Item 5 - Proposed Project Antidegradation Analysis

1.1 Project Description

The current Site use is as a sand distribution facility. Currently, covered barges berth at an existing dock located south of the Site. Sand is transferred by clam shell or excavator to a conveyor where it then travels to a storage building. Two silos located adjacent to the storage building are then used to load trucks for delivery. The storage building, silos, and conveyance system were constructed in 2012. The existing barge dock currently used by Fairmount Santrol was originally constructed in the 1940's and is not controlled by FMSA. As such, there are often barges backed up on the river waiting to get into the dock. The completion of the new barge dock will allow FMSA to control their access to berthing barges and minimize the amount of barges waiting on the river.

The proposed project is a barge dock which will be constructed as a filled wharf contained by a combined wall or "kingpile" bulkhead. The combined wall system will be located approximately 35 feet off of the existing shoreline and will consist of interlocking steel king piles and steel sheet piles driven in the river. Once the combined wall system has been installed in the river, granular fill consisting of clean sand and gravel will be loosely placed in-the-wet between the wall and existing shoreline. This bulk fill is anticipated to be placed up to approximate elevation 646 feet. The bulk fill will be compacted in-place using a method of vibratory probe compaction which involves the repeated driving of a steel pipe pile through the fill using a vibratory hammer. One to two feet of subsidence of the fill is expected resulting from the compaction, however, there should be a dry working surface above elevation 644 feet. Standard earthwork practices will then be followed to fill in-the-dry above elevation 644 feet to the bottom of pavement. The surface will be paved with reinforced concrete pavement to elevation 650 feet.

A reinforced concrete cap will be constructed along the length of the combined wall system and will serve as curbing and an anchor point for mooring hardware. The dock will be 200 feet long to facilitate berthing of one "Jumbo Hopper" barge. These barges are 195 feet long, 35 feet wide, and have an approximate 9 foot draft when fully loaded. Based on this vessel, a minimum mudline elevation of 633 feet at the dock is required, assuming 2 feet of clearance below the hull.

A bathymetric survey of the proposed dock area was performed in August 2014, by GZA GeoEnvironmental, Inc. With the face of the proposed dock located as indicated in the attached drawings, water depths appear sufficient to support the barges that currently visit the terminal, therefore, no dredging is required.

Once barges are in the new berth, a tracked excavator with clamshell attachment will unload the sand barges. The excavator will dump sand into a rail mounted mobile hopper that will travel with the excavator along a length of the dock. The hopper will transfer the sand to new conveyance system consisting of a nearly horizontal conveyor and bucket elevator. This new equipment will tie into the recently constructed conveyance system, transferring the sand to the existing storage building.

This project is scheduled to commence in 2016.

1.2 Avoidance

There were no other project sites considered for this project as the current operation is already in existence on the property and is renting dock space on the adjacent property to the south. The riverbank at the proposed project site is already disturbed, having a buried concrete erosion control wall already in place. In addition, the shoreline includes a significant quantity of debris and concrete rubble with concrete beneath. The shoreline vegetation is primarily invasive species (75% Japanese Knotweed) with a small quantity of small (4-8" diameter) locust trees. There are no wetlands and no tributary streams on or adjacent to the property. The only water present is the Ohio River. As this project is a dock construction project for access to the Ohio River, this project could not be done without affecting the Ohio River.

At the beginning of the project, three conceptual design layouts with two design options for each layout were considered. The following briefly summarizes each conceptual design option.

Option 1A: No Dredging, Anchored Wall System
Option 1A represented installation of new anchored steel sheet pile wall located approximately 30 to 40 feet into the river from the existing shoreline. The objective of this design alternative was to eliminate the need to dredge in the river by locating the sheets where the river bed elevation is approximately 633 feet, meeting the anticipated berth depth requirements. This alternative would require placement of a significant amount of fill in the river and behind the new bulkhead. Additionally, the installation of a deadman system would require the demolition and removal of the existing concrete shore protection system. Return walls consisting of similar steel sheet piles would also be required at either end of the new bulkhead to protect and contain fill at the northern and southern ends of the bulkhead. Rip rap slopes would then be constructed along the return wall and to the shoreline to protect the working platform. A second wall would also be required at each corner and diagonal bracing would be required to support the corners.

The new deadman system would consist of a pair of steel H-piles per tie rod. The H-piles would be located approximately 40 feet behind the new sheet pile wall. The tie rods would be fastened to the H-piles using a continuous double-channel steel wale consisting of paired steel channels. The same double-channel steel wale would also be utilized to fasten the tie rods to the new sheet piles. The area behind the bulkhead would be filled in-the-wet using granular fill. The fill would then be densified using VPC or another equivalent means of deep in-situ densification.

