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of Engineers®**
Los Angeles District

Los Angeles River Ecosystem Restoration Feasibility Study

DRAFT – APPENDIX C COST

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LOS ANGELES RIVER ECOSYSTEM RESTORATION FEASIBILITY STUDY
COST APPENDIX

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1. INTRODUCTION

1.1 General

The Los Angeles River Ecosystem Restoration Feasibility Study is evaluating ecosystem restoration opportunities on an 11.5-mile long reach of the Los Angeles River (River) located in southern California. This reach, named the Los Angeles River ARBOR (Area with Restoration Benefits and Opportunities for Revitalization) extends from the Headworks area downstream to First Street in downtown Los Angeles. The ARBOR reach includes the Glendale Narrows—one of the few sections of the study area that does not have a hardened river bed—and contains several distinctive sites and connections including the Headworks, Pollywog Park, Bette Davis Park, the Burbank-Western Channel and Glendale River Walk, Griffith Park, Ferraro Fields, Verdugo Wash, Atwater Village, Taylor Yard and the Rio de Los Angeles State Park, the “Cornfields” (Los Angeles State Historic Park), Arroyo Seco, Elysian Park, “Piggyback Yard” (also known as the “Los Angeles Transportation Center” as well as “Mission Yard”), and downtown Los Angeles.

This appendix documents the various unit costs and construction assumptions utilized for the Los Angeles River Ecosystem Restoration project cost estimates. For estimating purposes the ARBOR reach was split into eight sub-reaches, and within these eight sub-reaches various restoration measures were estimated. The restoration measures are intended to solve specific problems or help obtain certain planning objectives. From these measures and sub-reaches, various alternatives have been developed for performing the economic alternatives analysis. A summary matrix of costs for each alternative at each sub-reach can be found in Attachment 1.

1.2 Purpose

The purpose of this work is to develop preliminary cost estimates – consistent to the conceptual level of design – for the eight sub-reaches of the project in order to perform an economic alternatives analysis. The costs within this document are not for budgetary purposes and are subject to change.

1.3 Design Features

The design features for the sub-reaches are designed at a conceptual level. Features include those components necessary to implement the measures and sub measures described in the associated Design Appendix and main report. Features include concrete demolition; excavation and fill; riprap; grouted riprap; turf reinforcement mats; fencing; clearing and grubbing; reinforced cast-in-place concrete walls, planters, slabs and piers; detention basins; sub-drainage system; and tunneling.

1.4 Design Limitations

Designs are based on preliminary, planning-level conceptual designs, and common engineering practices. The development of the hydraulic and geotechnical reports is currently under way, and thus the preliminary designs of this project took place without this engineering information. Future design phases would be more integrated with the hydraulic information, geotechnical

analyses, and vegetation requirements such that the concepts shown and discussed herein would be modified as necessary.

Also due to the limited hydraulic and geotechnical information, several items such as diversion and control of water, as well as construction items to control for scour were not included as line items within the cost estimates. However, these two items are anticipated to be fairly uniform across all the alternatives being considered in the economic analysis. Thus, across all alternatives the costs would be similar and would have no discernible impact on the comparison of alternatives, and ultimately the selection of a recommended plan. Once a recommended plan is selected, and further design information is generated, these items will be incorporated into a more detailed cost estimate.

2. BASIS OF ESTIMATE

2.1 Basis of Design

Available design documents of the project elements are listed below

- Los Angeles River Feasibility Study Conceptual Design Drawings, Tetra Tech, April 2013
- Los Angeles River Feasibility Study Design Report, Tetra Tech, April 2013
- Los Angeles River As-Built Drawings, Various Dates, USACE

2.2 Quantities

The cost estimate is based on project quantity take-offs that have been calculated in accordance with the documents above. A discussion of the quantity calculation process is provided below, and detailed quantity take-offs can be found in Attachment 2.

2.2.1 Demolition Quantities

The demolition quantities were developed primarily with the aid of existing typical cross section drawings taken from as-built drawings. Each of the typical cross sections corresponds to a specific length of channel. Thus the typical cross section areas and counts were multiplied into the designated length to calculate the required demolition quantities.

2.2.2 Installation Quantities

The installation quantities were developed in the same fashion as the demolition quantities. New typical cross sections were created for the various sub-reaches and side channels. These cross sections along with the length of the given sub-reaches were used to calculate the construction items required for revitalizing the channel.

3. UNIT COSTS AND ASSUMPTIONS

3.1 Unit Cost Development

Unit prices were developed with detailed labor, equipment and material pricing data. Recent vendor quotes for materials and placement were utilized in the development of several unit costs. A table containing the unit costs used in this estimate can be found in Attachment 3.

3.1.1 Borrow/Disposal Areas and Materials

Borrow materials are assumed to be available in the greater Los Angeles area. Any borrow material required is assumed to be trucked into the project site.

Any excess earthen material is assumed to be hauled off-site by the contractor to a disposal location. Three landfills that accept clean soils have been located within a 20-mile radius of the project location. These landfills are the Puente Hills Landfill, Scholl canyon Landfill and Savage Canyon Landfill. Thus, the estimate includes costs for transporting the excess material 20-miles as well as a tipping fee for disposal at the landfills.

3.2 Cost Item Assumptions

3.2.1 Excavation Grade Control (All Material Haul)

This construction cost item accounts for the excavation of material in the existing channel bed. The unit cost includes excavating with the use of hydraulic excavators and assumes all (100%) the material excavated would be hauled off-site for disposal. Front end loaders are assumed to load the trucks for hauling. The trucks are then assumed to travel 20-miles (one way) to a landfill for disposal of the material. A tipping fee is included in the cost as well.

3.2.2 Excavation Grade Control (Medium Material Haul)

This construction cost item accounts for the excavation of material in the existing channel bed. The unit cost includes excavating with the use of hydraulic excavators and assumes half (50%) the material excavated would be hauled off-site for disposal. Front end loaders are assumed to load the trucks for hauling. The trucks are then assumed to travel 20-miles (one way) to a landfill for disposal of the material. A tipping fee is included in the cost as well.

3.2.3 Excavation Grade Control (Limited Material Haul)

This construction cost item accounts for the excavation of material in the existing channel bed. The unit cost includes excavating with the use of hydraulic excavators and assumes a limited amount (15%) of the material excavated would be hauled off-site for disposal. Front end loaders are assumed to load the trucks for hauling. The trucks are then assumed to travel 20-miles (one way) to a landfill for disposal of the material. A tipping fee is included in the cost as well.

3.2.4 Grouted Riprap

This construction cost accounts for the placement of the grouted riprap grade control structures that would be placed within the channel. The unit cost includes all materials (stone and concrete), transportation, and placement required for the structures.

3.2.5 Excavation Embankment Control (All Material Haul)

This construction cost item accounts for the excavation of materials on the existing slopes of the channel. The unit cost includes excavating with the use of conventional scrapers. The scrapers would also transport the excavated material to a stockpile site and assumes all (100%) the material excavated would be hauled off-site for disposal. Front end loaders are assumed to be used at the stockpile location to load the trucks for hauling. The trucks are then assumed to travel 20-miles (one way) to a landfill for disposal of the material. A tipping fee is included in the cost as well.

3.2.6 Excavation Embankment Control (Medium Material Haul)

This construction cost item accounts for the excavation of materials on the existing slopes of the channel. The unit cost includes excavating with the use of conventional scrapers. The scrapers would also transport the excavated material to a stockpile site and assumes half (50%) the material would be hauled off-site for disposal. Front end loaders are assumed to be used at the stockpile location. The trucks are then assumed to travel 20-miles (one way) to a landfill for disposal of the material. A tipping fee is included in the cost as well.

3.2.7 Excavation Embankment Control (Limited Material Haul)

This construction cost item accounts for the excavation of materials on the existing slopes of the channel. The unit cost includes excavating with the use of conventional scrapers. The scrapers would also transport the excavated material to a stockpile site and assumes a limited amount (15%) of the material excavated would be hauled off-site for disposal. Front end loaders are assumed to be used at the stockpile location to load the trucks for hauling. The trucks are then assumed to travel 20-miles (one way) to a landfill for disposal of the material. A tipping fee is included in the cost as well.

3.2.8 Riprap

This construction cost item accounts for the all the riprap to be placed as erosion protection along the revitalized channel. The unit cost accounts for the purchase of the stone material, transporting the material a distance of approximately 40-miles, and placing the stone with the use of hydraulic excavators.

3.2.9 Grading

This construction cost item accounts for grading of newly constructed slopes. The unit cost assumes utilizing grader and equipment operator.

3.2.10 Turf Reinforcement Mat

This construction cost item accounts for the material and placement of the reinforcement mats along designated slopes of the newly constructed channel. The cost for material and placement was provided by Geotextile Systems Inc. This quoted price was used as a sub-contractor bid in the estimate, and thus accrued appropriate sub-bid mark-ups.

3.2.11 Rock at Reinforcement Mat Tie-In

This construction cost item accounts for the rock required at the tie-in to the slope. The stone for this item is assumed to be purchased from a quarry in the greater Los Angeles region and trucked to the project site. The material would be placed with front end loaders.

3.2.12 Top Soil

This construction cost item accounts for the top soil that would be placed on top of the turf reinforcement mats. The soil is assumed to be all borrow material, and would need to be trucked to the site. The material is assumed to be placed with front end loaders and compacted.

3.2.13 Vegetation

This construction item accounts for the placement of vegetation along the channel where necessary. The unit cost accounts for all materials and labor required to place the vegetation. The cost is based on recent estimates of planting costs along channel ways.

3.2.14 Concrete Demolition

This construction cost item accounts for the demolition of existing concrete slabs, slopes and walls found within the channel. The concrete is assumed to be demolished with the use of a concrete pulverizer and hydraulic excavator. The concrete would then be loaded onto trucks for hauling to a concrete recycling facility. The cost includes the disposal fee at the recycle plant and a 10-mile (one way) haul distance.

3.2.15 Subdrainage System Demolition

This construction cost item accounts for the demolition of existing subdrainage piping. The excavation required to access the subdrains is assumed to be accounted for in the other excavation items in the estimate. The piping to be removed is assumed to be 12" in diameter.

3.2.16 Chain Link Fence Demolition

This construction item accounts for the removal of existing fencing that runs along the channel. The fence is assumed to be chain link and would require hauling off site for disposal.

3.2.17 Clearing and Grubbing

This construction cost item accounts for the clearing and grubbing of the existing channel slopes prior to any earthwork being performed. The crew includes the use of a hydraulic excavator and trucks for removal of material.

3.2.18 6' Chain Link Fence

This construction cost item accounts for the placement of a 6-foot high chain link fence. The unit cost accounts for all labor, equipment, and material costs required placing the fence.

3.2.19 Aggregate Base Course

This construction cost item accounts for the placement of an aggregate base layer beneath the required asphalt pavement. The base material is assumed to be purchased and then hauled to the project site from the greater Los Angeles area. The base layer is assumed to be 6-inches in depth, and would be placed with front end loaders and then compacted.

3.2.20 Asphalt Pavement

This construction cost item accounts for the placement of asphalt roadways. The asphalt layer is assumed to be 6-inches thick, and would be placed on an aggregate base layer, which is accounted for in another unit cost.

3.2.21 Asphalt Demolition

This construction cost item accounts for the demolition of existing asphalt roadways throughout the project. The asphalt would be demolished, and then loaded onto trucks for hauling off-site. A tipping fee is also included in the unit cost of this item.

