**Amendments to March 17, 2015 Project Description – April 9, 2015**

The National Park Service (NPS) is continuing to evaluate cost effective/cost efficient operational solutions that will meet removal and restoration objectives as well as reducing overall impacts of the infrastructure removal project. Through this process, the NPS is continuing to identify more efficient operational approaches that will achieve the best project outcome. This Amendment updates March 17, 2015 Project Description and presents other approaches that are now being considered as well as making specific changes and requests for consideration of actions that were not included in the original submittal. Other documents provided to the CCC today, including the supplemental appendix and response to questions reflects these amendments to the project description.

**Temporary Offload and Transfer Facility**

The NPS is still evaluating removal methods and debris transport solutions that may allow for the use of a smaller dock (thereby reducing temporary impacts described as part of the floating dock) or eliminate the need for a dock (in which case a smaller footprint may need to be affected to unload materials at the shoreline site). For the purpose of this analysis, the NPS requests that the CCC evaluate the dock as proposed in the original submittal (20'x150'), with the understanding that smaller structure, or alternative access may ultimately meet the site needs and result in far more limited impact.

**Oyster Rack Removal**

The NPS is continuing to evaluate rack removal approaches, with the interest in increasing operational flexibility and removal efficiency. While a mini-excavator was shown and described in the March 17 submittal, other types of equipment may prove more efficient at achieving the removal objectives and would be considered by the NPS as part of this project. Larger excavators, which could allow operators to have a longer reach and therefore require less anchoring, were described in the Project Description associated with debris removal, but could also be effective with rack removal responsibilities. Additionally, smaller hand-held hydraulic cutting tools are now under consideration. The primary issue is that with 2,234 bents (nearly 6,700 posts), any increase to operational efficiency (reduced anchoring, fewer times barges need to be moved for set up) would result in substantial time savings and overall impact reduction.

*Use of hydraulic cutting tools (other than hydraulic shears)*

One method that was not included in the March 17 Project Description is the use of underwater reciprocating saws to cut members rather than only the use of hydraulic shears on the head of the excavator arm. The reciprocating saw blade is narrower with much smaller teeth than a chainsaw (less than 1/8 inch wide). The utility of smaller, handheld reciprocating saws could provide far greater flexibility for a contractor to remove the wood members from the structure without requiring the larger barge supporting the excavator to constantly be moved and re-anchored. The increased flexibility is anticipated to increase speed and reduce bottom impacts during the rack deconstruction.

The cutting of all stringers and cap lumber will facilitate simple removal of the posts. It is also anticipated that the divers could cut the bottom cross-beam located at or just below the bottom surface. A single cut of the bottom cross-member between each vertical post could also reduce the direct impact of cross-beam removal associated with eelgrass (currently estimated at 1 SF/linear foot of the cross-member). A single cut would allow the board to rotate as it is pulled out with the vertical post, and would reduce the breakage impacts if pulled without a cut.

The discharge of saturated fine wood particles from the reciprocating saw blade would be minimal for any single cut, and because it would be generated from already saturated lumber, the fine wood particles would likely drop directly to the bottom without any further dispersion. There is little likelihood that any of the fine wood particles would disperse on the surface because of the wood saturation. Other concerns related to this activity are those related to potential for mobilization of chemical used in pressure treatment of the lumber in the water. As part of the early planning process, the NPS ran the leaching model developed by the NMFS for pressure treated lumber in salt water. The model showed that any chemicals would have leached from the wood in less than 1 year. Because all of the lumber that is to be removed has been in Drakes Estero for 1-4 decades, any potential for leaching has long-since passed.

Assuming all wood members would need to be cut, the NPS anticipates that the potential volume of wood debris that is lost during the cutting would be approximately 35 cubic feet. There are many members and bents that will not require as many cuts, so the volume is likely less than 35 CF. While most easily referred to as saw dust, the actual discharge would be saturated fine wood particles in essentially a mush-like form. The limited volume of material would not accumulate in any one area and would not result in additional impacts. No additional BMPs are identified at this time.

**Aquaculture Debris Removal**

The NPS documented approximately 1 acre of aquaculture debris (tubes, strings, bags and lines) within the footprint of the racks. The March 17 Project Description identifies a dredge bucket on an excavator as the method for removal. The NPS has further evaluated methods and objectives described in the aquaculture debris removal section to identify what method can most effectively, efficiently, and safely remove the aquaculture debris while minimizing disturbance of Dvex, sediment and indirect impacts to eelgrass as part of the removal. The NPS is examining whether other bucket types deployed from an excavator arm may be more effective. The NPS is also evaluating whether this scale of work could be achieved by divers removing the debris by hand. Hand removal would be supported with some mechanical equipment to assist with pulling heavier debris, etc. This approach, however, would generally have reduced indirect sediment impacts than mechanical removal, so if hand-removal is used for implementation the NPS would expect an overall reduction in potential indirect impacts associated with this activity. While hand-removal methods are being explored, the analysis of the impacts included in these supplemental documents still assumes mechanical removal.

**Experimental In-Situ Treatment of Accumulated Shell**

The NPS is continuing to consult on the in-situ shell treatment approaches. The March 17 Project description identifies in-situ treatment as a raking or mix-in of shell across the 2.4 acres of heavy/moderate shell accumulation. There are no other examples of this type of condition or treatment being addressed in the literature. The primary question is whether leaving shell caps in place or treating them with a mix-in activity would promote eelgrass growth and minimize habitat for Dvex. Because there is not information either way that the NPS can cite to that would identify whether such in-situ treatment would address the identified concerns, or if it could inadvertently aggravate those same concerns (e.g. create more Dvex habitat by mobilizing more shell to the surface) the following approach is to a revision to the March 17 Project Description.

