrounding area. The turbidity would be visible, and would temporarily impact recreation. The turbidity would rapidly diminish over a few days as the particles settled and disperse. Nutrients could be released along with the turbidity that might stimulate algal growth in the area. |
| Introduction of contaminated fill | No fill will be introduced | No fill will be introduced |
| Potential significant Impacts | Very unlikely | Very unlikely |
| Disturbance of existing contaminated fill | No evidence to suggest any contaminated fill, but if any is encountered it could contaminate the work zone | Very unlikely |

| | Within the Work Zone | Outside the Work Zone |
|---|---|---|
| Potential significant Impacts | Unlikely, but large volume of water in the work zone would rapidly dilute small amounts of contaminants to safe levels | Very unlikely |
| Runoff from shoreline activities | Plans would capture any runoff within the work zone, where sediments would settle | Very unlikely |
| Potential significant Impacts | Runoff from the shoreline might increase turbidity in the work zone, but this area would already temporarily impacted | Very unlikely |
| Introduction or movement of invasive species | Not likely, work sites would be surveyed prior to construction and any invasive species would be hand harvested or covered with mats. New equipment on site would be power washed | Very unlikely, no more of a risk than the introduction of invasive species elsewhere in the Lake. |
| Potential significant Impacts | Unlikely, see text on invasive species. | Unlikely, activities within the work zone would not release or otherwise encourage the growth of invasive species outside the work zone. |

#### 4.1.2.4 Conveyor Belts to Transport Material into Roll-Off Containers

This alternative could be used with any of the sediment removal alternatives. It represents a different way of transporting sediment from the water to the staging area on shore. It avoids the risks of spilling from moving the sediments with excavators or roll-off containers and trucks but adds risks from the conveyors. The risks to water quality from the conveyors include:

1. The possibility of grease and oil from the equipment being cast into the water. The conveyor equipment has many moving parts, all of which require lubrication. Small amounts of lubricants could find their way into the water. This risk is similar to the potential for dripping and leakage of grease from excavators and trucks. The conveyors have more external moving parts than excavators and trucks, but lack hydraulic oil and diesel fuel, so the risk of discharge of hydrocarbons is limited to small amounts of grease.

2. Loss of sediments from the conveyor. In the event of a breakdown of the conveyor, the sediment could be spilled. This could happen accidentally during a breakdown or as part of the action required to replace a roller or other broken part. In any case, there is a risk that some of the sediment could be re-suspended in the work zone, and if the conveyor was used to move material to shore outside of the work zone the material could be discharged outside the work zone. This risk can be mitigated by enclosing the entire path of the conveyor with silt curtains and effectively keeping the entire conveyance within the work zone.

**Table 4-4: Potential Adverse Significant Impacts Specific to the Use of a Conveyor Alternative**

| | Within the Work Zone | Outside the Work Zone |
|---|---|---|
| Accidental release of diesel fuel and grease | More sources of small amounts of fuel and grease | Would require a breach of the silt curtain barriers and failure of containment booms. No increase in risk from other alternatives |
| Potential significant Impacts | Conveyors use very small amounts of lubricants, not a significant source. Fuel for the conveyor engine would be secured. | Very unlikely |
| Release of turbidity | Reduction in the risk of moving containers (large spills) but greater risk of small spills | Would require a breach of the silt curtains. As is true of other alternatives, some turbidity would be released at project conclusion when the silt curtains would be removed |
| Potential significant Impacts | Very unlikely | Very unlikely |
| Introduction of contaminated fill | No fill will be introduced | No fill will be introduced |
| Potential significant Impacts | N/A | N/A |
| Disturbance of existing contaminated fill | No evidence to suggest any contaminated fill, but if any is encountered it could contaminate the work zone | Very unlikely |
| Potential significant Impacts | Unlikely, but large volume of water in the work zone would rapidly dilute small amounts of contaminants to safe levels | Very unlikely |
| Runoff from shoreline activities | Plans would capture any runoff within the work zone, where sediments would settle | Very unlikely |

| | Within the Work Zone | Outside the Work Zone |
|---|---|---|
| Potential significant Impacts | Runoff from the shoreline might increase turbidity in the work zone, but this area would already temporarily impacted | Very unlikely |
| Introduction or movement of invasive species | Not likely, work sites would be surveyed prior to construction and any invasive species would be hand harvested or covered with mats. New equipment on site would be power washed | Very unlikely, no more of a risk than the introduction of invasive species elsewhere in the Lake. |
| Potential significant Impacts | Unlikely, see text on invasive species. | Unlikely, activities within the work zone would not release or otherwise encourage the growth of invasive species outside the work zone. |

### *4.1.3 Mitigation Measures*

#### 4.1.3.1 Mitigation Measures Common to all Methods

Mitigation measures described in Section 6.3 of the DGEIS and in Section 3.2.1 of this SGEIS would apply to all the alternatives considered here. In all cases the Best Management Practices described in the NYSDEC Technical & Operational Guidance Series (TOGS) 5.1.9 "In-Water and Riparian Management of Sediment and Dredged Material" would be followed. This list of measures is designed to minimize any potential impacts from dredging. Additional measures are described below.