3.2.22 Utility Pole Relocations

A preliminary assessment of the utilities within the tentatively selected plan (TSP) and the sub-measures for the study area have identified Reach 6 and 7 as having potential relocations. In Reach 6 there are 8 high voltage transmission line towers within the study area where the TSP has identified widening of the channel, creation of marsh lands and planting of riparian habitat. In order to accomplish the sub-measures they will need to grade areas to a lower elevation and slope back banks. In Reach 7, 15 transmission line towers have been identified as potential utility relocations. In this reach, according to the TSP, the concrete walls of the channel will be reshaped to accommodate vegetation or planting boxes. This will not require relocation of poles or towers along the LAR channel. Currently plans to accomplish restoration in Arroyo Seco involve removing concrete, terracing the channel banks.

According to the Real Estate Appendix, a preliminary real estate assessment following the guidelines set forth in Real Estate Policy Guidance Letter No. 31 was completed for the transmission tower in Reach 6 and 7 of the TSP. Based on the real estate assessment, the transmission towers are of the type eligible for compensation and Los Angeles Department of Water and Power (LADWP) has been identified with a compensable interest in the property in the cases where the LADWP has been identified as the fee owner of the right of way. At this time only 3 of the 23 transmission towers that have been identified on land owned in fee by LADWP. Further real estate analysis will need to be completed to determine whether LADWP has a compensable interest in the property where the other 20 transmission towers are located. If LADWP is determined to have a compensable interest in the property the cost to relocate the identified utilities should be captured as a LERRD cost and not construction.

This cost item accounts for the moving of the 23 large steel transmission towers found in Reaches 6 and 7 of the project area. The unit cost assumes a crew of one large hydraulic crane, with the aid of several smaller cranes, would be able to lift and move the towers out of the construction zone. New concrete footings are assumed to be constructed at the new location of the towers. Cost estimates include the cost of relocating all 23 towers, however, it is unlikely that all of the towers would need to be moved.

3.2.23 Compacted Fill (All Borrow Material)

This construction cost item accounts for fill material to be placed for various structures throughout the project. The unit cost assumes the entire fill amount required (100%) would come from borrow material. Thus, the cost includes the price of the fill material delivered and stockpiled at the project site. It is assumed that the fill would be moved from a stockpile location, placed with a front end loader, and then compacted with a vibratory roller.

3.2.24 Compacted Fill (Medium Borrow Material)

This construction cost item accounts for fill material to be placed for various structures throughout the project. The unit cost assumes that half the fill amount required (50%) would come from borrow material, and the rest would come from on-site excavated material. The borrow material would need to be purchased, delivered and stockpiled at the project location. It is assumed that the fill would be moved from a stockpile location, placed with a front end loader, and then compacted with a vibratory roller.

3.2.25 Compacted Fill (Limited Borrow Material)

This construction cost item accounts for fill material to be placed for various structures throughout the project. The unit cost assumes that a portion of the fill amount required (15%) would come from borrow material, and the rest would come from on-site excavated material. The borrow material would need to be purchased, delivered and stockpiled at the project location. It is assumed that the fill would be moved from a stockpile location, placed with a front end loader, and then compacted with a vibratory roller.

3.2.26 Compacted Fill (No Borrow Material)

This construction cost item accounts for fill material to be placed for various structures throughout the project. The unit cost assumes the entire fill amount required would come from on-site material that has previously been excavated. It is assumed that the fill would be moved from a stockpile location, placed with a front end loader, and then compacted with a vibratory roller.

3.2.27 Sub Drainage System

This construction item accounts for the placement of the sub drainage system for the reinforced concrete walls. The unit cost includes several items. The drainage piping is assumed to be 12-inch diameter perforated PVC piping. This piping would be placed in the middle of a gravel packing, which would all be encased by geotextile fabric. Weep holes are assumed to be placed approximately every 10-feet along the drainage system.

3.2.28 Demo Grouted Riprap

This construction item accounts for the removal of the existing grouted riprap found along the channel. The unit cost includes demolishing the grouted stone and loading the material onto trucks. The trucks would transport the material to a proper disposal location.

3.2.29 Riprap Demolition

This construction item accounts for the removal of the existing riprap found along the current channel. The material would be removed with hydraulic excavators. The removed stone is then assumed to be crushed prior to being loaded and hauled off-site for disposal.

3.2.30 Remove Spalls

This construction item accounts for the removal of the spalls found in the current channel. The spalls would be removed with the use of hydraulic excavators. The spalls would then be loaded onto trucks for disposal off-site.

3.2.31 Sheet Pile Wall Demolition

This construction item accounts for the removal of existing sheet pile walls found in several sub-reaches. The sheet piles would be removed with the use of a hydraulic crane crew. No tipping fee has been included as the sheet piles are assumed to provide some salvage value.

3.2.32 Reinforced Concrete Retaining Wall

This construction item accounts for the placement of a reinforced concrete wall in the locations noted in the typical sections. The unit cost for this item includes costs for the formwork, concrete material, and concrete placement. The concrete is assumed to be pumped into place. An assumption of 150-lbs of reinforcing steel per cubic yard of concrete has been included as well.

3.2.33 Retaining Wall Gravel

This construction item accounts for the placement of the base material required beneath the retaining wall structures. The unit cost accounts for material and delivery of the gravel, as well as placement with front end loaders.

3.2.34 Reinforced Concrete Planters

This construction item accounts for the placement of the concrete planters along the channel slope in designated sub-reaches. The planters would be terraced up the slopes and consist of slab portions and vertical wall portions. The unit cost accounts for all formwork, concrete material, placement by pumping, and reinforcing steel required for the planters' construction.

3.2.35 Railroad Trestle

This construction item accounts for the placement of a new railroad trestle that would be constructed within the channel. The trestle is assumed to be placed on top of concrete piles. A

concrete deck would then be placed prior to installation of the rail line. The unit cost for this item accounts for all labor, equipment and materials required to place the aforementioned items.

3.2.36 Impermeable Liner

This construction item accounts for the placement of the liner in order to create a flood control basin. The unit cost includes all material and placement costs of the liner.

3.2.37 Reinforced Concrete Elevated Slab

This construction item accounts for the placement of a reinforced concrete elevated slab in the locations noted in the typical sections. The unit cost for this item includes costs for the formwork, concrete material, and concrete placement. The concrete is assumed to be pumped into place. An assumption of 150-lbs of reinforcing steel per cubic yard of concrete has been included as well.

3.2.38 Reinforced Concrete Slab

This construction item accounts for the placement of a reinforced concrete slab in the locations noted in the typical sections. The unit cost for this item includes costs for the formwork, concrete material, and concrete placement. The concrete is assumed to be pumped into place. An assumption of 150-lbs of reinforcing steel per cubic yard of concrete has been included as well.

3.2.39 Reinforced Concrete Piers

This construction item accounts for the placement of a reinforced concrete piers in the locations noted in the typical sections. The unit cost for this item includes costs for the formwork, concrete material, and concrete placement. The concrete is assumed to be pumped into place. An assumption of 150-lbs of reinforcing steel per cubic yard of concrete has been included as well.

3.2.40 Underground Basins

This construction item accounts for the creation of underground basins for water storage. The basins are assumed to be constructed of metal piping. The unit cost includes all material and labor to install the pipes for basin creation.

3.2.41 Storm Drain Daylighting

This construction item accounts for the placement of a new storm drain, associated piping and 1-acre of vegetation. The unit cost includes purchasing and placing a precast concrete storm drain that has a splitter sending low flows out a 24-inch pipe that would output flows into a wetland area, while high flows would exit the storm drain through a 36" pipe that outputs the flows into the river. The wetland area would be vegetated as well. Costs for the storm drain and piping were provided by Contech Engineered Solutions.

3.2.42 Four 24' Diameter Tunnels

This construction item accounts for the drilling and commissioning of four 24-foot diameter tunnels along an 8.2-mile stretch. The unit cost for this item was calculated from a quote

provided by JF Shea Construction, whom provided a cost for drilling and constructing one tunnel.

4. PRICE LEVEL

The effective price level date for this estimate is April 2013. This date applies to all elements of the cost estimates.

5. PROJECT MARKUPS AND FUNCTIONAL COSTS

5.1 Escalation

No escalation has been included in the estimates.

5.2 Preliminary Alternative Estimates Contingency

Contingencies represent allowances to cover unknowns, uncertainties and/or unanticipated conditions that are not possible to adequately evaluate from the data on hand at the time the cost estimate is prepared but must be represented by a sufficient cost to cover the identified risks. An overall contingency of 25% has been used to cover design changes and uncertainties in quantities and unit prices for the preliminary alternatives analysis.

5.3 Real Estate Costs

The costs for this feature were developed by the City of Los Angeles and USACE in August 2013. Costs were developed for each alternative in each sub-reach, and applied appropriately within the alternatives matrix.

5.4 Relocation Costs

The total costs for this feature include other costs developed by the USACE in August 2013 as well as the Railroad Trestle costs estimated within this document. Costs developed by the USACE were developed in accordance with P.L. 91-646 for businesses that would require relocation and more detailed discussion of the relocation costs is provided in the Real Estate Plan.

5.5 Mobilization and Demobilization

Costs for this item were estimated to be 7.5% of construction costs. This item accounts for transporting equipment and crews to the project site, as well as setting up site facilities and staging areas.

5.6 Planning, Engineering and Design

Costs for this account were estimated at 11% of construction costs. This account covers the preparation of plans, specifications, and engineering during construction.

5.7 Supervision and Administration

Costs for this account were estimated to be 6.5% of construction costs. This account covers construction management during construction.

5.8 Operations and Maintenance (O&M)

Costs for this item account for the routine work that is expected to occur each year over the life cycle of the project. Costs were developed for this by using percentages of the original installation cost for each item. A table of the percentages used and the overall O&M costs for each sub-reach can be found in Attachment 4.

6. INTEREST DURING CONSTRUCTION

Interest during construction (IDC) is the opportunity cost of capital, which is an economic cost incurred while construction funds are expended but benefits have not yet begun to accrue. This value is calculated from the overall costs, the construction duration, and the Federal discount rate (currently 3.75%). The IDC values can be found in the alternatives matrix in Attachment 1.

7. ANNUALIZED COSTS

Annualized construction and O&M costs have been calculated within the alternatives matrix spreadsheet. These costs have been annualized over the 50-year life cycle of the project. The current Federal discount rate of 3.75% was used in the computing of the annualized costs.

8. SPREADSHEET ESTIMATES

Cost estimates have been developed that contain all sub-measures found in each sub-reach. These estimates can be found in Attachment 3. The spreadsheet estimates are split into the eight sub-reaches. Each sub-reach in turn has estimates of each restoration measure that may be constructed in the sub-reach. These spreadsheet estimates are construction costs only and do not contain any of the project markups or functional cost items referenced above.

9. FINAL ARRAY OF ALTERNATIVES

The nineteen restoration alternatives, listed in Attachment 1, were analyzed as described in the Economics and Plan Formulation Appendix to identify the final array of alternatives. The final array consists of four alternatives that have been renamed to identify the recombination of restoration components. Each of the final array alternatives include a mixture of components taken from the initial nineteen alternatives and the table below includes the alternatives and reaches that compose the final array. The right hand column of the Table 9.1 includes the reaches and lists the preliminary array of nineteen alternatives from which the measures included in the final array originated.