Any in-situ treatments would now be limited in areal extent only to the heaviest shell accumulation areas as documented by our side boat videos. For the purposes of the CCD, the NPS anticipates that this treatment would be limited to approximately 0.5 acres (rather than 2.3 acres identified in the March 17 Project Description). The specific treatment areas would be selected based on density of shell accumulation, as well as proximity to the other work areas. The NPS is working with design engineers to identify a tool that could be used that would effectively mix shell down into the soil leaving the treated area with less shell exposed on the surface, and more area for fine sediment and eelgrass growing habitat. For the purpose of the CCD, the NPS proposed evaluation of the 0.5 acre in-situ treatment area.

**Experimental Shell Treatment Plots**

Once all aquaculture debris is removed, either mechanically or with divers, the NPS will set up a monitoring strategy to document response to variable shell accumulation conditions. The scale of the experimental treatment identified in the March 17 Project Description and Appendix B, 12’x12’ plots will be modified to a smaller 3’x3’ plot size. The plots will be installed by contract or research divers either as part of the removal activities or as part of the longer-term monitoring strategy. The smaller experimental plot size would still provide a replicable research approach that could be monitored with information reported through the NPS or university researchers. For the purpose of the CCD, the NPS will maintain the monitoring effort, but the experimental plot size will be smaller and installed and monitored by divers.

**Revised Table 1**

The changes described in this amendment result in some minor changes to Table 1 of the Project Description. A revision to Table 1 is included below.

**Table 1. Summary of Cumulative and eelgrass impact areas.**

Impact area for posts and deadmen are estimated based on general observations of impact area from the method pull test. The estimate for stingers is based on their dimensional footprint (approx. 4" wide by length of stringer). Deadmen are not included for Racks 4A, 8A, 8B and 8C. Aquaculture debris is included within the Moderate/Heavy debris area calculation, so it is not double counted in the total. The debris experiment area is subtracted from the Shell debris area. All values are estimated from underwater video footage from 71 of the 95 racks. Level of error for eelgrass cover, stringers on the estero floor, shell debris, and plastic/wire is unknown, but is likely less than 25%.

| | Cumulative Impact Area | | Eelgrass Impact Area | |
|---|---|---|---|---|
| **Component** | **Sq Ft** | **Acres** | **Sq Ft** | **Acres** |
| ***Within Rack Footprint*** | | | | |
| Posts (assume 1.3 SF/post) | 8,713 | 0.20 | 3,572 | 0.08 |
| Bottom Cross-member (assume 1 SF/LF) | 30,072 | 0.69 | 12,726 | 0.29 |
| Stringers on Estero Floor (total area of boards covering bed of Estero) | 11,928 | 0.27 | 6,232 | 0.14 |
| Moderate/Heavy Aquaculture and Shell Debris | 103,830 | 2.38 | 0 | 0.00 |
| Aquaculture Debris – Bag, Tube and String Cleanup* | 41,818 | 0.96 | 0 | 0.00 |
| In-Situ Shell Debris Treatment* | 21,800 | 0.50 | 0 | 0.00 |
| **Total Impact Area within Rack Footprint** | **154,542** | **3.55** | **22,530** | **0.52** |
| **Total Project Area within Rack Footprint** | **308,016** | **7.07** | **126,287** | **2.90** |
| ***Outside Rack Footprint*** | | | | |
| Dock and Anchors# | 3,200 | 0.07 | 3,200 | 0.07 |
| Oyster Mat Removal | 16,988 | 0.39 | 0 | 0.00 |
| Manila Clam Treatment (Bed 17) | 21,344 | 0.49 | 0 | 0.00 |
| **TOTAL IMPACT AREA** | **196,075** | **4.50** | **25,730** | **0.59** |
| **TOTAL PROJECT AREA** | **349,549** | **8.02** | **129,487** | **2.94** |

*areas within Total Moderate/Heavy Shell Debris Area

#see text for calculation of eelgrass impact

**Responses to CCC questions of April 6, 2015 regarding Drakes Estero Restoration Project.**

1) *A figure showing the specific proposed location of the dock. –*

   See Figure 14 (attached). Please note that as part of preliminary engineering report, the contractor has identified that for any final dock alignment, additional bathymetric and eelgrass surveys would be conducted to determine best alignment and location for the dock to provide access to the existing channel and minimize potential eelgrass impacts.

   Further – as presented in the Amended Project Description the NPS is evaluating whether a dock is still necessary for just the lumber off-haul, or if a smaller dock or other onshore access approach with more limited direct impact to subtidal habitat and eelgrass is viable. For the purpose of this review, please consider the 20x150 dock as identified in the March 17 Project Description.

2) *The proposed, size, configuration, and composition of the dock.*

   The dock identified in the Attached Figure 14 is 20x150 feet. The composition, whether a series of connected floats, or a single unit is not know at this time and likely depends on the contractor and their access to or ownership of such equipment.