A risk common to all the alternatives stems from the use of heavy diesel equipment and was discussed in the DGEIS. The equipment is powered by gas or diesel fuel, it has hydraulic pumps, hoses, and cylinders, and the external moving parts are lubricated with grease. Even with properly functioning equipment, small quantities of these fluids would be discharged to the water. These compounds all float on water. Mitigation for all the alternatives would involve daily inspections of equipment and the use of floating sorbent booms around the equipment. These booms contain materials that absorb spills.

A second risk common to all the alternatives is the temporary release of sediment and nutrients upon removal of the silt curtains. The description of the silt curtains and their use described in Section 6.3 of the DGEIS, along with the permit conditions described in Section 3.3 of the DGEIS is intended to mitigate this potential problem.

In addition to the mitigation measures described in the DGEIS, the potential for all alternatives would include:

- <u>Timing of the removal of curtains.</u> Retaining the silt curtains in place would allow most of the turbidity to settle. Section 6.3.2 of the DGEIS discusses the use of silt curtains to "*provide for full control of turbidity and suspended solids, preventing discharge of turbidity and suspended solids to the ambient water column and away from active work areas. The silt curtains will likewise serve to control any nutrients and toxics/metals that may be associated with the turbidity and suspended solids, by retaining the turbidity and suspended solids to the interior of the active work area, where they will re-settle to the Lake bottom*." As discussed in DGEIS section 6.2.1, *"Potential adverse impacts to turbidity and water clarity will be temporary and short term in nature. Potential impacts will be substantively reduced by the physical nature of the sediments proposed for removal under the Project...the sediments that will be removed from the deltas will predominantly coarse-grained materials (i.e. sands). If re-suspended into the ambient lake water during the active sediment removal activities, these sediments will tend to quickly resettle to the Lake bottom, in the immediate work area."*

Retaining silt curtains in place too long would prevent mixing and allow stagnant water, potentially higher in nutrients, to possibly support a bloom of algae within the work zone. Although specific studies documenting the use of silt curtains to retain turbidity and nutrients in conditions similar to those for this project are not commonly published, there is extensive literature on artificially increasing the nutrient content in low-nutrient lakes within small to moderate-sized enclosures (mesocosms). The data

gathered over many decades since the 1970's whole lake experimentation of Schindler[17] [18] [19] have provided a wealth of information documenting the response of aquatic communities to the addition of nutrients, especially phosphorous, to enclosures in freshwater ecosystems. Recent discussion in the literature has questioned the usefulness of smaller scale examples of nutrient enhancement experiments on whole lake ecosystem responses[20]. Based on these studies, it can be concluded that a pulse of nutrient resulting from the disturbance of sediments during dredging may cause a short term response and a potential for a rapid uptake up nutrients by algae and plants within the enclosure (silt curtains). However, upon the removal of the curtains, the release of the small volume of water that may be slightly enriched with nutrients will likely have only a minor short-term impact, if any impact at all, on the adjacent ecological communities.

Observations on Lake George or in other lake studies of high turbidity behind silt curtains may not be representative of the proposed delta dredging since the composition of the material to be dredged in this project is dominated by sand and gravel and not by finer sediment particles. In general, finer sediments (silt and clay fractions) stay in suspension longer and are associated with higher nutrient content than sands and gravels. Projects that have resulted in high turbidity within silt curtains resulting from dredging activities have been in areas of finer-grained organic sediments.

This mitigation measure would maintain the silt curtains in place until there was no visible difference in water clarity or turbidity between the water in the work zone (within the silt curtains) and the lake water outside the curtains. Upon removal of the curtains, the release of turbidity and associated nutrients is expected to result in a negligible impact to the water quality of the lake as the water retained in the work area mixes with the ambient lake water. The scale of this release is likely to be less than the episodic release of nutrients to the delta area from run-off during a storm event.

As described in the DGEIS, two forms of silt curtains are to be deployed during the removal of lake sediments. A fixed silt curtain and a work zone silt curtain are to be utilized. Generally, a work zone silt curtains will encircle a smaller area where active excavation will occur, and the fixed silt curtain will be placed around a larger perimeter of the area targeted for removal. The placement of the work zone curtains will depend (in part) on the excavation method, the equipment utilized, site conditions, and the rate and progress of excavation. Generally, the fixed silt curtain will encircle an area larger than the work zone and will stay in place for a longer period of time. Work zone silt curtains will move as sediment removal progresses, and fixed curtains will stay in place until such time as the turbidity monitoring program requires they be removed. Work zone silt curtains typically will not extend all the way to the lake bottom and perimeter work zone curtains will extend to the lake bottom[21].