Table 9.1 Final Array of Alternatives Summarized

Final Array Name	Reaches and Alternatives	
10 ARBOR Riparian Transitions (ART)	Reach 1 - A11 Reach 2 - A11 Reach 3 - A17 Reach 4 - A16	Reach 5 - A16 Reach 6 - A14 Reach 7 - A9 Reach 8 - A15
13 ARBOR Corridor Extension (ACE)	Reach 1 - A11 Reach 2 - A11 Reach 3 - A16 Reach 4 - A16	Reach 5 - A16 Reach 6 - A13 Reach 7 - A12 Reach 8 - A15
16 ARBOR Narrows to Downtown (AND)	Reach 1 - A11 Reach 2 - A11 Reach 3 - A16 Reach 4 - A16	Reach 5 - A5 Reach 6 - A13 Reach 7 - A12 Reach 8 - A3
20 ARBOR Riparian Integration via Varied Ecological Reintroduction (RIVER)	Reach 1 - A11 Reach 2 - A13 Reach 3 - A18 Reach 4 - A16	Reach 5 - A5 Reach 6 - A13 Reach 7 - A16 Reach 8 - A3

Total first costs (not including O&M, interest during construction, or escalation) for the final array of alternatives are summarized in Table 9.2, and a detailed breakdown of costs can be found in Attachment 5.

9.1 Recreation Costs

Recreation costs have been included in Table 9.2. The recreation plan includes modifications, upgrades, and creation of multi-use trails and amenities (access points, wildlife viewpoints, parking lots, restrooms and signage). The plan also includes several non-motorized multi-use bridges that span the river and tributaries. A separate economic analysis was completed to determine the recommended plan for the Recreation components, and this recommended plan is assumed to be constructed in each of the four final array construction alternatives.

A detailed discussion of the Recreation plan can be found in Appendix J of the main report, and detailed cost estimates of the Recreation items can be found in Attachment 6 here within.

9.2 Abbreviated Risk Analysis (ARA)

An Abbreviated Risk Analysis (ARA) was completed in order to develop the contingencies for the Channels; Planning, Engineering and Design; and Construction Management feature

accounts of the four final array alternatives. A single risk register was developed due to the similarity of the construction components between each of the four alternatives. The individual construction element contingencies calculated from the risk register were then pulled out and applied to each alternative's construction costs to generate the weighted construction contingencies seen in Table 9.2. The ARA and the calculated construction contingency spreadsheet can be found in Attachment 7.

Table 9.2 Final Array of Alternatives Cost Estimates by Work Breakdown Structure

Alt 10 - ARBOR Riparian Transitions (ART)

WBS No.	Feature Account	First Costs	Contingency (%)	Total Costs
01	Lands and Damages	\$247,425,237	20.00%	\$296,910,284
02	Relocations ¹	\$11,392,360	20.00%	\$13,670,832
09	Channels	\$39,947,368	38.83%	\$55,456,944
14	Recreation	\$4,543,482	35.00%	\$6,133,701
30	Planning, Engineering and Design	\$4,394,210	24.40%	\$5,466,398
31	Construction Management	\$2,596,579	26.25%	\$3,278,181
Total Project Cost:				\$380,916,340

1) Relocation cost and contingency provided by USACE.

Alt 13 - ARBOR Corridor Extension (ACE)

WBS No.	Feature Account	First Costs	Contingency (%)	Total Costs
01	Lands and Damages	\$250,048,826	20.00%	\$300,058,591
02	Relocations ¹	\$11,392,360	20.00%	\$13,670,832
09	Channels	\$88,459,438	36.01%	\$120,312,641
14	Recreation	\$4,543,482	35.00%	\$6,133,701
30	Planning, Engineering and Design	\$9,730,538	24.40%	\$12,104,790
31	Construction Management	\$5,749,864	26.25%	\$7,259,203
Total Project Cost:				\$459,539,758

1) Relocation cost and contingency provided by USACE.

Alt 16 - ARBOR Narrows to Downtown (AND)

WBS No.	Feature Account	First Costs	Contingency (%)	Total Costs
01	Lands and Damages	\$278,031,210	20.00%	\$333,637,452
02	Relocations ¹	\$35,422,360	32.14%	\$46,805,411
09	Channels	\$261,753,170	37.89%	\$360,927,221
14	Recreation	\$4,543,482	35.00%	\$6,133,701
30	Planning, Engineering and Design	\$31,436,149	24.40%	\$39,106,569
31	Construction Management	\$18,575,906	26.25%	\$23,452,081
Total Project Cost:				\$810,062,435

1) Relocation cost includes costs provided by the USACE and Railroad Trestle construction. Contingency is weighted average of contingencies provided by the USACE and calculated contingency from ARA.

Alt 20 - ARBOR Riparian Integration Via Varied Ecological Reintroduction (RIVER)

WBS No.	Feature Account	First Costs	Contingency (%)	Total Costs
01	Lands and Damages	\$352,858,303	20.00%	\$423,429,963
02	Relocations ¹	\$49,072,002	31.46%	\$64,511,752
09	Channels	\$363,575,556	39.38%	\$506,743,287
14	Recreation	\$4,543,482	35.00%	\$6,133,701
30	Planning, Engineering and Design	\$43,186,611	24.40%	\$53,724,144
31	Construction Management	\$25,519,361	26.25%	\$32,218,193
Total Project Cost:				\$1,086,761,040

1) Relocation cost includes costs provided by the USACE and Railroad Trestle construction. Contingency is weighted average of contingencies provided by the USACE and calculated contingency from ARA.

10. REFERENCES

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- U.S. Army Corps of Engineers, 2008b, *Construction Cost Estimating Guide For Civil Works, Engineering Technical Letter 1110-2-573*, Department of the Army, Washington D.C., 30 September 2008.

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Los Angeles District

Los Angeles River Ecosystem Restoration Feasibility Study

Cost Appendix

Attachment 1

Alternatives Matrix of Construction Costs

August 2013

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LOS ANGELES RIVER COST ESTIMATE
ALTERNATIVES MATRIX

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
			Comprehensi ve	City: Awater to Cornfields	Banks & Tribes Only	Highest Scoring Objectives (over 3)	City: Los Feliz to Arroyo Seco	Corps Team	highest objectives (over 5)	Charette Team 1	Soft Bottom & Channel & associated banks	Highest Other Criteria (over 11)	Charette Team 4	Charette Team 3	Charette Team 6	Charette Team 5	Charette Team 2	Side Channels Only	Charette Team 7	Comprehen sive Pockets	Taylor Yard
1. Reach	Measure Type	Submeasure																			
	I. Adjacent or off channel modifications	3/5. create geomorphology and plant for freshwater marsh, open water le pool/rifle system	X		X	X					X	X				X	X	X	X		
		2. expose stormdrain outlets; convert to natural stream confluence, & divert to water quality ponds as needed (put in adjacent channel etc)	X		X			X			X	X				X		X			
	II. Attenuation	10. divert tributary & river flow into side channels on both sides (minimize impacts to existing use in parks & plant riparian/marsh habitat)	X		X			X		X	X	X				X		X			
		7. Create underground basin for attenuation at equestrian center - continue current use	Y		Y			Y			Y					Y		Y		Y	
		9. culverts & or underground basins to divert flood flows	Y		Y	Y		Y	Y	Y	Y						Y		Y		
10. Pollywog Park/Headworks to Midpoint of Betty Davis Park	IV. Planting/ implies soil amendments and geomorphic restructuring as needed	16. bioengineer channel walls (vines, vegetated notching near top of vertical walls)	X							X					X						
		17. habitat corridors/ riparian planting on banks (assume easiest method)	X		X	X		X		X	X	X	X	X	X	X	X	X	X	X	
		22. channel banks maintain/widen channel (implies erosion control)	X															X			
	V. Remove concrete (implies required erosion control such as grade control, planting and geomorphic restructuring, etc)	23. channel bed (implies deepening or attenuation)	X			X		X		X		X		X		X					
		25. tributary channels/widen channel (implies erosion control)	X		X			X			X					X					
		26. terrace banks (check for connectivity vs too small once mapping is completed)	X		X			X		X	X	X		X	X	X			X		
	VI Reshape Channel	27. modify trap channel to vertical sides to gain width (adds capacity)	X			X			X						X						
		Construction		71,138,775	-	50,790,568	22,707,817	-	63,895,827	936,944	59,532,012	67,498,547	60,731,449	1,460,173	39,056,801	25,989,049	42,959,521	5,062,893	23,134,820	25,951,542	1,460,173
		Mobilization (7.5%)		5,335,408	-	3,809,293	1,703,086	-	4,792,187	70,271	4,464,901	5,062,391	4,554,859	109,513	2,929,260	1,949,179	3,221,964	379,717	1,735,112	1,946,366	109,513
		Construction Subtotal		76,474,183	-	54,599,860	24,410,903	-	68,688,014	1,007,215	63,996,913	72,560,938	65,286,307	1,569,686	41,986,061	27,938,228	46,181,485	5,442,610	24,869,932	27,897,907	1,569,686
		Contingency (25%)		19,118,546	-	13,649,965	6,102,726	-	17,172,004	251,804	15,999,228	18,140,235	16,321,577	392,421	10,496,515	6,984,557	11,545,371	1,360,653	6,217,483	6,974,477	392,421
		PER/EDC (11%)		8,412,160	-	6,005,985	2,685,199	-	7,555,682	110,794	7,039,660	7,981,703	7,181,494	172,665	4,618,467	3,073,205	5,079,963	598,687	2,735,693	3,068,770	172,665
		S&A (6.5%)		4,970,822	-	3,548,991	1,586,709	-	4,464,721	65,469	4,159,799	4,716,461	4,243,610	102,030	2,729,094	1,815,985	3,001,797	353,770	1,616,546	1,813,364	102,030
		Construction Period (Months)		32	-	24	16	-	26	9	22	27	23	8	16	15	21	11	16	15	9
		IDC		5,532,329	-	2,931,039	875,221	-	3,983,847	20,568	3,243,568	4,510,035	3,334,547	27,908	1,484,615	950,985	2,225,551	133,558	895,086	949,278	32,312
		LERRDS		5,449,862	-	5,443,610	5,315,390	-	5,443,610	8,813	5,440,071	4,921,692	5,443,610	4,784,304	5,440,071	5,448,854	5,443,610	5,306,609	4,788,223	5,440,071	4,784,304
		Total Cost Subtotal		119,957,902	-	86,179,450	40,976,148	-	107,307,878	1,464,662	99,879,239	112,831,065	101,811,145	7,049,014	66,754,823	46,211,814	73,477,778	13,195,886	41,122,963	46,143,867	7,053,419
		Annualized Construction Costs		5,347,030	-	3,841,382	1,826,480	-	4,783,165	65,286	4,452,039	5,029,357	4,538,152	314,204	2,975,544	2,059,855	3,275,215	588,196	1,833,024	2,056,827	314,401
		Annualized O&M Costs		410,062	-	369,512	92,889	-	339,033	163,400	348,864	369,512	341,794	62,410	199,535	240,085	233,014	92,889	204,669	230,014	62,410
		Total Annualized Costs		5,757,091	-	4,210,894	1,919,369	-	5,122,198	228,686	4,800,903	5,398,869	4,879,946	376,615	3,175,079	2,299,940	3,508,229	681,086	2,037,693	2,286,841	376,811
	I. Adjacent or off channel modifications	3/5. create geomorphology and plant for freshwater marsh, open water le pool/rifle system	X		X	X					X	X				X	X	X	X		
		2. expose stormdrain outlets; convert to natural stream confluence, & divert to water quality ponds as needed (put in adjacent channel etc)	X		X			X			X	X				X		X			
	II. Attenuation	10. divert tributary & river flow into side channels on both sides (minimize impacts to existing use in parks & plant riparian/marsh habitat)	X		X			X		X	X	X						X			
		9. culverts & or underground basins to divert flood flows	Y		Y	Y		Y	Y	Y	Y						Y		Y		
	IV. Planting/ implies soil amendments and geomorphic restructuring as needed	16. bioengineer channel walls (vines, vegetated notching near top of vertical walls)	X							X					X						
		17. habitat corridors/ riparian planting on banks (assume easiest method)	X		X	X		X	X	X	X	X	X	X	X	X	X	X	X		
	V. Remove concrete (implies required erosion control such as grade control, planting and geomorphic restructuring, etc)	23. channel bed (implies deepening or attenuation)				X			X												
		26. terrace banks (check for connectivity vs too small once mapping is completed)	X					X		X	X	X		X							
	VI Reshape Channel	27. modify trap channel to vertical sides to gain width (adds capacity)	X			X			X						X						
		Construction		37,354,526	-	7,633,672	28,184,790	-	9,657,836	24,852,325	10,293,099	12,990,301	12,990,301	41,962	5,398,591	24,406,187	3,374,427	3,374,427	7,633,672	3,332,465	-
		Mobilization (7.5%)		2,801,589	-	572,525	2,113,859	-	724,338	1,863,924	771,982	974,273	974,273	3,147	404,894	1,830,464	253,082	253,082	572,525	249,935	-
		Construction Subtotal		40,156,115	-	8,206,198	30,298,649	-	10,382,173	26,716,249	11,065,081	13,964,573	13,964,573	45,109	5,803,485	26,236,651	3,627,509	3,627,509	8,206,198	3,582,400	-
		Contingency (25%)		10,039,029	-	2,051,549	7,574,662	-	2,595,543	6,679,062	2,766,270	3,491,143	3,491,143	11,277	1,450,871	6,559,163	906,877	906,877	2,051,549	895,600	-
		PER/EDC (11%)		4,417,173	-	902,682	3,332,851	-	1,142,039	2,938,787	1,217,159	1,536,103	1,536,103	4,962	638,383	2,886,032	399,026	399,026	902,682	394,064	-
		S&A (6.5%)		2,610,147	-	533,403	1,969,412	-	674,841	1,736,556	719,230	907,697	907,697	2,932	377,227	1,705,382	235,788	235,788	533,403	232,856	-
		Construction Period (Months)		18	-	10	13	-	11	12	11	12	11	4	6	10	6	7	9	6	-
		IDC		1,650,016	-	189,053	895,239	-	245,812	685,316	264,200	384,884	345,329	428	80,831	595,199	48,238	58,354	165,950	47,591	-
		LERRDS		2,257,456	-	2,093,163	2,230,703	-	2,116,844	2,230,703	2,254,384	2,119,884	2,116,844	2,091,559	2,112,199	2,257,423	2,088,				