   The impact analysis provided in our March 17 submittal assumes that ½ the area would potentially affect eelgrass. Based on discussion with NMFS, that will be updated to reflect the full area of the dock and anchors (3,200 SF) could potentially affect eelgrass. The revised Table 1 reflects the full area of the dock in the eelgrass impact calculations. Also note that as part of pre-design additional bathymetric and eelgrass surveys would be conducted to determine best alignment and location for the dock to provide access to the existing channel and minimize potential eelgrass impacts.

3) *How dock installation and removal would be accomplished.*

   Materials for the construction of the dock would be transported in from the road. It would be deployed from the former commercial pad and secured to a bulkhead constructed on the upland portion of the site.

4) *The number and type of proposed vessels (barges, support vessels, transports, etc.)*

   It is assumed that there will be multiple crews working on the Estero, and multiple debris transport barges. A preliminary estimate is between 8-12 vessels, though the actual number of vessels would be determined by the contractor's approach. Most of the vessels would likely be barges for support of removal operations (e.g. barge with excavator on it) and debris transport (e.g. barge and possibly push/tow vehicle), with 1-2 small vessels for daily crew access to the barges.

*5) Measures that would be used to minimize the potential for vessel collisions with marine mammals (low speeds, spotters, etc.)*

The operations in the Estero, with transport of debris barges and operations barges will be low speed in nature and will not result in any anticipated impacts. The crew vessels – to get out to the work barges will likely operate at higher speeds, but still generally less than 10 knots. The NPS will brief contractors prior to work on scanning for seals, and to slow down to 5 knots if a seal is sighted within 100yd of the vessel.

*6) The size and composition of debris containers.*

The assumption used for the Title I development was that the debris barges would support a 5 CY debris box for easy loading and unloading. The contractor may propose other approaches, but that is what was used in the initial engineering approach.

*7) The size, number, and type of machinery used to transport debris containers to shore (along the dock).*

Depending on the anticipated weights of the incoming debris box load, the boxes may be unloaded with a wheeled forklift – or an excavator. The boxes may be carried or rolled the length of the dock to the onshore area for debris transfer to larger containers. Ultimately it is anticipated that only 1-2 pieces of equipment would operate on the dock (and only 1 at a time).

*8) The type of vehicles used to transport debris offsite.*

This has not been specified or determined, however, it is likely that the debris from the offshore work would be consolidated into larger debris boxes for transport to an approved disposal facility. It is anticipated that the contractor will minimize truck trips by using larger transport containers – e.g. 10 CY dump trucks or 20 CY debris box transports, and by making sure the debris boxes are fully loaded prior to leaving the site.

*9) The estimated number of truck trips to remove material from the site.*

The preliminary estimates for weight of lumber, sandbar debris, and other aquaculture debris exceeds 500 tons. Given the overall mass of materials, and anticipated duration of work on the water, the number of trips per day of operation would not likely exceed 20 but is more likely on the order of 10 trips per day.

During the week of January 12, 2015, the onshore demolition contractor removed all of the commercial structures and affiliated infrastructure and debris at the site. This totaled 660 cubic yards of material (buildings, docks, and debris) and 6,256 square feet of asphalt and concrete. For that week there were approximately 10-15 trips per day required to remove the 660 CY of debris from the site. During that same period, a separate contractor removed approximately 37,000 pounds of shellfish and affiliated material (plastic tubes, mesh bags, etc) from the Estero using smaller vehicles.

*10) Any proposed traffic controls, parking restrictions, or visitor use limits that would be in place during project activities.*

At this time there are no closures or traffic controls anticipated. The work would not affect the current public parking lot. During the onshore removal activities and emergency shellfish removal, no closures or access restrictions were necessary. However, given the scale of the full offshore project, and in order to facilitate safe on-water operations, the park may implement a temporary recreational boat closure during days of operation (or for the whole period), similar to the annual harbor seal recreational boat closure.

Any decision to temporarily close the estero to recreational boating will be informed by the number of vessels in use for rack and debris removal, potential conflicts between the removal work and the public, and other factors. This determination will be made based on the final proposal by the contractor and any such decision to close would be made from the perspective of assuring operational and visitor safety.

*11) The location and type of onshore structures (lighting, parking, restrooms, temporary offices, etc.) that would be installed at the onshore base of operations.*

The temporary onshore staging site development plan is attached (Figure 12 of the Title I report). Based on discussions with the design engineer, the onshore area will not require a shell washing station and other onshore separation and preparation areas. This conceptual plan is not final or to scale but represents the general location and distribution for the work site facilities that will be in operation for the duration of the work period.