Option 1B: No Dredging, Cantilevered Wall System
Option 1B represented installation of new cantilevered steel combination wall located approximately 30 to 40 feet into the river from the existing shoreline. Having roughly the same location as Option 1A, the objective of this design alternative was to eliminate the need to dredge in the river, however, a cantilevered system will not require installation of a deadman or tie rods.

The combined wall system would consist of a pair of king piles with an intermediary pair of AZ sheet pile (or equivalent) installed between the pair of king piles.

Option 2A: Balanced Dredging and Fill, Anchored Wall System
Option 2A represented installation of a new anchored steel sheet pile wall located approximately 15 to 20 feet into the river from the existing shoreline. The objective of this

design alternative was to balance the volume of dredged material with the volume of fill required. This option would require dredging to meet the required berth depths. Approximately 450 cubic yards of sediment will need to be dredged from the river and approximately 600 cubic yards of fill will be required.

The anchored wall would be structurally identical to the wall system described in Option 1A, with the exception that return walls and corner bracing at the northern and southern ends of the bulkhead will not be required. It is anticipated that rip rap slopes that extend to the shoreline would be constructed the ends of the bulkhead to adequately protect the working platform. Similarly to Option 1A, the installation of a deadman system would require the demolition and removal of the existing concrete shore protection system.

Option 2B: Balanced Dredging and Fill, Cantilevered Wall System

Option 2B represented installation of a new cantilevered combined wall system located approximately 15 to 20 feet east the existing shoreline. The objective of this design Option was to balance the volume of dredged material with the volume of fill required, similar to the objective of Option 2A.

The cantilevered combined wall system is structurally identical to the wall system described in Option 1B, with the exception that return walls and corner bracing at the northern and southern ends of the bulkhead will not be required. It is also anticipated that rip rap slopes that extend to the shoreline can be constructed the ends of the bulkhead to adequately protect the working platform.

Although a deadman system would not be required with this option, demolition and removal of the existing concrete shore protection system would be required due to the close proximity to the existing concrete shore protection system.

Option 3A: Minimal Filling, Anchored Wall System

Option 3A represented installation of a new anchored steel sheet pile wall located approximately 5 to 10 feet into the river from the existing shoreline. The objective of this design option was to minimize the amount of filling that would be required.

This option would require dredging to meet the required berth depths. Approximately 1,400 cubic yards of sediment will need to be dredged from the river. Filling would be minimal. The anchored wall would structurally identical to the wall system described in Option 2A. Again, it is anticipated that rip rap slopes that extend to the shoreline can be constructed the ends of the bulkhead to adequately protect the working platform.

Similarly to Options 1A and 2A, the installation of a deadman system would require the demolition and removal of the existing concrete shore protection system. In addition, the existing conveyance system may be impacted by the construction of the platform this close to shore. The conveyance system will either need to be relocated or the existing foundations will need to be underpinned to accommodate the dock platform.

Option 3B: Minimal Filling, Cantilevered Wall System

Option 3B represented installation of a new cantilevered combined wall system located approximately 5 to 10 feet east the existing shoreline. The objective of this design Option was to minimize the amount of filling that would be required, similar to that of Option 3A.

The cantilevered combined wall system is structurally identical to the wall system described in Option 2B. Although a deadman system would not be required with this option, demolition and removal of a portion of the existing concrete shore protection system would be required due to the close proximity to the existing concrete shore protection system. In addition, the existing conveyance system may be impacted by the construction dock platform. The conveyance system would either need to be relocated or the existing foundations will need to be underpinned to accommodate the dock platform.

Following the conceptual design phase, field studies were conducted and additional information was garnered about the Site property. This resulted in a host of design constraints, as follows:

- Steeply sloping terrain leading from the current Site operations down to the waterfront;
- An existing right-of-way that must be maintained located near the waterfront and connecting the adjacent properties to the north and south of the Site;
- The location of recently constructed sand conveyance structures and equipment; and
- The location and elevation of an existing municipal VCP sewer line.

Project requirements for functionality include:

- A 50 foot wide platform to support the sand conveyance operations;
- A platform at elevation 650 feet to service the fleet of barges currently operating in this area;
- A paved surface for the platform capable of supporting industrial surcharge loads;
- A vehicular access road having maximum grade of 10% connecting the upland portions of the site to the platform; and,
- A minimum berth depth of 11 feet (mudline elevation 633 feet) at the dock.

Preferred Design:

The proposed design represents the most feasible concept for the new barge dock and access roadway. Although this layout requires filling within the waterway, moving the dock closer to the shoreline would not be possible. Because the proposed platform needs to be at elevation 650 feet and the crown of the existing sewer line is nearly at elevation 650 feet, if the dock were situated any closer to the shoreline, there would be less than 1 foot of cover over the pipe and damage of the structure would be imminent. Relocation of the gravity fed sewer line would require significant excavation on and off the property and would likely not be feasible. The slope of the existing gravity sewer, between the two manholes that could be located, is currently estimated to be less than 1%. This is based on a topographic plan (by others) where the pipe inverts at the two manholes are listed as elevations 549.10 and 553.59. The distance between the two manholes is roughly 590 feet. Relocating the line would result in an even longer run and therefore a shallower slope. The risk of obstruction or blockage of the gravity line would increase with slopes this shallow.