LOS ANGELES RIVER COST ESTIMATE
ALTERNATIVES MATRIX

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		
			Comprehensi ve	City: Answer to Cornfields	Banks & Tribes Only	Highest Scoring Objectives (over 3)	City: Los Feliz to Arroyo Seco	Corps Team	highest objectives (over 5)	Charette Team 1	Soft Bottom & Channel & Channel associated banks	Highest Other Criteria (over 11)	Charette Team 4	Charette Team 3	Charette Team 6	Charette Team 5	Charette Team 2	Side Channels Only	Charette Team 7	Comprehen sive Pockets	Taylor Yard		
1	Reach	Measure Type	Submeasure																				
72		I. Adjacent or off channel modifications	3/5. create geomorphology and plant for freshwater marsh, open water le pool/riffle system	X	X	X			X	X		X						X	X				
73			2. expose stormdrain outlets, convert to natural stream confluence, & divert to water quality ponds as needed (put in adjacent channel etc)	X	X	X	X	X	X	X	X	X		X			X	X					
80			4. grade adjacent areas to a lower elevation for habitat & offline retention	X	X	X	X	X	X			X		X				X					
81		II. Attenuation	10. divert tributary & river flow into side channels on both sides (minimize impacts to existing use in parks & plant riparian/marsh habitat)	X	X	X	X	X	X	X		X			X			X					
82			7. Create underground basins for attenuation - continue current use	Y	Y					Y				Y	Y			Y					
83			9. culverts & or underground basins to divert flood flows	Y	Y	Y	Y	Y	Y	Y	Y		Y										
84	4. Brazil to Los Feliz Blvd	III. Wildlife Access (formerly other)	12. bridge undercrossings for wildlife	X	X												Y		Y				
85			15. wildlife passage/tunnels	X	X			X								X	X						
87		IV. Planting/ implies soil amendments and geomorphic restructuring as needed	17. habitat corridors/ riparian planting on banks (assume easiest method)	X	X		X	X	X	X					X			X					
88			21/22 widenchannel, provide erosion control may lower channel banks and provide setback levees or vegetated berms	X	X	X		X	X					X									
89			23. channel bed (implies deepening or attenuation)		X	X	X		X							X							
90			26. terrace banks (check for connectivity vs too small once mapping is completed)	X	X	X	X	X	X	X	X	X	X		X	X							
91		VI Reshape Channel	27. modify trap channel to vertical sides to gain width (add capacity)	X	X		X	X	X						X	X							
92			Construction		137,219,364	138,376,364	127,488,009	137,874,958	7,848,819	131,040,351	137,874,958	126,011,065	114,541,639	127,488,009	113,641,639	12,108,299	119,433,459	122,871,588	900,000	13,846,370	6,577,607	-	-
93			Mobilization (7.5%)		10,291,452	10,378,227	9,561,601	10,340,622	588,661	9,828,026	10,340,622	9,450,830	8,590,623	9,561,601	8,523,123	908,122	8,957,509	9,215,369	67,500	1,038,478	493,321	-	-
94			Construction Subtotal		147,510,816	148,754,591	137,049,610	148,215,580	8,437,481	140,868,377	148,215,580	135,461,895	123,132,262	137,049,610	122,164,762	13,016,421	128,390,968	132,086,957	967,500	14,884,848	7,070,927	-	-
95			Contingency (25%)		36,877,704	37,188,648	34,262,402	37,053,895	2,109,370	35,217,094	37,053,895	33,865,474	30,783,066	34,262,402	30,541,191	3,254,105	32,097,742	33,021,739	241,875	3,721,212	1,767,732	-	-
96			PEDEDC (11%)		16,226,190	16,363,005	15,075,457	16,303,714	928,123	15,495,522	16,303,714	14,900,808	13,544,549	15,075,457	13,438,124	1,431,806	14,123,006	14,529,565	106,425	1,637,333	777,802	-	-
97			S&A (6.5%)		9,588,203	9,669,048	8,908,225	9,634,013	548,436	9,156,445	9,634,013	8,805,023	8,003,597	8,908,225	7,940,710	846,067	8,345,413	8,585,652	62,888	967,515	459,610	-	-
98			Construction Period (Months)		43	43	35	39	17	36	39	35	27	32	26	15	33	27	13	17	12	-	-
99			IDC		14,782,451	14,967,077	11,163,895	13,508,715	328,001	11,645,434	13,508,715	10,966,480	7,642,732	9,919,258	7,184,143	449,021	9,718,354	8,171,589	27,158	564,516	191,153	-	-
100			LERRDS		19,830,552	19,830,552	19,001,697	19,792,938	19,756,075	19,820,195	19,792,938	18,802,694	17,300,599	18,974,422	17,578,612	17,549,694	18,353,356	16,799,997	634,224	17,993,208	562,014	-	-
101			Total Cost Subtotal		244,815,916	246,772,921	225,461,286	244,508,854	32,107,486	232,203,067	244,508,854	222,802,375	200,406,804	224,189,374	198,847,541	36,546,115	211,028,839	213,195,499	2,040,069	39,768,632	10,829,238	-	-
102			Annualized Construction Costs		10,912,478	10,999,710	10,049,761	10,898,791	1,431,166	10,350,270	10,898,791	9,931,242	8,932,977	9,993,066	8,863,474	1,629,015	9,406,446	9,503,023	90,935	1,772,656	482,705	-	-
103			Annualized O&M Costs		554,898	554,898	545,049	547,377	102,772	500,101	547,377	552,570	461,521	545,049	452,521	61,329	496,293	454,849	59,000	142,528	106,277	-	-
104			Total Annualized Costs		11,467,377	11,554,609	10,594,809	11,446,168	1,533,939	10,850,371	11,446,168	10,483,811	9,394,497	10,538,115	9,315,994	1,690,343	9,902,739	9,957,872	149,935	1,915,184	588,982	-	-
105		I. Adjacent or off channel modifications	3/5. create geomorphology and plant for freshwater marsh, open water le pool/riffle system	X	X	X			X	X		X	X		X								
106			2. expose stormdrain outlets, convert to natural stream confluence, & divert to water quality ponds as needed (put in adjacent channel etc)	X	X													X					
107		II. Attenuation	10. culverts & or underground basins to divert flood flows	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y		Y				
108		III. Wildlife Access (formerly other)	14. wildlife access from river to bank (in daylighted storm drain)	X	X		X	X	X	X		X		X			X						
109	5. Los Feliz to Glendale Fwy (2)	IV. Planting/ implies soil amendments and geomorphic restructuring as needed	16. bioengineer channel walls (vines, vegetated notching near top of vertical walls)	X	X		X					X					X						
110			17. habitat corridors/ riparian planting on banks (assume easiest method)	X	X		X	X	X	X		X		X	X			X					
111		V. Remove concrete (implies required erosion control such as grade control,planting and geomorphic restructuring, etc)	23. channel bed (implies deepening or attenuation)				X	X	X	X													
112			26. terrace banks (check for connectivity vs too small once mapping is completed)	X	X	X	X	X		X				X									
113		VI Reshape Channel	27. modify trap channel to vertical sides to gain width (add capacity)	X	X		X	X	X														
114			Construction		87,401,820	87,401,820	31,784,946	55,367,624	87,401,820	100,000	55,367,624	149,250	100,000	-	31,784,946	-	55,516,874	-	-	100,000	-	-	
115			Mobilization (7.5%)		6,555,137	6,555,137	2,383,871	4,152,572	6,555,137	7,500	4,152,572	11,194	7,500	-	2,383,871	-	4,163,766	-	-	7,500	-	-	
116			Construction Subtotal		93,956,957	93,956,957	34,168,817	59,520,196	93,956,957	107,500	59,520,196	160,444	107,500	-	34,168,817	-	59,680,640	-	-	107,500	-	-	
117			Contingency (25%)		23,489,239	23,489,239	8,542,204	14,880,049	23,489,239	26,875	14,880,049	40,111	26,875	-	8,542,204	-	14,920,160	-	-	26,875	-	-	
118			PEDEDC (11%)		10,335,265	10,335,265	3,758,570	6,547,222	10,335,265	11,825	6,547,222	17,649	11,825	-	3,758,570	-	6,564,870	-	-	11,825	-	-	
119			S&A (6.5%)		6,107,202	6,107,202	2,220,973	3,868,813	6,107,202	6,988	3,868,813	10,429	6,988	-	2,220,973	-	3,879,242	-	-	6,988	-	-	
120			Construction Period (Months)		29	30	15	20	30	12	20	13	10	-	15	-	20	-	-	10	-	-	
121			IDC		6,278,039	6,559,371	1,161,876	2,647,887	6,559,371	2,877	2,647,887	4,752	2,270	-									