Silt curtains come in three forms. Type 1 barriers are for waters with low currents, Type 2 curtains are for higher current waters (up to five feet per second) and Type 3 curtains are similar to Type 2 barriers except that a polypropylene filter fabric is permanently inserted into the barrier skirt to meet some

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[17] Schindler, D. W. 1974. Eutrophication and recovery in experimental lakes: implications for lake management. Science 184, 897–899.

[18] Schindler, D. W. 1998. *Replication versus realism: the need for ecosystem-scale experiments. Ecosystems 1, 323–334.*

[19] Schindler, D.W. 2012. The dilemma of controlling cultural eutrophication of lakes. Proceedings B of the Royal Society, Published online August 22, 2012

[20] Schindler, 2012

[21] See page 49 of the DGEIS for additional information on deployment of silt curtains.

specialty applications. Based on review of US Army Corp of Engineers literature and consultation with dredging contractors, it is envisioned Type II barriers will be utilized. No variation of pore size or permeability occurs with the 3 types of barriers. Variation of permeability is achievable through custom application and is generally limited to specialty dredging applications where sediment contaminant is a concern.

- Monitoring turbidity. The turbidity monitoring program described in Section 6.3.3 of the DGEIS would be extended after the work is complete to allow for settling of suspended materials. No further work will proceed inside the work zone while the suspended material settles. Retaining silt curtains until there is no visible turbidity behind the curtain and at least 24 hours from the end of the disturbance in the work zone will minimize the potential for release of turbidity and nutrients to Lake George.

In addition to these general mitigation measures for routine operations, the following mitigation measures are intended to avoid, minimize, or reduce the potential impacts from the accident scenarios described in Section 4.1.2.1.

1. Fuel or oil spills from equipment. Routine measures for mitigating leakage and minor spills are described above. However, in the unlikely but possible event of reportable fuel spill, a construction team member trained in spill response techniques would be on site at all times during construction activities. All petroleum spills that occur within New York State (NYS) must be reported to the NYS Spill Hotline (1-800-457-7362) within 2 hours of discovery, except spills which meet all of the following criteria:

    A. The quantity is known to be less than 5 gallons; and

    B. The spill is contained and under the control of the spiller; and

    C. The spill has not and will not reach the State's water or any land; and

    D. The spill is cleaned up within 2 hours of discovery.

    A spill is considered to have not impacted land if it occurs on a paved surface such as asphalt or concrete. A spill in a dirt or gravel parking lot is considered to have impacted land and is reportable. This team member would direct emergency responses until a NYSDEC Hazardous Materials team could arrive on site and direct additional resources toward a response. Furthermore, the outer silt curtain would be designed to contain even this worst case scenario.

2. Failure of a silt/turbidity curtain. The work zones would be protected by two layers of turbidity curtains. If either curtain is breached a repair would be effected as quickly as possible. However, some of the turbid water from the silt could be released. If this were to happen, the area outside of the silt curtain would be exposed to additional turbidity and the nutrients associated with the sediment. If the breach of the silt curtain was caused by construction equipment or a boating accident there would be a risk of fuel and oil spills. In the unlikely event of a boating accident, the NYSDEC spill response team would be called to manage the accident scene.

3. Introduction of contaminated fill. This accident scenario would be avoided by the TCLP testing of any material that is proposed for introduction to the lake.

4. Disturbance of existing contaminated sediments. If contaminated sediments are found at a dredge site they would be treated like hazardous materials. If these sediments were subsequently spilled the contaminated material would settle to the bottom and be more contained in deeper water than the current condition, where the water is shallow and the contaminated material is exposed to more wave action.
5. Runoff of contaminated material from onshore activities. There would not be any stockpiling of contaminated material on shore. If TCLP testing determines that material is contaminated, it would be loaded into sealed roll off disposal units and trucked off site to a hazardous material landfill.
6. Removal of delta sediments in the near-shore portions of the deltas could result in increased wave action in these areas, which in turn could provide increased erosive energy on the shoreline. Phase 2 design should address and incorporate measures to ensure that increased shoreline erosion does not occur following completion of the sediment removal activities. An inspection of the shoreline to identify potential high energy areas (tributaries, streams, vertical shoreline) should be completed as a component of Phase 2. Appropriate protection measures could range from placement of engineered rip rap (rocks) or other conventional ground cover/protection materials and measures to construction of more engineered-type structures such as wooden or concrete retaining cribs and walls, etc. Specific details for any such required shoreline erosion protection measures will determined as part of the Phase 2 detailed design work
7. Introduction or movement of invasive species. All equipment used in the lake would be required to be pressure washed to remove invasive species that might be attached to the equipment. The area within the work zone would be surveyed for invasive species prior to any construction. Any invasive species in this area would be harvested and removed to the extent practicable prior to the start of construction.