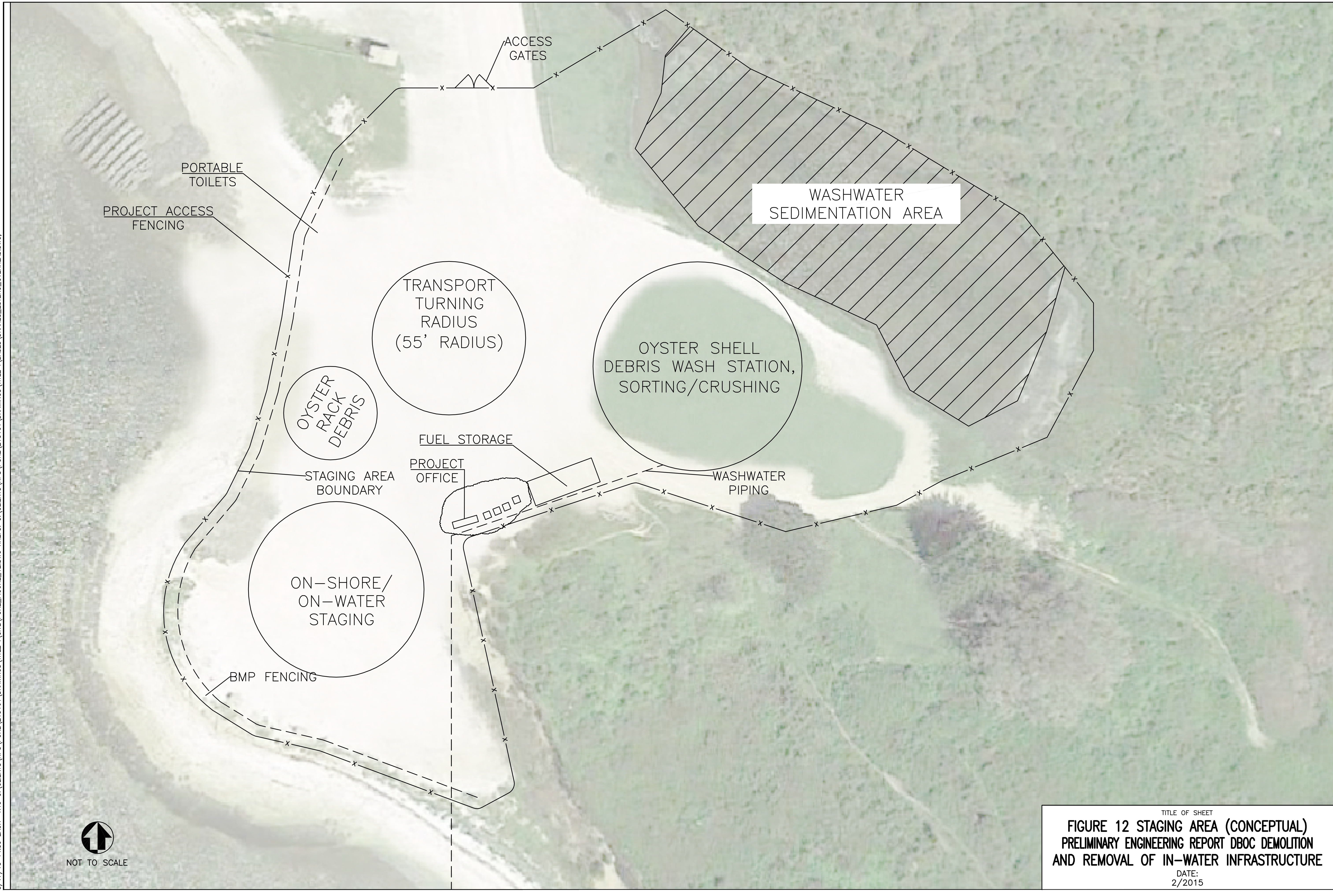
*12) The activities used to complete the installation and removal of these structures.*

We do not anticipate that installation of the job trailer and job restroom and work office facilities will require any additional grading. There is power to the site and the contractor could work with PGE to connect. The contractor would be required to provide all water. The restroom facility would be self contained (e.g – no connection to a site disposal system) and the contractor or a contracted company would be responsible for maintenance and dispose of all septic water away from the site.

The contractor would likely need to conduct some grading in upland areas (eg areas above MHW) in association with installation of the temporary dock approach and bulkhead but the overall need for additional grading at the site would be minimal.