LOS ANGELES RIVER COST ESTIMATE
ALTERNATIVES MATRIX

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
	Measure Type	Submeasure	Comprehens ive	City: Awater to Cornfields	Banks & Trib Only	Highest Scoring Objectives (over 3)	City: Los Feliz to Arroyo Seco	Corps Team	highest objectives (over 5)	Charette Team 1	Soft Bottom & Channel associated banks	Highest Other Criteria (over 11)	Charette Team 4	Charette Team 3	Charette Team 6	Charette Team 5	Charette Team 2	Side Channels Only	Charette Team 7	Comprehen sive Pockets	Taylor Yard	
1	Reach	I. Adjacent or off channel modifications	1. elevate railroads on trestles (consider other locations when necessary - is this an "all alt" measure?)	X	X	X		X		X		X	X		X			X	X	X		
2. expose existing storm drains & gravity flow through DWP to LAR with terracing into the river			X	X				X		X		X	X					X		X		
3/5. create geomorphology and plant for freshwater marsh, open water le pool/rifle system			X	X	X	X	X	X		X		X	X					X		X		
4. expose stormdrain outlets; convert to natural stream confluence, & divert to water quality ponds as needed (put in adjacent channel etc)			X	X		X	X	X		X		X	X		X				X			
10. divert tributary & river flow into side channels on both sides (minimize impacts to existing use in parks & plant riparian/marsh habitat)			X	X	X						X								X			
II. Attenuation		8. creation of wetlands flood control basin (assumes culvert under Baker St)	X	X		X		X	X				X			X			X			
		9. culverts & or underground basins to divert flood flows	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						Y		Y	X	
		III. Wildlife Access (formerly other)	15. wildlife passage/tunnels	X	X				X										X			
			16. bioengineer channel walls (vines, vegetated notching near top of vertical walls)	X	X			X			X								X			
			17. habitat corridors/ riparian planting on banks (assume easiest method)	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X
7. I-5 to Main	IV. Planting/ implies soil amendments and geomorphic restructuring as needed	19. Planting built into channel walls (reshape concrete walls to accommodate vegetation or add hanging boxes (native vines, small shrubs, etc)	X	X	X	X	X	X	X	X		X			X			X				
		21/22 widenchannel, provide erosion control may lower channel banks and provide setback levees or vegetated berms	X	X	X	X	X	X				X	X	X		X	X			X		
		23. channel bed (implies deepening or attenuation)	X			X	X			X			X			X	X			X		
		25. tributary channels/widen channel (implies erosion control)		X	X	X	X	X	X	X	X		X					X			X	
		26. terrace banks (check for connectivity vs too small once mapping is completed)	X	X	X		X	X	X		X		X	X		X						
	VI Reshape Channel	27. modify trap channel to vertical sides to gain width (adds capacity)	X	X		X	X		X				X	X								
		Construction		79,429,472	79,429,472	72,919,284	75,353,714	70,653,714	72,919,284	6,704,487	48,176,162	300,000	72,993,007	76,768,766	21,161,663	75,353,714	25,011,145	64,143,526	48,176,162	68,649,227	34,086,903	-
		Mobilization (7.5%)		5,957,210	5,957,210	5,468,946	5,651,529	5,299,029	5,468,946	502,837	3,613,212	22,500	5,474,476	5,757,657	1,587,125	5,651,529	1,875,836	4,810,764	3,613,212	5,148,692	2,556,518	-
		Construction Subtotal		85,386,683	85,386,683	78,388,231	81,005,242	75,952,742	78,388,231	7,207,324	51,789,374	322,500	78,467,483	82,526,423	22,748,788	81,005,242	26,886,980	68,954,290	51,789,374	73,797,919	36,643,421	-
		Contingency (25%)		21,346,671	21,346,671	19,597,058	20,251,311	18,988,186	19,597,058	1,801,831	12,947,343	80,625	19,616,871	20,631,606	5,687,197	20,251,311	6,721,745	17,238,573	12,947,343	18,449,480	9,160,855	-
8. Main to First	I. Adjacent or off channel modifications	PEDEDC (11%)		9,392,535	9,392,535	8,622,705	8,910,577	8,354,802	8,622,705	792,806	5,696,831	35,475	8,631,423	9,077,907	2,502,367	8,910,577	2,957,568	7,584,972	5,696,831	8,117,771	4,030,776	-
		S&A (6.5%)		5,550,134	5,550,134	5,095,235	5,265,341	4,936,928	5,095,235	468,476	3,366,309	20,963	5,100,386	5,364,218	1,478,671	5,265,341	1,747,654	4,482,029	3,366,309	4,796,865	2,381,822	-
		Construction Period (Months)		33	35	27	24	27	27	11	20	6	25	27	10	27	11	21	17	18	17	-
		IDC		6,558,718	6,817,666	4,909,491	4,419,999	4,699,799	4,909,491	171,517	2,365,663	4,315	4,451,664	5,029,087	516,740	4,898,390	643,390	3,307,376	1,916,525	3,005,039	1,400,811	-
		LERRDS		47,061,897	47,061,897	31,372,890	31,282,450	22,658,568	47,057,422	5,869,762	45,153,206	2,324,206	31,372,890	31,372,890	5,749,795	45,237,420	5,653,606	25,045,660	33,285,601	25,628,633	31,372,890	-
	II. Attenuation	Total Cost Subtotal		175,296,639	175,555,587	147,985,610	151,134,919	135,591,024	163,670,142	16,311,716	121,319,726	2,788,084	147,640,717	154,002,130	38,683,557	165,568,280	44,610,943	126,612,900	109,001,884	133,795,707	84,990,576	-
		Annualized Construction Costs		7,813,711	7,825,253	6,596,343	6,736,721	6,043,864	7,295,469	727,082	5,407,687	124,277	6,580,970	6,864,525	7,380,077	7,988,498	5,643,671	4,858,678	5,963,839	3,788,388	5,963,839	-
		Annualized O&M Costs		277,496	277,496	263,119	320,002	267,002	263,119	120,291	237,622	53,000	255,626	263,119	70,918	267,002	70,918	255,626	234,622	249,711	81,412	-
		Total Annualized Costs		8,091,207	8,102,749	6,859,462	7,056,723	6,310,866	7,558,588	847,373	5,645,310	177,277	6,836,595	7,127,644	1,795,207	7,647,079	2,059,416	5,899,297	5,093,300	6,213,550	3,869,800	-
		9. Main to First	I. Adjacent or off channel modifications	1. elevate railroads on trestles (consider other locations when necessary - is this an "all alt" measure?)	X		X	X		X	X	X		X	X	X		X		X	X	
3/5. create geomorphology and plant for freshwater marsh, open water le pool/rifle system	X				X	X		X		X		X						X				
2. expose stormdrain outlets; convert to natural stream confluence, & divert to water quality ponds as needed (put in adjacent channel etc)	X							X			X							X				
6. rebuild geomorphology for historic wash	X				X	X				X			X				X					
10. divert tributary & river flow into side channels on both sides (minimize impacts to existing use in parks & plant riparian/marsh habitat) to recreate channel braiding	X				X	X		X	X					X				X	X			
II. Attenuation	9. culverts & or underground basins to divert flood flows		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				X			X			
	III. Wildlife Access (formerly other)		15. wildlife passage/tunnels	X	X				X					X				Y		Y		
			16. bioengineer channel walls (vines, vegetated notching near top of vertical walls)	X							X							X				
			17. habitat corridors/ riparian planting on banks (assume easiest method)	X		X	X	X	X	X	X	X		X	X	X	X	X	X			
	V. Remove concrete (implies required erosion control such as grade control/planting and geomorphic restructuring, etc)		21/22 widenchannel, provide erosion control may lower channel banks and provide setback levees or vegetated berms	X		X			X	X				X	X	X		X	X			
23. channel bed (implies deepening or attenuation)		X			X				X		X		X			X						
26. terrace banks (check for connectivity vs too small once mapping is completed)				X			X	X					X									
VI Reshape Channel		27. modify trap channel to vertical sides to gain width (adds capacity)	X			X								X								
		Construction		141,779,824	-	109,533,381	90,353,761	-	98,659,287	53,192,364	57,775,550	200,000	50,858,186	99,560,232	64,496,286	40,570,055	90,126,824	12,271,741	51,514,951	40,600,920	-	-
Alternative Totals	I. Adjacent or off channel modifications	Mobilization (7.5%)		10,633,487	-	8,215,004	6,776,532	-	7,399,447	3,989,427	4,333,166	15,000	3,814,364	7,467,017	3,837,221	3,042,754	6,759,512	920,381	3,863,621	3,045,069	-	
		Construction Subtotal		152,413,311	-	117,748,384	97,130,293	-	106,058,734	57,181,791	62,108,716	215,000	54,672,550	107,027,249	69,333,507	43,612,809	96,886,335	13,192,122	55,378,573	43,645,989	-	
		Contingency (25%)		38,103,328	-	29,437,096	24,282,573	-	26,514,683	14,295,448	15,527,179	53,750	13,668,137	26,756,812	17,333,377	10,903,202	24,221,584	3,298,030	13,844,643	10,911,497	-	
		PER/EDC (11%)		16,765,464	-	12,952,322	10,684,332	-	11,666,461	6,289,997	6,831,959	23,650	6,013,980	11,772,997	7,626,686	4,797,409	10,657,497	1,451,133	6,091,643	4,801,059	-	
		S&A (6.5%)		9,906,8																		

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**US Army Corps
of Engineers®**
Los Angeles District

Los Angeles River Ecosystem Restoration Feasibility Study

Cost Appendix

Attachment 2 Quantity Take-Offs

August 2013

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PROJECT: **LA River Feasibility**
DETAIL: *Reach 1 Quantity Calculations*
COMPUTED BY: SKV
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/17/2011

REACH 1 - INSTALLATION CALCULATIONS

Page 1 of 3

Reach Length

Length = 8,225 lf

Total Length = **8,225 LF**

[03] Create Geomorphology and Plant for Freshwater Marsh

Excavation for Grade Control Structures

Length = 8,225 lf

Distance Between Structures = 500 lf

of Structures = 17 ea

Cross Section Area* = **709 sf**

* Measured in CAD from typical section

Channel Width = 130 lf

Concrete Invert Length = **103 lf**

Concrete Invert Width = 130 lf

Concrete Invert Thickness = **1 lf**

Concrete Demo per Structure = 496 cy

Excavation Volume = **49,602 CY**

Grouted Riprap Structures

Length = 8,225 lf

Distance Between Structures = 500 lf

of Structures = 17 ea

Cross Section Area* = **215 sf**

* Measured in CAD from typical section

Channel Width = 130 lf

Low Flow Channel Area = **33 sf**

* Measured in CAD from typical section

Low Flow Channel Length = **18.5 lf**

Grouted Riprap Volume = **17,214 CY**

Compacted Backfill for Grade Control Structure

Length = 8,225 lf

Distance Between Structures = 500 lf

of Structures = 17 ea

Cross Section Area* = **534 sf**

Channel Width = 130 lf

Compacted Fill Volume = **43,709 CY**

Hauling of Material

Excavation Volume = 49,602 cy

Unusable % = 20%

Unusable Volume = 9,920 cy

Compacted Fill Volume = 43,709 cy

Unused Fill = -4,027 cy

Volume to be Hauled = **9,920 CY**

Borrow Fill Needed = **4,027 CY**



PROJECT: **LA River Feasibility**
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REACH 1 - INSTALLATION CALCULATIONS