#### 4.1.3.2 Mechanical Dredging from In-Lake Temporary Access Pads

Mitigation for this dredging alternative would include the measures common to all alternatives described above in Section 3.2.1. Besides the mitigation already discussed in Section 3.2.1, oil absorbing materials would be placed around the excavators to absorb any oil or fuel spilled by the machinery. Additional mitigation would reduce the risks of water quality impacts unique to this method. Stability of the in-lake access pads would be a critical design component. Materials and placement of the fill material would be carefully reviewed by an engineer. The fill material would be tested for contamination, and the stability would be tested to avoid any structural failures.

#### 4.1.3.3 Mechanical Dredging From Equipment Operating Directly On the Deltas

Mitigation for this dredging alternative would include the measures common to all alternatives described above in Section 3.2.1. Besides the mitigation already discussed in Section 3.2.1, a floating roll of oil absorbing material would be placed around the excavators to absorb any oil or fuel spilled into the water by the machinery.

## 4.2 Other Aquatic Plants and Animals; Aquatic Wetlands and Benthics

### *4.2.1 Environmental Setting*

The existing conditions in the vicinity of the seven tributary brook deltas described in Section 8 of the DGEIS have not changed substantially since 2000. The existing delta areas do not support more than sparse populations of aquatic plants (macrophytes). However, concern about the control of non-native species throughout the watershed has risen since 2000. The occurrence of Zebra Mussel (*Dreissena polymopha*), first detected in 1999 has been demonstrated in more areas, and aggressive management by intensive monitoring, hand harvesting, deployment of mats to cut off light and oxygen, and less than ideal habitats for the mollusks has had local success at control[22]. Similar attempts at the control of Eurasian Watermilfoil (*Myriophyllum spicatum*) via hand harvesting, benthic mats, and suction harvesting have slowed the dispersal of this invasive species but full eradication of the weed is unlikely. Nonetheless, management of an area via these methods can stop or slow the spread of milfoil[23]. Other invasive species include Curlyleaf Pondweed (*Potamogeton crispus*) rainbow Smelt (*Osmerus mordax*), Asian Clam (*Corbicula fluminea*), Chinese Mystery Snail (*Bellamya chinensis*), and Banded Mystery Snail (*Viviparus georgianus*), have been reported.[24] Recently the Spiny Water Flea (*Bythotrephes longimanus*) has also been collected in the open water of Lake George.[25]

From 1986 to 2011, the number of sites with Eurasian watermilfoil documented in Lake George increased from 3 to 191. Management strategies led to 173 sites having been cleared of watermilfoil by hand harvesting 2011.[26] Ongoing management of watermilfoil in the lake is being undertaken by the Lake George Park Commission and consists mainly of hand-harvesting plants.

Asian clams were discovered in 2010 and Chinese mystery snails in 2011. Management for both of these has been undertaken mainly with matting and suction dredging methods.[27] Some detailed information about the distribution and management of the invasive clam species follows.

*Zebra Mussels*

The Zebra Mussel (*Dreissena polymorpha* ) is a freshwater clam native to Europe that has invaded many of the fresh water systems in the Unitized States. A free-swimming larval stage makes distribution of a population within a lake very likely to be widespread[28]. Zebra Mussels can grow in large numbers, fouling water inlets and lining dock pilings with their sharp shells, and coating hard bottoms. They are

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[22] Wimbush, J. , M. E. Frischer, J. W. Zarzynski and S. A. Nierzwicki-Bauer. 2009. Eradication of colonizing populations of zebra mussels (*Dreissena polymorpha*) by early detection and SCUBA removal:

Lake George, NY. Aquatic Conserv: Mar. Freshw. Ecosyst. 19: 703–713

[23] NYSDEC. Local / Shoreline Management Activities. Accessed 9-24-12

[24] Farrell, J, and S. Nierzwicki-Bauer. Status of Aquatic Invasive Species in Lake George, and Effectiveness of Control and Management Methods. http://www.lgpc.state.ny.us/PDF/LGPC%20invasives-jlf.pdf

[25] http://www.dec.ny.gov/press/83913.html

[26] Lake George Park Commission (LGPC). 2011. Lake George Integrated Aquatic Plant Management Program. Prepared by Lycott Environmental Services, Inc. Southbridge, MA. December 2011.