With the location of a right-of-way connecting the two adjacent parcels across the site, excavation into the upland portions of the site would not be possible without impacting this right-of-way. To meet the 20 foot change in elevation from the upland portions of the site down to the proposed platform while maintaining a 10% grade, nearly 200 linear feet of roadway would be required.

To maintain the existing grades along the right-of-way and meet the proposed grades at the platform, the roadway would need to run parallel to the sewer line. To maintain cover and prohibit overstressing of the pipe from surcharge loading, the new roadway would need to be aligned to cross the sewer where adequate cover was available and be located off of the sewer alignment where there was less than 4 feet of cover. Since crossing the sewer line with less than 1 foot over cover is not possible, the access road must meet the platform after crossing the sewer line. These conditions ultimately force the location of the dock to the shown location. Placing fill within the waterway will be required; however, there will not be a need to dredge.

Minimal Degradation Alternative: The minimal degradation alternative ultimately was the selected alternative. With the design constraints present on the Site, the selected alternative has the least impact possible while still going forward with the project.

Non-Degradation Alternative: There was no alternative that would result in no impacts to existing water resources. If the dock were constructed at the river's edge, then dredging would be required in order to allow barges to utilize the dock. Therefore, the only non-degradation alternative is to not construct the barge dock.

1.3 Minimization

Originally, there were 6 conceptual designs (as described above). All six options required some amount of filling in the river. Two of the options also required dredging in the river. The final design does not have any dredging, which minimizes the amount of disturbance to the riverbottom. In addition, the design includes a king pile wall. Construction of the project will be sequenced such that the king pile wall is installed prior to any fill activities. This will minimize the amount of turbidity impact to the river.

The existing shoreline along this Site is not pristine. The shoreline in the vicinity of the proposed barge dock is overgrown; however, existing U.S. Army Corps of Engineers (USACE) permit documents (1970 and previous) indicate that there is a buried concrete erosion control/ shore protection system in place. The presence of an approximately 2 foot thick layer of concrete that appears to extend from elevation 650 feet downward to the water's edge, (at least elevation 644 feet), has been confirmed by recent subsurface explorations at the site. Limited visual observations beneath the overgrowth along the water's edge indicate that the river bank consists of miscellaneous fill and concrete rubble. The shoreline is steep and densely vegetated with invasive Japanese knotweed (*Polyganum cuspidatum*). There are no wetlands on the site. As such, this project will not be degrading an existing resource.

Multiple designs were considered for this project. Ultimately, the design selected minimizes the impact to the river by avoiding the need for dredging activities. In addition, the design places the kingpile wall further from the middle of the river (closer to shore) than the existing dock located south of the Site. The sequencing of the project will be done in a manner that will minimize the amount of turbidity that reaches the river. Construction of the proposed dock will be phased so that installation begins at the farthest point out in the river and continues inland. Phasing construction limits the impact to the waterway during fill placement and provides a working platform for the remaining upland construction activities. Below is the more detailed phasing approach proposed for this project.

Phase 1- Site Establishment and Installation of Combined Wall System

During the initial phase of construction, all temporary erosion and sedimentation controls, temporary construction fencing, and staging areas will be established and piles for the combined wall system will be driven. For pile installation, it is expected that a crane barge will be mobilized to the site and the steel king piles and steel sheet piles will be driven with a vibratory hammer along the alignment of the proposed bulkhead. A limited amount of demolition of the existing concrete shore protection system will be required at either end of the new bulkhead to allow installation of the piles that form the return walls of the new wharf and allows the bulkhead to be anchored into the river bank. This will effectively close off the fill area from the river.

Phase 2- Filling and Vibratory Probe Compaction

Once the combined wall system has been installed, granular fill will be placed in-the-wet behind the bulkhead up to elevation 646, or two feet above normal pool elevation and one foot above ordinary high water. Fill will be contained by the new combined wall system and displaced water will drain through the sheet pile interlocks. The rate at which fill will be placed will not permit displaced water from overtopping the wall. The fill will be placed behind the bulkhead and will be loose once in place, deep in-situ compaction of the fill will be required. The same equipment that drove the piles for the new wall will utilize a probe (steel pipe pile, H-pile, etc.) that will be driven and extracted with a vibratory hammer on a grid pattern across the filled area. This will compact and homogenize the fill below the water level. Some subsidence of the fill is expected, which is why fill was initially placed to elevation 646 feet. After the vibratory probe compaction has been completed, test borings will be performed to confirm the density of the fill. If test borings indicate undesirable conditions, an additional pass of vibratory probe compaction will be performed. Once the fill has reached the appropriate density, additional fill will be placed in-the-dry to bottom of pavement elevation, approximately 645.5 feet.