Page 2 of 3

[07] Create Underground Basin for Attenuation

Underground Basin

Length = 1,400 lf
Width = 1,500 lf
Height = 9 lf

Underground Basin Volume = **18,900,000 CF**

[16] Bioengineer Channel Walls

Pyramat Turf Reinforcement Mat

Length = 8,225 lf
Width = 44 lf
Extra Pyramat at Tie-Ins = 30 lf

Reinforcement Mat Area = **67,628 SY**

Rock at Pyramat Tie-In

Length = 8,225 lf
Width = 3 lf
Height = 3 lf
No. of Rock Tie-Ins = 2 ea

Rock Volume = **5,483 CY**

[17] Habitat Corridors/Riparian Planting on Banks

Top Soil

Length = 8,225 lf
Width = 164 ft
Thickness = 0.5 ft

Top Soil Volume = **24,980 CY**

Revegetation

Length = 8,225 lf
Width = 164 ft

Revegetation Area = **31.0 ACRE**

[26] Terrace Banks

Excavation Left Bank

Length = 8,225 lf
Cross Section Area* = 481 sf
Retaining Wall Height = 18 lf
Retaining Wall Width = 1 lf
Retaining Wall Area = 18 sf
Excavation Area = 463 sf

* Measured in CAD from typical section

Excavation Volume = **141,007 CY**



PROJECT: **LA River Feasibility**
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REACH 1 - INSTALLATION CALCULATIONS

Page 3 of 3

Excavation Right Bank

Length = 8,225 lf
Cross Section Area* = 21.6 sf
Retaining Wall Height = 4 lf
Retaining Wall Width = 1 lf
Retaining Wall Area = 4 sf
Excavation Area = 18 sf

* Measured in CAD from typical section

Excavation Volume = 5,349 CY

Riprap Toe Protection

Length = 8,225 lf
Cross Section Area* = 305 sf

* Measured in CAD from typical section

Riprap Volume = 92,912 CY

Compacted Fill Embankment

Length = 8,225 lf
Cross Section Area* = 292 sf

* Measured in CAD from typical section

Compacted Fill Volume = 88,952 CY

Hauling of Material

Excavation Volume = #####
Compacted Fill Volume = 132,661 cy

Volume to be Hauled = 13,696 CY

Fencing

Length = 8,225 lf
No. of Fences = 4 ea

Fencing Length = 32,900 LF

Aggregate Base Layer

Length = 8,225 lf
No. of Roads = 2 ea
Width = 16 ft
Thickness = 0.5 ft

Aggregate Base Volume = 4,874 CY

Asphalt Pavement

Length = 8,225 lf
No. of Roads = 2 ea
Width = 16 ft

Asphalt Area = 29,244 SY



PROJECT: **LA River Feasibility**
DETAIL: *Reach 1 Demo Quantity Calculations*
COMPUTED BY: NSS
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/19/2011

REACH 1 - DEMOLITION CALCULATIONS

Page 1 of 2

Reach Length

Length = 8,225 lf

* From Station 487+25 to Station 405+00

Total Length = 8,225 LF

[23] Channel Bed

Demo Reinforced Concrete Channel Invert

Length 1 = 7,725 lf

* From Station 487+25 to Station 410+00

Width From Centerline = 130 ft

Invert Thickness 1 = 1.0 ft

Length 2 = 500 lf

* From Station 410+00 to Station 405+00

Width 2a = 212 ft

Width 2b = 180 ft

Invert Thickness 2 = 1.0 ft

Concrete Demo Volume = 40,824 CY

Demo 12-Inch-Diameter Subdrainage System

Length = 8,225 lf

No. of Pipes = 4 ea

Pipe Demo Length = 32,900 LF

Demo Subdrainage System Risers and Hoods

Length = 8,225 lf

Interval = 1 set/750 ft

No./set = 4 ea

Number of Demo Risers/Hoods = 44 EA

[26] Terrace Banks

Demo Left Bank Reinforced Concrete Channel Wall

Length = 7,725 lf

* Rectangular from Station 487+25 to Station 410+00

Height = 18 lf

Top of Wall Thickness = 1.0 ft

* Estimated based on dims. of similar USACE channels

Base of Wall Thickness = 2.0 ft

* Estimated based on dims. of similar USACE channels

Concrete Demo Volume = 7,725 CY

Demo Top 4' of Right Bank Reinforced Concrete Channel Wall

Length = 7,725 lf

* Rectangular from Station 487+25 to Station 410+00

Height = 4 lf

* Height from LA River Feas. Prelim. design drawings

Top of Wall Thickness = 1.0 ft

* Estimated based on dims. of similar USACE channels

Concrete Demo Volume = 1,144 CY

Demo Existing 4-Foot-High Chain-Link Fence

Length = 16,450 lf

* Chain-link fences on both banks

Chain-Link Fence Length = 16,450 LF



PROJECT: **LA River Feasibility**
DETAIL: *Reach 1 Demo Quantity Calculations*
COMPUTED BY: NSS
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/19/2011

REACH 1 - DEMOLITION CALCULATIONS

Page 2 of 2

Demo Asphalt-Concrete Access Road

Length = 5,000 lf * Length measured from aerial photographs
Width = 16 ft
Thickness = 0.25 ft * Assumed above grade

Asphalt-Concrete Pavement Demo Volume = 741 CY

Clearing and Grubbing Landside Vegetation

Length = 8,225 lf
Width = 90 ft * Width estimated to be 60' on LB and 30' on RB

Clear and Grub Area = 17 AC

Utility Pole Structures to Demo

No. of Structures = 10 ea * Estimated from aerial photographs

Utility Pole Structure Demo Number = 10 EA

[27] Modify Trapezoidal Channel to Vertical Sides

Demo Trapezoidal Reinforced Concrete Channel Slope Paving

Length = 1,000 lf * Conc. on both banks from Sta. 410+00 to Sta. 405+00
Width = 63 ft * $W = 60/\cos(3H:1V)$
Thickness = 1.0 ft

Concrete Demo Volume = 2,342 CY

Hauling of Concrete

Concrete Volume = 52,036 cy
Concrete Unit Weight = 2 tons/cy
Asphalt Volume = 741 cy
Asphalt Unit Weight = 1.4 tons/cy

Weight of concrete to be hauled = 105,072 tons



PROJECT: **LA River Feasibility**
DETAIL: *Burbank Channel Quantity Calculations*
COMPUTED BY: SKV
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/17/2011

REACH 1 - BURBANK CHANNEL INSTALLATION CALCULATIONS

Reach Length

Length = 1,645 lf

Total Length = 1,645 LF

Excavation Left Bank

Length = 1,645 lf

Cross Section Area* = 2,203 sf

* Measured in CAD from typical section

Retaining Wall Height = 18 lf

Retaining Wall Width = 1 lf

Retaining Wall Area = 18 sf

Excavation Area = 2,185 sf

Excavation Volume = 133,112 CY

Riprap Toe Protection

Length = 1,645 lf

Cross Section Area* = 237 sf

* Measured in CAD from typical section

Riprap Volume = 14,425 CY

Hauling of Material

Excavation Volume = 133,112 lf

Compacted Fill Volume = 0 sf

Volume to be Hauled = 133,112 CY

Pyramat Turf Reinforcement Mat

Length = 1,645 lf

Width = 70 lf

Extra Pyramat at Tie-Ins = 15 lf

Reinforcement Mat Area = 15,536 SY

Rock at Pyramat Tie-In

Length = 1,645 lf

Width = 3 lf

Height = 3 lf

No. of Rock Tie-Ins = 1 ea

Rock Volume = 548 CY

Fencing

Length = 1,645 lf

No. of Fences = 2 ea

Fencing Length = 3,290 LF



PROJECT: **LA River Feasibility**
DETAIL: *Burbank Channel Quantity Calculations*
COMPUTED BY: SKV
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/17/2011

REACH 1 - BURBANK CHANNEL INSTALLATION CALCULATIONS

Page 2 of 2

Aggregate Base Layer

Length = 1,645 lf
No. of Roads = 1 ea
Width = 16 ft
Thickness = 0.5 ft

Aggregate Base Volume = 487 CY

Asphalt Pavement

Length = 1,645 lf
No. of Roads = 1 ea
Width = 16 ft

Asphalt Area = 2,924 SY

Top Soil

Length = 1,645 lf
Width = 70 ft
Thickness = 0.5 ft

Top Soil Volume = 2,132 CY

Revegetation

Length = 1,645 lf
Width = 70 ft

Revegetation Area = 2.6 ACRE



PROJECT: **LA River Feasibility**
DETAIL: *Burbank Channel Demo Quantity Calculations*
COMPUTED BY: NSS
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/19/2011

REACH 1 - BURBANK CHANNEL DEMOLITION CALCULATIONS

Page 1 of 1

Reach Length

Length = 1,645 lf

* Length estimated by Scott E.

Total Length = 1,645 LF

Demo Left Bank Reinforced Concrete Channel Wall

Length = 1,645 lf

Height = 18.5 lf

Top of Wall Thickness = 1.0 ft

Base of Wall Thickness = 2.0 ft

* Height shown on typical section in O&M Manual

* Estimated based on dims. of similar USACE channels

* Estimated based on dims. of similar USACE channels

Concrete Demo Volume = 1,691 CY

Demo Subdrainage System

Length = 1,645 lf

No. of Pipes = 1 ea

Pipe Demo Length = 1,645 LF

Demo Existing Chain-Link Fence

Length = 1,645 lf

* Fence shown on typical section in O&M Manual

Chain-Link Fence Length = 1,645 LF

Clearing and Grubbing Landside Vegetation

Length = 800 lf

Width = 250 ft

* Estimated from aerial photographs

* Estimated from aerial photographs

Clear and Grub Area = 4.6 AC

Hauling of Concrete

Concrete Volume = 1,691 cy

Concrete Unit Weight = 2 tons/cy

Weight of concrete to be hauled = 3,381 tons



PROJECT: **LA River Feasibility**
DETAIL: *Reach 1 Side Channel Quantity Calculations*
COMPUTED BY: NSS
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/13/2011

REACH 1 - SIDE CHANNEL QUANTITY CALCULATIONS

SITE A

Page 1 of 2

Embankment Excavation

Length = 2,600 LF
Height = 8 LF
Depth = 140 LF

Excavation Volume = **53,926 CY**

Embankment Riprap Toe Protection

Length = 2,600 LF
Cross Sectional Area = 148 sf * Measured in CAD from typical section

Riprap Volume = **14,281 CY**

Side Channel Excavation

Length = 2,300 LF
Depth = 5 LF
Top Width = 50 LF
Side Slopes = 3H:1V
Base Width = 20 LF