*13) The proposed fate of removed timber – reuse, disposal, etc.*

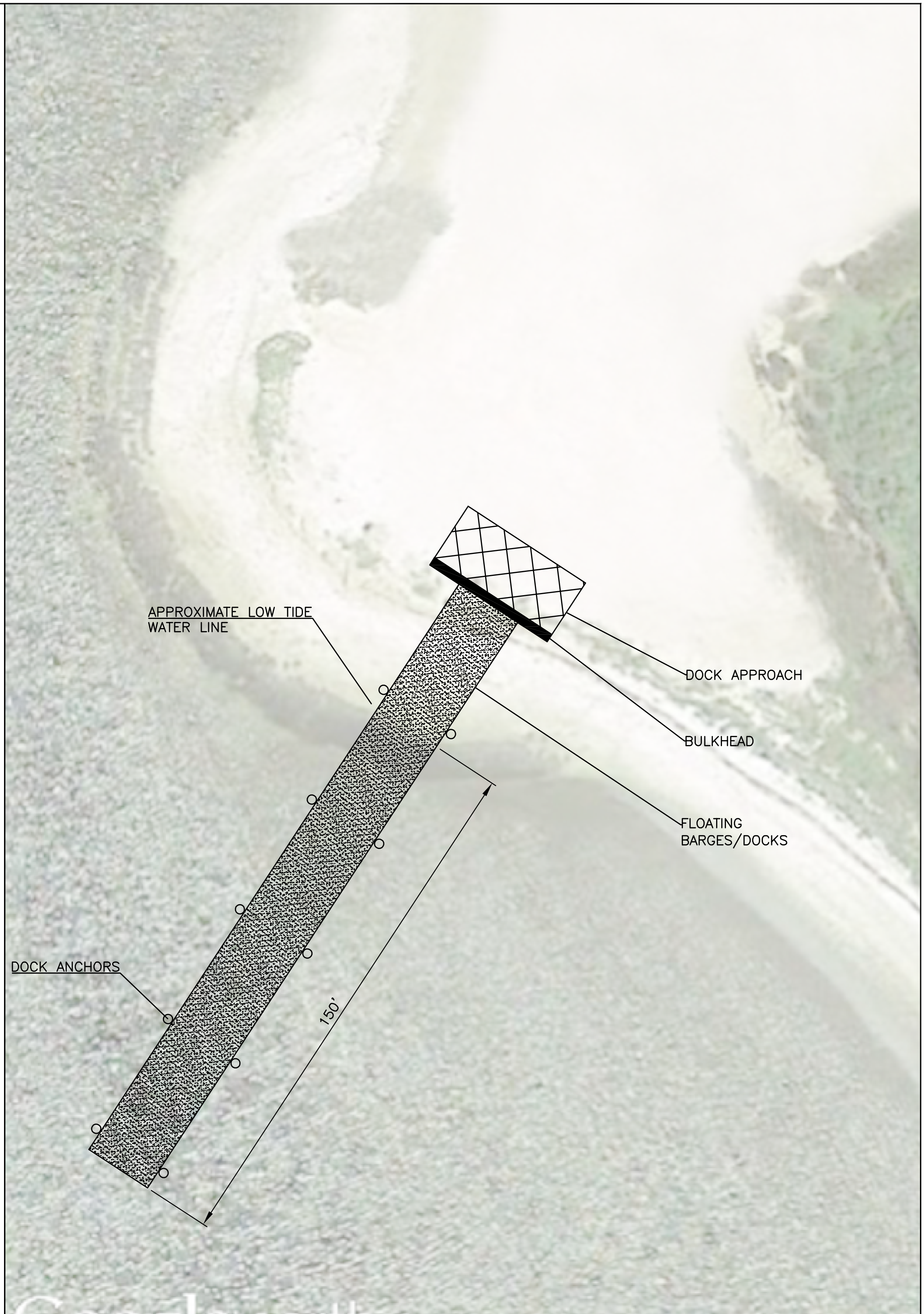
The lumber that is associated with the oyster racks has been in the water for decades and is in poor condition, not subject to reuse. The contractor will be required to dispose of the lumber at an appropriate disposal facility.




TITLE OF SHEET

**FIGURE 12 STAGING AREA (CONCEPTUAL)**
**PRELIMINARY ENGINEERING REPORT DBOC DEMOLITION AND REMOVAL OF IN-WATER INFRASTRUCTURE**

DATE:
2/2015




NOT TO SCALE

TITLE OF SHEET

# FIGURE 14 – TEMPORARY DOCK ALTERNATIVE (CONCEPTUAL)

**PRELIMINARY ENGINEERING REPORT DBOC DEMOLITION AND REMOVAL OF IN-WATER INFRASTRUCTURE**

DATE:
3/2015

**Supplemental Appendix 1**

**Impacts Avoidance Measures**

## 1. Overall Project Approach

The National Park Service (NPS) has documented that the footprint of the removal activities is approximately 8.02 acres, including 7.07 acres in the footprint of the racks, 0.88 acres of debris areas on sand bars (outside of oyster rack footprint), and 0.07 acres for placement of a temporary dock facility to facilitate removal of debris from Drakes Estero. The NPS has documented areas of heavy/moderate debris accumulation over nearly 2.3 acres of bottomlands beneath the racks, including ~1 acre comprised of fallen tubes, bags and strings. While all agencies were aware of the presence of aquaculture debris below the racks, the areal extent (approximately 1 acre) was not fully understood until extensive reconnaissance surveys in late January 2015. Activities proposed for the 0.88 acres identified as sand bar debris areas includes removal of oyster mats, anchors and lines, and uncontained manila clam from the area documented in the March 17 Project Description.

Vessel transit, anchoring and other essential operational activities will be conducted in a manner that avoids or minimizes to the greatest extent possible impacts to eelgrass (see anchoring plan discussion). However, it is anticipated that there will be some level of impact associated with these activities. Other activities integral to the removal operations include vessel transit and anchoring and upland development of a temporary transfer facility to support off-haul of the collected marine debris for disposal at an appropriate location. As noted in the amended project description of April 9, 2015, the NPS is evaluating the necessity of a temporary dock or if there are other smaller – lower impact measures that may be used to support offload of materials at the shore.

The nature of the work (removal of infrastructure), the proximity of eelgrass to many of the structures (within and immediately adjacent), and the hydrodynamics of the estuary (high tidal flushing) make the design and evaluation of the project and its potential impacts unique. The removal of infrastructure that is unnatural to the system is beneficial both in the short and long-term. Eelgrass is immediately adjacent to many of the racks and removal of the racks necessitates access to and likely impacts to eelgrass adjacent to the racks. Removal of materials and debris associated with these linear structures will necessitate that the contractor moves along the line quickly. As a result, the duration of work at any one location will be minimal. This coupled with the energetic tidal dynamics and hydrologic turnover, the indirect impacts associated with rack removal and aquacultural debris removal will be minimal.