[27] Farell and Nierzwicki-Bauer, 2011.

[28] U.S. Geological Survey. Non-Indigenous Aquatic Species *Dreissena polymorpha,* accessed 3/13/13. http://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=5

such successful filter-feeders on algae that they have resulted in dramatic increases in visibility in lakes[29]. This reduces the availability of food for naturally occurring planktivorous animals.

Since the first observation of Zebra Mussels in Lake George in 1999, these clams have been observed in ten locations on the Lake[30]. An active control program is underway. Although juvenile clams seem to grow and thrive in Lake George, the low calcium content of Lake George results in high mortality of larvae[31]. This may help to ameliorate the spread of this invasive species, which in other infected lakes has resulted in large changes in the nutrient dynamics and the lining of the shallow bottoms with these sharp-edged clams.

The preferred habitat of Zebra Mussels is hard substrates, so the newly excavated substrates in dredge areas (composed mainly of sandy sediment) are not likely to present good habitat for the Zebra mussel to become established.

*Asian Clam*

The Asian Clam, *Corbicula fluminea,* is an invasive species of freshwater mollusk that lives primarily in sandy in-shore areas. It filter feeds on algae in the water column and unlike native freshwater clams, gives birth to juveniles without a free-swimming larval stage. This reproductive strategy allows for dense populations of the clam to grow and occupy all the substrate in densities up to 50,000 per $m^2$ in Lake Tahoe, Nevada and California[32]. Its presence represents a real threat to water intakes from its habit of blocking intakes, and the shells can render beaches difficult to use because of sharp-edged shells. They release nutrients as waste products and can stimulate algal production. If populations become established Asian Clams can alter the nutrient and energy dynamics of the whole Lake[33].

Asian Clams was first observed in Lake George in 2010 off Lake Avenue in Lake George Village. This five-acre site was treated with benthic mats in 2011. Since then, and following intensive surveys of over 200 sites, this invasive species has been found at a total of eight sites including a site in the north end of the Lake[34]. Mats and hydraulic suctioning have been used to control the populations. Control efforts have had mixed results, and the "Lake George Asian Clam Rapid Response Task Force" has been organized to

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29 Bastviken, D.T.E., N.F. Caraco, and J.J. Cole. 1998. Experimental measurements of zebra mussel (*Dreissena polymorpha*) impacts on phytoplankton community composition. Freshwater Biology 39:375-386.

30 Lake George Association. 2013. Map of current locations of Zebra Mussels. Accessed 3/13/13 http://www.lakegeorgeassociation.org/what-we-do/Citizen-Science/documents/zebramusselsremovedfromLakeGeorge-2009.pdf

31 Rensselaer Polytechnic Institute 10/14/98. Press Release, Accessed 3/13/13. http://www.newswise.com/articles/lake-george-water-is-death-on-zebra-mussel-larvae

32 U.S. Fish and Wildlife Service, Nevada Office website, accessed 3/13/13. http://www.fws.gov/nevada/nv_species/invasive_species/asian_clams.htm

33 U.S. Geological Survey. Non-Indigenous Aquatic Species, *Corbicula fluminea,* accessed 3/13/13. http://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=92

34 Lake George Association. 2012. Asian Clam Management in Lake George, Fall 2012. Lake George Asian Clam Rapid Response Task Force. Accessed 3/13/13 http://www.lakegeorgeassociation.org/what-we-do/Invasive-Species/documents/LakeGeorgeAsianClamFall2012TreatmentReport-1-24-13-forweb.pdf

pool resources, information, and results of control measures. However, one must assume that any exposed and suitable substrate could become habitat for the Asian Clam.

No Asian Clams have been observed at any of the proposed dredge sites. The existing shallow, sandy deltas are preferred habitat for Asian Clams. The restored habitats would be deeper than the existing deltas and not characterized by coarse sand. These factors would not favor the development of this species. However, like any other place on the Lake, introduction of clams represents an ongoing threat by this invasive species and the Lake George Asian Clam Rapid Response Task Force would be made aware of these changes in habitats.

Besides the plants and invasive clam species, Lake George supports a normal population of the aquatic insects, crustaceans, clams and worms that are characteristic of fresh water lakes. These animals fulfill many ecosystem functions, including mixing and aerating of the surficial sediment layer, converting organic debris such as leaf litter into food for fish, amphibians, birds, and reptiles, and larger invertebrates such as crustaceans. They typically disperse by crawling or burrowing and most of the insects can leave the water as adults to fly considerable distances. These effective dispersal mechanisms allow them to recolonize new habitats quickly.