Excavation Volume = **14,907 CY**

Side Channel Riprap Toe Protection

Length = 2,300 LF
Cross Sectional Area = 148 sf * Measured in CAD from typical section
of Sides = 2 ea

Riprap Volume = **25,266 CY**

Side Channel Site Grading

Area = 540,000 sf
Depth = 1 LF

Graded Area = **60,000 SY**

SITE B

Side Channel Excavation

Length = 3,800 LF
Depth = 10 LF
Top Width = 125 LF
Side Slopes = 3H:1V
Base Width = 65 LF

Excavation Volume = **133,704 CY**



PROJECT: **LA River Feasibility**
DETAIL: *Reach 1 Side Channel Quantity Calculations*
COMPUTED BY: NSS
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/13/2011

REACH 1 - SIDE CHANNEL QUANTITY CALCULATIONS

Page 2 of 2

Riprap Toe Protection

Length = 3,800 LF
Cross Sectional Area = 148 sf * Measured in CAD from typical section
of Sides = 2 ea

Riprap Volume = 41,744 CY

SITE C

Side Channel Excavation

Length = 2,475 LF
Depth = 5 LF
Top Width = 100 LF
Side Slopes = 3H:1V
Base Width = 70 LF

Excavation Volume = 38,958 CY

Riprap Toe Protection

Length = 2,475 LF
Cross Sectional Area = 148 sf * Measured in CAD from typical section
of Sides = 2 ea

Riprap Volume = 27,189 CY



PROJECT: **LA River Feasibility**
DETAIL: *Reach 2 Quantity Calculations*
COMPUTED BY: SKV
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/6/2011

REACH 2 - INSTALLATION CALCULATIONS

Page 1 of 4

Reach Length

Length = 3,820 lf

Total Length = **3,820 LF**

[03] Create Geomorphology and Plant for Freshwater Marsh

Excavation for Grade Control Structures

Length = 3,820 lf

Distance Between Structures = 500 lf

of Structures = 8 ea

Cross Section Area* = **709 sf**

* Measured in CAD from typical section

Channel Width = 250 lf

Excavation Volume = **52,519 CY**

Grouted Riprap Structures

Length = 3,820 lf

Distance Between Structures = 500 lf

of Structures = 8 ea

Cross Section Area* = **215 sf**

* Measured in CAD from typical section

Channel Width = 250 lf

Low Flow Channel Area = **33 sf**

* Measured in CAD from typical section

Low Flow Channel Width = **24 lf**

Grouted Riprap Volume = **15,691 CY**

Compacted Backfill for Grade Control Structure

Length = 3,820 lf

Distance Between Structures = 500 lf

of Structures = 8 ea

Cross Section Area* = **534 sf**

* Measured in CAD from typical section

Channel Width = 250 lf

Compacted Fill Volume = **39,556 CY**

[09] Culverts or Underground Basins

Underground Basin

Length = **1,300 lf**

Width = **150 lf**

Height = **9 lf**

Underground Basin Volume = **1,755,000 CF**



PROJECT: **LA River Feasibility**
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REACH 2 - INSTALLATION CALCULATIONS

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[16] Bioengineer Channel Walls

Pyramat Turf Reinforcement Mat

Length = 3,820 lf
Width = 43 lf
Extra Pyramat at Tie-Ins = 15 lf

Reinforcement Mat Area = 24,618 SY

Rock at Pyramat Tie-In

Length = 3,820 lf
Width = 3 lf
Height = 3 lf
No. of Rock Tie-Ins = 1 ea

Rock Volume = 1,273 CY

[17] Habitat Corridors/Riparian Planting on Banks

Revegetation

Length = 3,820 lf
Width = 29 ft

Revegetation Area = 2.5 ACRE

[26] Terrace Banks

Excavation Left Bank

Length = 3,820 lf
Cross Section Area* = 390 sf
Concrete & Spalls Width = 63 lf
Concrete & Spalls Depth = 1.75 lf
Concrete & Spalls Length = 785 lf
Concrete & Spalls Volume = 3,221 cy

* Measured in CAD from typical section

Excavation Volume = 52,019 CY

Excavation Right Bank

Length = 3,820 lf
Cross Section Area* = 750 sf
Concrete & Spalls Width = 63 lf
Concrete & Spalls Depth = 1.75 lf
Concrete & Spalls Length = 554 lf
Concrete & Spalls Volume = 2,273 cy

* Measured in CAD from typical section

Excavation Volume = 103,819 CY

Excavation Retaining Wall

Length = 3,820 lf
Cross Section Area* = 534 sf

* Measured in CAD from typical section

Excavation Volume = 75,507 CY



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REACH 2 - INSTALLATION CALCULATIONS

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Top Soil

Length = 1,910 lf
Width = 42 ft
Thickness = 0.5 ft

Top Soil Volume = 1,486 CY

[27] Modify Trapezoidal Channel to Vertical Sides

Riprap Toe Protection

Length = 3,820 lf
Cross Section Area* = 297 sf * Measured in CAD from typical section

Rip Rap Volume = 42,020 CY

Compacted Fill Right Bank

Length = 3,820 lf
Cross Section Area* = 67 sf * Measured in CAD from typical section

Compacted Fill Volume = 9,500 CY

Compacted Fill Retaining Wall

Length = 3,820 lf
Cross Section Area* = 417 sf * Measured in CAD from typical section
Sub-Drain Area = 4 sf

Compacted Fill Volume = 58,432 CY

Retaining Wall Concrete

Length = 3,820 lf
Cross Section Area* = 89 sf * Measured in CAD from typical section

Concrete Volume = 12,592 CY

Retaining Wall Gravel

Wall Length = 3,820 lf
Gravel Length = 18.5 lf
Gravel Thickness = .5 lf

Gravel Volume = 1,307 CY

Fencing

Length = 3,820 lf
No. of Fences = 4 ea

Fencing Length = 15,280 LF



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Aggregate Base Layer

Length = 3,820 lf
No. of Roads = 2 ea
Width = 16 ft
Thickness = 0.5 ft

Aggregate Base Volume = 2,264 CY

Asphalt Pavement

Length = 3,820 lf
No. of Roads = 2 ea
Width = 16 ft

Asphalt Area = 13,582 SY

Top Soil

Length = 1,910 lf
Width = 29 ft
Thickness = 0.5 ft

Top Soil Volume = 1,026 CY

Sub Drainage System Pipe

Length = 3,820 lf
No. of Systems = 1 ea

Length of Drainage System = 3,820 LF

Sub Drainage Bedding

Length = 3,820 lf
Width = 2 ft
Height = 2 ft

Bedding Stone Volume = 455 CY

Sub Drainage Geotextile Wrap

Length = 3,820 lf
Width = 2 ft
Height = 2 ft

Geotextile Wrap Area = 3,396 SY

Sub Drainage Weep Holes

Length = 3,820 lf
Distance Between Holes = 10 ft

Weep Holes = 382 EA



PROJECT: **LA River Feasibility**
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REACH 2 - DEMOLITION CALCULATIONS

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Reach Length

Length = 3,820 lf

* From Station 405+00 to Station 366+79.60

Total Length = 3,820 LF

[23] Channel Bed

Demo Reinforced Concrete Channel Invert

Length = 330 lf

* From Station 387+80 to Station 384+50

Width = 180 lf

Thickness = 1.0 ft

Concrete Demo Volume = 2,200 CY

Demo Grouted Riprap Toe Protection

LB Length 1 = 475 lf

* Grouted RR on LB from Sta. 405+00 to Sta. 400+25

RB Length 1 = 350 lf

* Grouted RR on RB from Sta. 405+00 to Sta. 401+50

Width 1 = 6 lf

Depth 1 = 1.5 ft

* Toe down to be grouted min. of 1.5 feet per as-builts

LB Length 2 = 3,035 lf

* From Sta 400+25-387+80 and 384+70-366+79.60

RB Length 2 = 2,917 lf

* From Sta 401+50-389+04.57 and 383+50.8-366+79.6

Width 2 = 6 ft

Depth 2 = 1.5 ft

* Toe down to be grouted min. of 1.5 feet per as-builts

Grouted Riprap Demo Volume = 2,259 CY

Demo Grouted Riprap Grade Stabilizer

Length = 100 lf

* From Sta 405+00 to 404+50 & Sta. 384+50 to 384+00

Width = 156 ft

* Channel base width (180') - toe down width (12'*2)

Depth = 3.0 ft

Grouted Riprap Demo Volume = 1,733 CY

Demo Riprap Grade Stabilizer

Length = 100 lf

* From Sta 405+00 to 404+50 & Sta 384+50 to 384+00

Width = 156 ft

* Channel base width (180') - toe down width (12'*2)

Depth = 5.0 ft

Riprap Demo Volume = 2,889 CY

Demo 12-Inch-Diameter Subdrainage System

Length = 330 lf

* From Station 387+80 to Station 384+50

No. of Pipes = 4 ea

Pipe Demo Length = 1,320 LF



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REACH 2 - DEMOLITION CALCULATIONS

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[26] Terrace Banks

Demo Reinforced Concrete Channel Slope Paving, Left Bank

LB Length = 785 lf * LB from Sta. 405+00 - 400+25 & Sta 387+80 - 384+70
Width = 63 ft * $W = 60/\cos(3H:1V)$
Thickness = 1.0 ft

Concrete Demo Volume = 1,839 CY

Demo Grouted Riprap Slope Paving, Left Bank

LB Length = 3,035 lf * LB from Sta. 400+25 - 387+80 & Sta 384+70 - 366+79.6
Width = 63 ft * $W = 60/\cos(3H:1V)$
Thickness = 1.0 ft

Grouted Riprap Demo Volume = 7,110 CY

Demo Riprap Toe Protection

LB Length 1 = 475 lf * LB from Station 405+00 to Station 400+25
Width 1 = 6 lf
Depth 1 = 7.8 ft * Loose rock placed below 1.5' thick grouted toe down
LB Length 2 = 3,035 lf * LB from Sta 400+25 - 387+80 & 384+70 - 366+79.60
Width 2 = 6 ft
Depth 2 = 5.5 ft * Loose rock placed below 1.5' thick grouted toe down
LB Length 3 = 725.0 ft * LB from Sta 404+50 to 400+25 and 384+00 to 381+00
Width 3 = 6.0 ft
Depth 3 = 9.3 ft

Riprap Demo Volume = 6,018 CY

Remove Spalls Below Grouted Riprap Slope Paving

LB Length = 3,035 lf * LB from Sta 400+25 - 387+80 & 384+70 - 366+79.60
Width = 63 ft * $W = 60/\cos(3H:1V)$
Thickness = 0.75 ft

Spalls Demo Volume = 5,333 CY

Remove Spalls Below Concrete Slope Paving

LB Length = 785 lf * From Sta 405+00 to 400+25 & Sta 387+80 to 384+70
Width = 63 ft * $W = 60/\cos(3H:1V)$
Thickness = 0.75 ft

Spalls Demo Volume = 1,379 CY

Demo 20-Foot-Long Steel Sheet Piles

LB Length = 825 lf * From Sta 405+00 to 400+25 & Sta 384+50 to 381+00
Cross Channel Length = 180 lf * Crosses 180'W channel in two locations

Steel Sheet Pile Demo Length = 1,005 LF



PROJECT: **LA River Feasibility**
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REACH 2 - DEMOLITION CALCULATIONS

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Clearing and Grubbing Landside Vegetation