<u>Project Benefits to Eelgrass</u>

Overall, the NPS has calculated that within the 7.07 acre area of the racks, there are 2.9 acres that currently include some level of eelgrass growth, whether underneath collapsed racks or right at the edges of in-tact structures. It is anticipated that removal of the oyster racks will create approximately 1.8 acres of eelgrass habitat and removal of aquacultural debris will enhance an additional 1 acre of habitat. As described in the amended project description (April 9, 2015) the NPS is reevaluating the potential impact/benefit of the proposed in-situ treatments. As a result, the NPS now proposes to implement in-situ treatment of accumulated shell on approximately 0.5 acres (not 2.3 acres as documented in the March 17 Project Description) and to conduct experimental monitoring to determine effectiveness of this type of treatment.

Estimates from field reconnaissance surveys indicate that the rack removal and temporary dock installation will result in temporary impacts to approximately 0.59 acres of eelgrass. The restoration project, including complete removal of oyster racks and accumulated aquaculture debris (tubes, strings, and bags), will provide 4.5:1 eelgrass benefit. The sandbar treatment areas identified as part of the project are not within, and therefore are not anticipated to impact eelgrass habitat or the impact calculation ratios presented above. Overall, for the purposes of planning, the removal activities would far exceed the eelgrass mitigation threshold of >1.2:1 and therefore no eelgrass mitigation is proposed.

Rack Removal Activities

The impacts identified with the removal of racks and aquacultural debris, and limited in-situ treatment is dependent on duration of work at any single location. Rates of treatment and removal are presented in Table S-1 below. Rack removal, including removal of posts and buried cross-beams will result in temporary intermittent sediment disturbance when the posts are pulled. Observations made during the method tests indicate that turbidity dissipated from the removal sites within a matter of 5 minutes or less. Three-post arrays are distributed in linear fashion at 12-foot intervals. The Preliminary Engineering Report estimates that it will take contractors between 15-20 minutes to complete removal of a 3-post bent, then moving on to the next bent. The only action that will disturb the bottom sediments is the actual removal of the posts and bottom cross member. Removal of racks and bents will have localized turbidity impacts on the order of minutes at each bent site. No additional BMPs are identified as necessary as part of rack removal activities.

Aquaculture Debris Removal and Experimental In-situ Treatment Activities

A second treatment that is proposed as part of this project is tied to the removal of aquacultural debris from approximately 1 acre of the rack footprint and the experimental in-situ treatment of shell on approximately 0.5 acres of area. Images of the debris indicate that the aquaculture debris (primarily tubes, bags, and strings) supports the presence and growth of *Didemnum vexillium* (Dvex). Debris removal will reduce the overall impact and availability of the accumulated debris as an unnatural substrate on the bottom of Drakes Estero and monitoring will be conducted to determine the effectiveness of the differing approaches.

The NPS has further evaluated methods and objectives described in the aquaculture debris removal section to identify what method can most effectively, efficiently, and safely remove the aquaculture debris while minimizing disturbance of Dvex, sediment and indirect impacts to eelgrass as part of the removal. Other bucket types, deployed from an excavator arm may be more effective at picking up the debris, and the NPS is also evaluating whether this scale of work could be achieved by divers removing the debris by hand. While hand-removal methods are being explored, the analysis of the impacts included in these supplemental documents still assumes mechanical removal at the scale presented in the amended project description.

The impacts associated with these removal or treatment activities are linked to the duration of work (disturbance) at any one location. Table S-1 documents that mechanical removal/treatment removal rates range from 432-915 SF/hour, meaning that the focal point of work, and therefore sedimentation generated from any specific activity will not linger in any single location very long. Hand removal of aquaculture debris is currently being evaluated by the NPS. While the rate of area treated using hand removal is much slower, the ability of divers to pick up and reduce breakage and secondary dispersal of materials in contact with the debris is much more discrete and effective.

**Table S-1.** Rates of debris removal and in-situ treatment of shell.

| | | **Rate per Hour** | |
|---|---|---|---|
| **Substrate** | **Sq Ft** | **Bents** | **Linear Feet** |
| Mechanized Heavy debris removal | 432 | 3 | 36 |
| Mechanized Moderate debris removal | 720 | 5 | 60 |
| Mechanized In-situ treatment of shell | 915 | 6 | 76 |
| Diver debris removal* | 70 | 0.5 | 6 |

*estimated from Title I – Diver suction device operation for removal

The following pages reference NMFS eelgrass guidelines and BMPs to arrive at this determination.

**2. Sediment Management and Impacts to Eelgrass**

The NMFS (http://www.westcoast.fisheries.noaa.gov/publications/habitat/california_eelgrass_mitigation/sfb_light monitoringprotocol.pdf) reports on Zimmerman et al's (1991) findings that:

> *"If the period of irradiance-saturated photosynthesis ($H_{sat}$ ) decreases below 3-5 hours per day, the maintenance of whole plant carbon balance and growth period is negatively affected (Zimmerman et al. 1991). Due to high turbidity levels in SF Bay, eelgrass plants located at the deeper edges of established eelgrass beds are less likely to accumulate large carbon reserves making them unable to withstand 30 days of reduced light conditions (Zimmerman et al. 1991). This protocol was established to ensure consistent collection of light monitoring data, and to guide users on the appropriate application of such measurements."*