### *4.2.2 Potential Significant Adverse Impacts*

The potential impacts to plants and other animals are related to the proposed direct removal of the dredge material and the indirect impacts from the potential increases in turbidity described in Section 8.2 of the DGEIS and Section 4.1.2 of this document. Indirect impacts may also result of the compaction of lake bottom soils. The plants and animals that inhabit the deltas would be removed with the sediments and destroyed as a consequence of the proposed action. These losses would be the same for all alternatives that remove the same amount of substrate. As described in Section 8 of the DGEIS, there are differences in plant communities between the different deltas. However, the choice of dredge alternative would not affect the potential impacts within the dredge zone or the project work zone at any single delta.

In addition to the loss of organisms associated with the direct removal of sediments, suspension of sediments could contribute to plumes of turbidity that might affect the plants and animals within the work zones on a short-term basis. These impacts would also be similar for each of the alternatives, and would depend on the size of the containment zones. As a percentage of the total lake productivity and food sources, these temporary adverse impacts would not represent a significant impact.

A concern is the ability of the aquatic plant and macroinvertebrate communities (aquatic insects, worms, clams, etc.) to recover and recolonize the dredged areas. The dredged areas would provide suitable habitat for many of the native, naturally occurring organisms, and recovery would take place over a period of time.

Although not well studied in fresh water systems, one study in Illinois[35] showed that macroinvertebrates in the Illinois River did not recolonize a site to pre-impact population densities that received dredge

[35] Stevenson, K.E. and T.M. Koe.l. 1999. Effects of dredge material placement on macroinvertebrate communities. Illinois Natural History Survey LTRMP Havana Field Station7 04 N. Schrader Avenue Havana, IL 62644 accessed 9-23-12 https://www.ideals.illinois.edu/bitstream/handle/2142/10347/inhscaev01999i00016_opt.pdf?sequence=2

material in a year. Presumably an area that was dredged in Lake George would also take more than a year to recolonize. This study area was very soft muddy sediment, quite different than the deltas of Lake George, which would likely recolonize faster. In another study, bottom sediments in Lake Tahoe were suction dredged to control the invasive Asian Clam, *Corbicula fluminea.* A year after suction dredging the natural benthic community had not recovered, although the Asian Clams had begun to regrow[36]. The scientists in Lake Tahoe recommended using benthic mats to control the Asian Clam, which is now the preferred means of controlling this invasive species in Lake George and Lake Tahoe. In contrast, the U.S. Army Corps of Engineers, in its evaluation of the potential impacts of dredging Lake Erie in Toledo Harbor concluded that: "Recolonization of these areas by benthos from the surrounding bottom substrate typically occurs rapidly following the dredging activities. Such impacts would be minor, adverse and short-term."[37]

Since newly exposed bottom surface would represent new habitat, it is reasonable to assume that a normal benthic community would develop in a few years, particularly since the sediment composition post-dredging is likely to be similar to the existing conditions. However, because the newly exposed bottom would be deeper (nominally six feet instead of 1-3 feet), the consistency of the new material could be different, and the organic content would be lower, at least initially, the community that might develop could be different than the community that was removed. The ecological principle known as "hysteresis" would occur; that is, a community may be resilient to a perturbation but its recovery from an impact may not lead to a return to the baseline community. This change may not be adverse; in Lake George it was shown that waters 2-5 m deep had more diverse plant communities than water 1 m deep[38]. The analysis of the seven deltas described in the DGEIS indicated that plant communities in the shallow deltas were very sparse. More diverse plant communities would support more diverse animal communities, so the post-dredging community, once recovered from the dredging, is likely to be more diverse and productive than the shallow, wave-swept habitat that currently exists. "Recovery" of the benthic community from dredging is difficult to define, since the post-dredging community may not be the same composition as the pre-impact community. The literature on this topic was reviewed by Wilbur and Clarke in 2007[39], and they conclude that recovery in fresh water is generally quick but difficult to predict and dependent upon the type of sediment, with recoveries being faster in fine muds that are rich in organic material.

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[36] Marion E. Wittmann,, Brant Allen, Sudeep Chandra, John E. Reuter, S. Geoffrey Schladow, and Katie Webb. 2011. Final Report for the Lake Tahoe Asian clam Pilot Project. Accessed 9-13-12: http://lands.nv.gov/docs/LTLPreports/Invasive%20Species/Lake%20Tahoe%20Asian%20Clam%20Pilot%20Project%202009%20-%202011.pdf

[37] U.S. Army Corps of Engineers Buffalo District. 2009. Finding Of No Significant Impact and Environmental Assessment. Operations And Maintenance Dredging And Placement Of Dredged Material Toledo Harbor Lucas County, Ohio Accessed 9-23-12 http://pbadupws.nrc.gov/docs/ML1126/ML112650182.pdf

[38] C.D. Collins, C.W. Boylen, and R.B. Sheldon. 1981. Multivariate analysis of submersed rooted macrophytes of Lake George, N.Y. and their Significance as ecological indicators. Rensselaer Digital Collections. Accessed 9-24-12

[39] Wilber, D.H. and D.G. Clarke. 2007. Defining and assessing benthic recovery following dredging and dredged material disposal. Proceedings of the Eighteenth World Dredging Congress, Lake Buena Vista, FL. Paper 3#-3, page 603.