Phase 3- Upland Retaining Walls

The existing gravel roadway leading down to the waterfront areas will essentially remain in place to provide access to the newly constructed platform. This phase of the project will involve widening, lengthening, and re-grading of the roadway. To maximize the square footage of the platform and provide staging area for equipment necessary to the terminal operations, retaining walls will be required to support the roadway and surrounding slopes. The construction of two small gravity retaining walls and a soldier pile and lagging wall are included in this phase. The gravity walls will consist of concrete block or gabions. The soldier pile and lagging wall will consist of steel H-piles installed in pre-drilled holes that are joined by pre-cast concrete panels to form a wall. Pre-drilling for soldier pile installation is proposed in order to minimize vibrations that may adversely impact existing structures, in particular, the gravity sewer. The wall will serve to support the roadway and existing equipment foundations located immediately adjacent to the platform. Cutting and filling of the existing gravel road will then be completed to match proposed grades.

Phase 4- Construction of Terminal Equipment and Dock Amenities

The final phase of construction will include the installation of the terminal equipment, concrete cap along the perimeter of the dock, installation of mooring hardware, guardrails, and concrete pavement. Terminal equipment will include a bucket elevator, rail mounted hopper, and covered conveyor, all of which should stand on shallow mat foundations. The reinforced concrete cap will run along the top of the combined wall system and provide anchorage for marine fender systems and mooring hardware. Mooring hardware (cleats and bollards) will be anchored to the concrete cap. Guardrails will be installed along the gravel access roadway in the vicinity of the solder pile and lagging wall and gravity retaining walls. Concrete pavement will be installed across the platform to elevation 650 to provide a working surface for the terminal operations.

1.4 Magnitude of the Proposed Lowering of Water Quality

This project will permanently impact 226 feet of shoreline of the Ohio River. The Ohio River is defined as a warmwater habitat under OAC 3745-1-32. The Ohio River is also designated as a public water supply, agricultural water supply, industrial water supply, and bathing waters.

There are no known threatened or endangered aquatic species present in this portion of the Ohio River that will be impacted by the construction of the barge dock. However, native mussels are protected in Ohio and a mussel survey is required by both ODNR and WVDNR. The mussel survey is being planned for summer 2015 and is being coordinated with both ODNR and WVDNR.

The impact to water quality will primarily be added turbidity during construction. The phased approach to construction, discussed in Section 1.3 above, will minimize the turbidity added to the River. In addition, once the barge dock is constructed, the turbidity should return to pre-construction conditions in the River near the dock.

This project will improve the Ohio River in this area for recreation and commercial activities by reducing the number of barges sitting in the river waiting to be unloaded. This is both an improvement in the ability of other water craft to maneuver down the river and an aesthetic improvement.

1.5 Technical Feasibility and Cost Effectiveness

This project utilizes readily available technologies (king pile wall) and is economically feasible and cost effective for the preferred alternative. The other alternatives considered are not feasible or cost effective due to Site constraints.

1.6 Economic Considerations

This project will create 10-15 temporary jobs during construction. The project will not affect local unemployment rates or poverty rates.

1.7 Cumulative Impact

This area of the Ohio River shoreline is fairly developed for commercial/industrial use. The addition of the proposed barge dock will remove some vegetative buffer on the property, but debris will be kept on the Site property (and out of the Ohio River) by the curbing that will be present on the barge dock surface. The existing shoreline is already constructed of concrete for erosion protection so the barge dock king pile wall will provide the same type of protection currently in place.

1.8 Indirect Impacts

The proposed project will create a barrier to movement of aquatic species. However, the existing dock south of the proposed project goes further out into the river than the proposed dock. In addition, by adding the dock, less barge traffic will be sitting in the water and reducing the amount of sunlight and oxygen getting to the surface of the water.

1.9 Construction Stormwater Management Plans

The area on land that will be affected by this project is less than one acre (0.55 acres). During construction, a Soil Erosion and Sedimentation Control (SESC) Permit will be in place with the Jefferson County Soil and Water Conservation District. Stormwater best management practices including silt fence and straw bales will be used during the construction. In addition, a silt curtain will be in place at the shore line between the edge of the dock and the remaining vegetative buffer at either end of the dock.

1-10 Post Construction Stormwater Management Plans

Following construction, stormwater will infiltrate into the pervious areas of the property. The curbing on the dock will prevent sheet flow into the Ohio River from the property during heavy rainfall events.