No part of the Drakes Estero Restoration project (post removal, debris removal via bucket, or in-situ shell treatment) will be on any particular site adjacent to a patch of eelgrass for more than 3-5 hours (since contractors plan to work at a 12' bent site only between 15-20 minutes), and certainly not more than 30 days. Furthermore, Zimmerman et al. 1991 concluded that 30 days of reduced light conditions would affect deeper edges of eelgrass beds (with lower carbon reserves). All work areas in Drakes Estero are approximately 1m deep at 0 tide. These are not deep eelgrass beds and should therefore have adequate carbon reserves (all else being equal). We therefore propose that there is no risk to eelgrass productivity from short term suspended sediment and light reduction. **We therefore conclude that**

**there is unlikely to be any detectable effect on eelgrass carbon budgets, survivorship, or density due to light attenuation from suspended sediment.**

Nonetheless, considering NOAA's California Eelgrass Mitigation Policy and Implementing Guidelines (October 2014) provides turbidity guidance on P. 12 which states that (*numbers ours*):

A. T*o avoid and minimize potential turbidity-related impacts to eelgrass:*
   *A.1. Where practical, actions should be located as far as possible from existing eelgrass; and*
   *A.2. In-water work should occur as quickly as possible such that the duration of impacts is minimized.*

*B. Where proposed turbidity generating activities must occur in proximity to eelgrass and increased turbidity will occur at a magnitude and duration that may affect eelgrass habitat, measures to control turbidity levels should be employed when practical considering physical and biological constraints and impacts. Measures may include:*
   *B.1. Use of turbidity curtains where appropriate and feasible;*
   *B.2. Use of low impact equipment and methods (e.g., environmental buckets, or a hydraulic suction dredge instead of clamshell or hopper dredge, provided the discharge may be located away from the eelgrass habitat and appropriate turbidity controls can be provided at the discharge point);*
   *B.3. Limiting activities by tide or day-night windows to limit light degradation within eelgrass habitat;*
   *B.4. Utilizing 24-hour dredging to reduce the overall duration of work and to take advantage of dredging during dark periods when photosynthesis is not occurring; or*
   *B.5. Other measures that an action party may propose and be able to employ to minimize potential for adverse turbidity effects to eelgrass.*

This project must occur in proximity to eelgrass (#2), however, elevated turbidity levels will be too short lived (<5 minutes) to impact photosynthesis. This is the case whether pulling posts or removing debris from the seafloor with a bucket or divers. Furthermore, BCDC, citing USACE on much larger dredging (this project is not a dredging project) projects in San Francisco Bay concluded that:

> *"The suspension of sediments during dredging will generally result in localized, temporary increases in turbidity that are dispersed by currents or otherwise dissipate within a few days, depending on hydrodynamics and sediment characteristics (e.g., USACE and Port of Oakland 1998)." From BCDC August 1998 Long-Term Management Strategy for Bay Area Dredged Material Final Environmental Impact Statement/Environmental Impact Report CHAPTER 3.0 DREDGING AND DREDGED MATERIAL CHARACTERISTICS — AN OVERVIEW.*

Drakes Estero flushes much of its volume of water each day with the tides, as evidenced by modeling (NRC 2009) and the areas where the majority of racks exist contain primarily of oceanic plankton communities (Buck et al 2014). Thus while observations during rack removal tests indicated that visible sediment dissipated in a few minutes, the tidal cycles and currents of the estero will certainly reduce localized turbidity to times lower than impact thresholds (3-5 hr/d, 30 days to impact on deeper eelgrass) described by Zimmerman et al. (1991)

**Proposed BMP** - In consultation with NMFS, we have determined that our BMP for sediment impacts to eelgrass is that if operations in the field exceed 5 hours at a single bent, operations must be modified to increase operational efficiency. Note that after performing test pulls, we currently estimate only 15-20 minutes per bent.

## 3. Non-Natives Impacts

The primary concern with non-natives in this project is the inadvertent spread of *Didemnum vexillum (Dvex)*, a colonial tunicate that has invaded much of the east and west coasts of North America over the past 15 years. Dvex was first noted in Drakes Estero by Elliot-Fisk et al. (2005) growing on oysters, oyster racks, and experimental settlement plates. In 2010, Dvex was also noted growing on eelgrass in Drakes Estero (Grosholz 2010). As of 2015, Dvex is an established invader in Drakes Estero which is common, but unquantified, on marine debris, oyster racks, rocky outcrops (at Bull Point), and eelgrass in Drakes Estero (Grosholz 2010, Becker pers. obs.). Removal programs around the world, have attempted methods for removal, with the most successful methods, being either bathing the tunicates in acetic acid (held in place by an encapsulating cover), covering with sheeting to achieve long-term anoxia, bathing in freshwater, or desiccation (summarized in Muñoz and McDonald 2014). Most of these methods are not 100% effective for eliminating Dvex nor are currently feasible over a 2500 acre estuary. We therefore suggest that removal of the majority of the preferred substrate and Dvex on those substrates is a viable initial approach to Dvex control in the estuary. A key motivation for the removal of the oyster racks, oyster shell and marine debris is that it serves as the key substrate for Dvex. Thus, by removing the habitat, the Dvex population should be reduced, although the apparent increasing use of eelgrass as substrate is worrying and the short and long-term impacts on eelgrass are currently unknown.

Additionally, in most other removal programs, infrastructure (oyster bags, posts, etc) were proposed to be left in place and therefore removal of Dvex from the structure was the goal. Conversely, in this project, the goal is to remove the substrate along with the Dvex. Discussions with experts (S. Cohen at SFSU) and consulting the literature leads to several broad best management practices (BMPs) when removing debris covered with Dvex in Drakes Estero.