Accessed 9-13-12: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CB8QFjAA&url=https%3A%2F%2Fwww.westerndredging.org%2Findex.php%2Finformation%2Fproceedings-presentations%2Fcategory%2F60-session-3d-environmental-aspects-of-dredging%3Fdownload%3D240%3A3-wilber-defining-and-assessing-benthic-recovery-following-dredging-and-dredged-material-disposalpdf&ei=NkNfUKbGF6ebyQHy4oHgCw&usg=AFQjCNFLcPQ3n9A3XJBxrDSqb_VtuxFPRg&cad=rja

Another consideration though is the potential for this new substrate to become colonized with invasive species, if nearby reservoirs of these organisms are available and can out-compete native species. Post-dredging monitoring would identify the nature of the recolonization and mitigation for invasive species could take place.

As reviewed by Madsen[40] invasion process for non-indigenous species follows a standard ecological process of introduction, establishment and spreading. The establishment and spread of the invasive species is influenced by a number of environmental factors. This is true for both plant and animal species. However, specifically for milfoil, Madsen correlated limnological parameters to Eurasian watermilfoil dominance. The study reported that the attempt to identify factors that might predict the success of Eurasian watermilfoil , identified two factors as indicators of potential risk. These factors were Carlson's Trophic State Index (TSI) and total water column phosphorus concentration. TSI is a summary statistic of water column biomass that takes into account transparency, chlorophyll concentration, and the concentration of phosphorus. The conclusions of these studies indicate that milfoil dominance is most frequently associated with lakes moderately enriched with nutrients. Madsen's data regarding sediment composition indicated that the preference of Eurasian watermilfoil dominance is in sediments with 10% to 18% sand. The lower dominance on sediments with low sand content (<10%) indicates a potential for low growth in highly organic sediments. Madsen suggests that at higher sand content (above 18%), the lower success of milfoil may be attributed to lower nutrient content of sandy sediments leading to lower growth rates. This observation is consistent with results by Barko and Smart[41] that showed Eurasian watermilfoil and *Hydrilla* both showed 10- to 20-fold declines in growth with increasing sediment organic content of up to about 20% dry sediment mass and poor growth on inorganic sediments with a high sand fraction (greater than 75% dry sediment mass). These studies indicate that the high sand content of the final substrate conditions after dredging in Lake George will not likely provide a preferred substrate for the invasion of milfoil.

These studies do not directly address compaction due to construction so much as sand composition and associated nutrient content of natural lake sediments. Compaction is sometimes used as a tool to control nuisance macrophyte growth in ponds when the water level can be drawn down and equipment used to compact sediments in the dry. However, as discussed (Section 3.2.2), the physical properties of the sand-dominated sediments that are subject to potential compaction by heavy equipment does not make them likely to significantly compact to the degree that establishment of aquatic plants and subsequent root growth are likely to be a major factor after overlying sediment and/or temporary pads or roads are removed. Impacts to the sessile macroinvertebrate and macrophyte communities would not vary significantly between the choices of dredging alternatives. Variations in the length of exposure to turbidly in the water column between alternative dredging techniques would not likely impact animal communities that live in mud. Reductions in light penetration inside the work zone and outside the dredge zone could affect plant communities, but normal variations in turbidity from rainstorms and land uses would be greater than the differences between alternatives. However, large fuel oil spills could impact the plant and animal communities similar to the potential impacts to water quality described in the sub-sections of Section 4.1.2. This sort of accident is not likely, and can occur now if a boat sinks or

[40] Madson, J. D. 1998. Predicting invasion success of Eurasian watermilfoil. J.Aquat Plant Mange. 36:28-32.

[41] Barko, John W., and R. Michael Smart. 1986. Sediment-Related Mechanisms of Growth Limitation in Submersed Macrophytes. Ecology 67:1328–1340.

a snowmobile falls into water. Contractors would plan carefully to avoid spills for which they are liable and that would damage their expensive equipment.

*Compaction of Lake Bottom Sediments*

There is some concern that compaction of the lake bottom as a result of heavy equipment may create an artificial environment that could contribute to degradation of the benthic environment hastening the introduction of invasives..