- Larval load and reproductive capacity are likely depressed when waters are colder. Water temperatures in Drakes Estero are relatively constant year round, but may be slightly cooler during spring upwelling and slightly warmer during late summer relaxation.
- In general fragmentation of Dvex colonies is likely a greater risk for spread than agitating larvae (S. Cohen pers. comm.).
- In estuaries where removal or treatment of Dvex has been delayed due to indecision, Dvex has spread, making the problem more difficult.
- Any Dvex not removed now will live to multiply and spread (via fragmentation or larvae) so by removing colonies now, we are removing future reproductive potential, even if some fragmentation occurs during removal.
- Dvex removed from the water should not be allowed to fall back into the water and should be disposed of on land.

- Some programs have encapsulated debris or posts covered with Dvex prior to removal (see review in (Muñoz and  McDonald 2014). We do not consider this technique feasible. Encapsulation has worked in Alaska where suspended aquaculture gear could be covered without touching the gear, but in Drakes Estero, divers would need to encapsulate each piece of debris (1000s of pieces) and 1000s of posts to achieve higher (but likely not perfect) levels of containment. Furthermore, the debris on the estuary floor would need to be handled prior encapsulation, and therefore would still be prone to fragmentation and release of larvae.  We therefore proposed that simple single handling and removal is most efficient and appropriate to minimized Dvex impacts.

Nonetheless, during removal activities, Dvex colonies on aquaculture debris, posts, and shell will be occasionally disturbed. We will minimize this disturbance and the chance of fragmentation by:

- No scraping or rubbing of lumber or debris so that tunicates are removed whole and no fragments are released into the water.
- No unnecessary agitation of tunicates (e.g. avoid grabbing posts where tunicates are present)
- Marine Debris is often covered with extensive Dvex, however the scooping method or hand picking proposed will simply scoop up debris and place it into the debris boxes.  This will agitate some of the tunicate and possibly induce release of larvae.  However, as discussed above these larvae would eventually be released if the tunicates were left in place, so while the removal effort may cause some release of larvae, the sum released will be lower than if the Dvex remained in place.

Therefore, while this project may change the timing that Dvex is released into the estuary, it should not add any additional Dvex to the estuary when considered over a full year time scale. **It can be anticipated that most of the Dvex will be removed whole and without agitating larvae, and therefore, the project will be greatly reducing the amount of Dvex larvae and reproductive budding that occurs. While the NPS has documented that removal using mechanized equipment is reasonably acceptable, any decision to employ divers removing material by hand would further reduce the overall potential impact described above.**

## 4. Spill Plan

A fuel or hydraulic oil spill in Drakes Estero could cause significant damage to eelgrass, fishes, fish eggs, waterbirds, infauna, and visitor enjoyment. The NPS contract requires that the contractor submit a spill prevention/response plan to be reviewed and approved prior to issuing the notice to proceed.  The NPS will review the contractor spill plan to ensure that the following topics are addressed adequately:

- Each vessel carrying fuel or hydraulics will carry absorbent boom and pads on board at all times for immediate deployment.  Additional boom will be immediately available onshore if additional boom is needed.

- Contractors must be trained in spill prevention and response prior to commencement of work. All spills will be immediately reported to NPS and USCG.
- Boats and hydraulic equipment must be inspected prior to work each day for leaks or potential spill hazards. Any issues must be corrected and approved by the site supervisor prior to work commencement.
- Bilges will not be pumped into the estero.
- Cleaners, solvents, paints, soaps or caustics will not be used on the water.

Additionally, the NPS will maintain a spill response plan for Drakes Estero that follows the following format (Adapted from California Marina and Yacht Club Spill Response Communication Packet: http://www.asmbyc.org/wp-content/uploads/2014/06/Final_Packet_May_2014.pdf).

A. Assess magnitude of spill
B. Identify Material spilled
C. Identify Source
D. Stop Source if able. Do not use soap or dispersing agents.
E. Contain spill using containment boom or absorbent pads. Use adequate PPE.
F. When incident is secured, complete an incident report and contact NPS and USCG.

**5. Anchoring Plan**

Anchors may damage eelgrass if placed in eelgrass beds, especially if anchors have a leading chain that repeatedly scrapes back and forth across eelgrass. A specific anchoring plan will be developed prior to work by consulting with the contractor. However, the plan will have these general requirements.

- No use of anchors with chains in eelgrass.
- Anchors should be deployed only where the bottom can be sighted to ensure anchors are not placed in eelgrass.
- Long, narrow poles that can be placed into the sediment may be used to stabilize barges without impacting eelgrass.
- Anchoring may occur within the footprint of existing oyster racks.
- In the event of an emergency where there is risk to human safety, running aground on an eelgrass bed, or a fuel spill, anchors may be temporarily deployed in eelgrass. Any such events will be reported to NPS.

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**Links to relevant documents.**

http://www.westcoast.fisheries.noaa.gov/publications/habitat/california_eelgrass_mitigation/Final%20CEMP%20October%202014/cemp_oct_2014_final.pdf

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http://www.bcdc.ca.gov/pdf/Dredging/EIS_EIR/chpt3.pdf

http://www.westcoast.fisheries.noaa.gov/publications/habitat/california_eelgrass_mitigation/sfb_lightmonitoringprotocol.pdf

http://www.oregon.gov/osmb/library/docs/construction_bmp_white_paper.pdf

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