Compaction of granular soils occurs when a load displaces air from the voids or pores between the soil grains. Similarly when a load is applied to a saturated soil, consolidation of the soils occurs when the load displaces water from the soil allowing the soil particles to pack together more tightly, therefore reducing its bulk volume. Compaction/consolidation usually occurs when the applied load exceeds the previous highest loading conditions (i.e. the allowable bearing capacity).

The deltas are comprised of medium dense to dense granular soils with minimal organic material. Granular soils when subjected to heavy loads may compact/consolidate. The lake bottom/delta sediments are located beneath several feet of water and therefore heavier loads are necessary to squeeze water out of the voids.

The proposed dredging methods may involve use of a long reach excavator operating directly on the lake bottom or on dredged materials placed on the delta to allow access of the excavation equipment into the lake as described in Sections 3.2.2 and 3.2.3.

For the purpose of illustrating and evaluating the potential compaction/consolidation of soils as a result of operating equipment on the delta – it is assumed that a machine similar to a Linkbelt 240X2LF (long reach excavator) will be utilized. The weight of this equipment will apply approximately 950 psf (pounds per square foot) over the bearing area to the existing delta surface. As part of the construction sequence, an access roadway constructed of dredged sediments may be constructed into the lake. This construction road could add an additional 600 psf to the existing surface, for a total of approximately 1,550 psf applied to the lake bottom.

This loading of the lake bottom sediment soils may result in some compaction of the uppermost portion of the soils. Under this load, the calculated settlement is 0.43 inches.

This compaction of the lake bottom will be limited to the top few inches of the soils. Most, if not all, of the area where access roads will be constructed and where excavation equipment will be operating directly on the lake bottom will be targeted for excavation. Therefore any compaction of lake bottom sediment will be effectively addressed with the removal of the delta sediments. This impact is temporary and therefore not significant.

### *4.2.3 Mitigation of Impacts*

Differences in the potential impacts to water quality from the alternative dredging techniques were described in Sections 4.1 and 4.2. The impacts to the plant and animal communities within the proposed dredge areas and the work zones would not be significantly different between alternative dredging techniques. Consequently, the recommended mitigation measures for these proposed actions would also be similar.

All the mitigation measures described in the SGEIS, and additional measures described in Section 4.1.3 to mitigate impacts to water quality would apply to the other animals and plant communities. An additional mitigation measure for the biological communities would be a monitoring program as

described in Section 8.3 of the DGEIS to determine if the newly exposed sediments harbor invasive species. The monitoring program described in the DGEIS would be expanded beyond milfoil to include monitoring for Zebra Mussels and Asian Clam. In the event that these nuisance organisms are discovered, management techniques such as the use of benthic mats, hand harvesting, or other such method(s), to the extent practicable would take place until native species grow.

The planting of native plant species to promote development of native plant communities as a mitigation measures was explored in the DGEIS (See Section 7.4 and 8.4 of the DGEIS). This measure was dismissed because of cost, complexity and efficacy of hand planting of aquatic species.

The purpose of the planting would be to prevent invasive species such as Eurasian watermilfoil invading a newly created habitat. In general, weedy species are highly adapted for exploiting disturbed conditions[42]. Once established, under certain conditions, exotic weeds can form large, mono-specific beds and prevent subsequent establishment of native plants, regardless of propagule availability of the native plants[43]. However, planting of native species to prevent colonization of exotic species such as milfoil has been met with mixed success. The major factors influencing the development of aquatic vegetation include: availability of propagules, physical (abiotic) disturbance and biotic disturbance[44]. Physical disturbance (wave action and storm discharge from streams) are potentially major factors that limit the success of planting after dredging. Additionally, biotic disturbance can be a major factor that affects establishment of aquatic plant communities. In particular fish and other organisms that feed in sediments easily dislodge seedlings[45] and can cause loss of the seedlings to predation. Under existing conditions, within most of the area proposed for dredging, field observations have documented very sparse macrophyte growth. Therefore, mitigation will include monitoring the dredge sites and invasive species management (had removal of invasive plants). Revegetation by native species may be slow, so monitoring is recommended for a period of 2 to 4 years prior to supplementing the native plant communities by planting. If colonization by desirable native species has not met pre-set performance standards within this time-frame, supplemental planting of native species could be undertaken.

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[42] Smart, M. and R. Doyle. 1995. Ecological theory and the management of submersed aquatic plant communities. Aquatic Plant Control Research Program Bulletin A-95-3, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. 8 pp.

[43] Smart, R. M., Dick, G.O., and Doyle, R.D. (1998) "Techniques for establishing native aquatic plants.," *Journal of Aquatic Plant Management* 36: 44-49

[44] Smart et al., 1998

[45] Smart et al., 1998