Length = 7,641 lf
Width = 20 ft
of Sides = 2 ea

* Width est. to be 20' outward from access road

Clear and Grub Area = **7.0 AC**

[27] Modify Trapezoidal Channel to Vertical Sides

Demo Reinforced Concrete Channel Slope Paving

RB Length = 554 lf
Width = 63 ft
Thickness = 1.0 ft

* Conc. from Station 389+04.57 to Station 383+50.80
* $W = 60/\cos(3H:1V)$

Concrete Demo Volume = **1,297 CY**

Demo Grouted Riprap Slope Paving

RB Length = 3,267 lf
Width = 63 ft
Thickness = 1.0 ft

* From Sta 405+00 - 389+04.57 & 383+50.80 - 366+79.60
* $W = 60/\cos(3H:1V)$

Grouted Riprap Demo Volume = **7,652 CY**

Demo Riprap Toe Protection

RB Length 1 = 350 lf
Width 1 = 6 lf
Depth 1 = 7.8 ft
RB Length 2 = 2,917 lf
Width 2 = 6 ft
Depth 2 = 5.5 ft
RB Length 3 = 600.0 ft
Width 3 = 6.0 ft
Depth 3 = 9.3 ft

* RB from Station 405+00 to Station 401+50
* Loose rock placed below 1.5' thick grouted toe down
* From Sta 401+50 - 389+04.57 & 383+50.80 - 366+79.60
* Loose rock placed below 1.5' thick grouted toe down
* From Sta 404+50 to 401+50 and 384+00 to 381+00

Riprap Demo Volume = **5,401 CY**

Remove Spalls Below Grouted Riprap Slope Paving

RB Length = 3,267 lf
Width = 63 ft
Thickness = 0.75 ft

* From Sta 405+00 - 389+04.57 & 383+50.80 - 366+79.60
* $W = 60/\cos(3H:1V)$

Spalls Demo Volume = **5,739 CY**

Remove Spalls Below Concrete Slope Paving

RB Length = 554 lf
Width = 63 ft
Thickness = 0.75 ft

* RB from Station 389+04.57 to Station 383+50.80
* $W = 60/\cos(3H:1V)$

Spalls Demo Volume = **973 CY**



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REACH 2 - DEMOLITION CALCULATIONS

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Demo 15-Foot-Long Steel Sheet Piles

Length = 880 lf

* From Sta 389+00 - 387+80, 371+90.48 - 366+70.60,
and across channel to top of LB (180'+60')

Steel Sheet Pile Demo Length = 880 LF

Demo 20-Foot-Long Steel Sheet Piles

RB Length = 700 lf

* From Sta 405+00 to 401+50 and Sta 384+50 to 381+00

Cross Channel Length = 180 lf

* Crosses 180'W channel in two locations

Steel Sheet Pile Demo Length = 880 LF

Demo Existing 4-Foot-High Chain-Link Fence

Length = 7,641 lf

* Chain-link fences on both banks

Chain-Link Fence Length = 7,641 LF

Demo Asphalt-Concrete Access Road

Length = 7,641 lf

* Access road on both banks

Width = 16 ft

Thickness = 0.25 ft

* Assumed above grade

Asphalt-Concrete Pavement Demo Volume = 1,132 CY

Utility Pole Structures to Demo

No. of Structures = 5 ea

* Estimated from aerial photographs

Number = 5 EA

Hauling of Material

Concrete Volume = 5,336 cy

Concrete Unit Weight = 2 tons/cy

Grouted Riprap Volume = 24,772 cy

Grouted Riprap Unit Weight = 2 tons/cy

Riprap Volume = 14,308 cy

Riprap Unit Weight = 1.5 tons/cy

Spalls Volume = 13,423 cy

Spalls Unit Weight = 1.35 tons/cy

Asphalt Volume = 1,132 cy

Asphalt Unit Weight = 1.35 tons/cy

Weight of material to be hauled = 101,328 tons



PROJECT: **LA River Feasibility**
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REACH 2 - SIDE CHANNEL QUANTITY CALCULATIONS

SITE D

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Side Channel Excavation

Length = 2,700 LF
Depth = 5 LF
Top Width = 75 LF
Side Slopes = 3H:1V
Base Width = 45 LF

Excavation Volume = 30,000 CY

Riprap Toe Protection

Length = 2,700 LF
Cross Sectional Area = 148 sf * Measured in CAD from typical section
of Sides = 2 ea

Riprap Volume = 29,660 CY

Perforated Pipe

Length = 3,300 LF

Length = 3,300 LF



PROJECT: **LA River Feasibility**
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REACH 3 - INSTALLATION CALCULATIONS

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Reach Length

Length = 5,247 lf

Total Length = **5,247 LF**

[03] Create Geomorphology and Plant for Freshwater Marsh

Riprap Below Vegetation Area

Length Left Bank = 2,568 lf

Riprap Area Left Bank* = **294 sf**

* Measured in CAD from typical section

Length Right Bank = 4,148 lf

Riprap Area Right Bank* = **294 sf**

* Measured in CAD from typical section

Riprap Volume = **73,217 CY**

Compacted Fill Inside Vegetation Area

Length Left Bank = 2,568 lf

Riprap Area Left Bank* = **300 sf**

* Measured in CAD from typical section

Length Right Bank = 4,148 lf

Riprap Area Right Bank* = **300 sf**

* Measured in CAD from typical section

Compacted Fill Volume = **74,660 CY**

[09] Culverts or Underground Basins

Underground Basin

Length = **1,400 lf**

Width = **1,000 lf**

Height = **9 lf**

Underground Basin Volume = **12,600,000 CF**

[17] Habitat Corridors/Riparian Planting on Banks

Revegetation

Length Left Bank = 2,568 lf

Width Left Bank = 58 ft

Length Right Bank = 4,148 lf

Width Right Bank = 50 ft

Revegetation Area = **8.2 ACRE**

[27] Modify Trapezoidal Channel to Vertical Sides

Excavation Left Bank

Length = 2,568 lf

Cross Section Area* = **1,318 sf**

* Measured in CAD from typical section

Concrete & Spalls Width = **99 lf**

* 63' slope and 36' channel width

Concrete & Spalls Depth = **1.75 lf**

Concrete & Spalls Volume = 16,478 cy

Excavation Volume = **108,897 CY**



PROJECT: **LA River Feasibility**
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REACH 3 - INSTALLATION CALCULATIONS

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Excavation Right Bank

Length = 4,148 lf
Cross Section Area* = 1,328 sf
Concrete & Spalls Width = 103 lf
Concrete & Spalls Depth = 1.75 lf
Concrete & Spalls Volume = 27,692 cy

* Measured in CAD from typical section
* 63' slope and 40' channel width

Excavation Volume = 176,365 CY

Excavation Retaining Wall Left Bank

Length = 2,568 lf
Cross Section Area* = 655 sf

* Measured in CAD from typical section

Excavation Volume = 62,258 CY

Excavation Retaining Wall Right Bank

Length = 4,148 lf
Cross Section Area* = 655 sf

* Measured in CAD from typical section

Excavation Volume = 100,563 CY

Riprap Toe Protection

Length Left Bank = 2,568 lf
Riprap Area Left Bank* = 141 sf
Length Right Bank = 4,148 lf
Riprap Area Right Bank* = 154 sf

* Measured in CAD from typical section

* Measured in CAD from typical section

Riprap Volume = 37,163 CY

Compacted Fill Left Bank

Length = 2,568 lf
Cross Section Area* = 603 sf
Sub-Drain Area = 4 sf

* Measured in CAD from typical section

Compacted Fill Volume = 56,972 CY

Compacted Fill Right Bank

Length = 4,148 lf
Cross Section Area* = 692 sf
Sub-Drain Area = 4 sf

* Measured in CAD from typical section

Compacted Fill Volume = 105,691 CY

Retaining Wall Concrete

Length = 6,716 lf
Cross Section Area* = 90 sf

* Measured in CAD from typical section

Concrete Volume = 22,449 CY



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REACH 3 - INSTALLATION CALCULATIONS

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Retaining Wall Gravel

Wall Length Left Bank = 2,568 lf
Gravel Length = 18.5 lf
Gravel Thickness = .5 lf
Wall Length Right Bank = 4,148 lf
Gravel Length = 18.5 lf
Gravel Thickness = .5 lf

Gravel Volume = 2,298 CY

Vegetation Retaining Wall Concrete

Length Left Bank = 2,568 lf
Cross Section Area* = 85 sf * Measured in CAD from typical section
Length Right Bank = 4,148 lf
Cross Section Area* = 85 sf * Measured in CAD from typical section

Concrete Volume = 21,143 CY

Fencing

Length = 5,247 lf
No. of Fences = 4 ea

Fencing Length = 20,988 LF

Aggregate Base Layer

Length = 5,247 lf
No. of Roads = 2 ea
Width = 16 ft
Thickness = 0.5 ft

Aggregate Base Volume = 3,109 CY

Asphalt Pavement

Length = 5,247 lf
No. of Roads = 2 ea
Width = 16 ft

Asphalt Area = 18,656 SY

Top Soil

Length Left Bank = 2,568 lf
Width Left Bank = 58 ft
Length Right Bank = 4,148 lf
Width Right Bank = 50 ft
Thickness = 0.5 ft

Top Soil Volume = 6,599 CY



PROJECT: **LA River Feasibility**
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REACH 3 - INSTALLATION CALCULATIONS

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Sub Drainage System

Length Left Bank = 2,568 lf
Length Right Bank = 4,148 lf
No. of Systems per Bank = 1 ea

Length of Drainage System = 6,716 LF

Sub Drainage Bedding

Length = 6,716 lf
Width = 2 ft
Height = 2 ft

* Total quantity subtracts volume of piping

Bedding Stone Volume = 800 CY

Sub Drainage Geotextile Wrap

Length = 6,716 lf
Width = 2 ft
Height = 2 ft

Geotextile Wrap Area = 5,970 SY

Sub Drainage Weep Holes

Length = 6,716 lf
Distance Between Holes = 10 ft

Weep Holes = 672 EA

Hauling of Material

Excavation Volume = 448,083 cy
Compacted Fill Volume = 237,322 cy

Volume to be Hauled = 210,760 CY



PROJECT: **LA River Feasibility**
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REACH 3 - DEMOLITION CALCULATIONS

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Reach Length

Length = 5,247 lf

* From Sta 366+79.60 to Sta 314+32.21, but no work assumed along portions with vertical walls

Total Length = 5,247 LF

[23] Channel Bed

Demo Reinforced Concrete Channel Invert

Length = 5,247 lf

* From Station 366+79.60 to Station 314+32.21

Width = 80 lf

* Width shown on LAR Feas. Study preliminary drawings

Thickness = 1.0 ft

Concrete Demo Volume = 15,548 CY

Demo 12-Inch-Diameter Subdrainage System

Length = 5,247 lf

* From Station 366+79.60 to Station 314+32.21

No. of Pipes = 2 ea

Pipe Demo Length = 10,495 LF

[27] Modify Trapezoidal Channel to Vertical Sides

Demo Reinforced Concrete Channel Slope Paving

LB Length = 2,568 lf

* From Sta 366+79.60-356+79.60 & 330+00-314+32.21

RB Length = 2,650 lf

* From Sta 351+82-341+00 and Sta 330+00-314+32.21

Width = 63 ft

* $W = 60/\cos(3H:1V)$

Thickness = 1.0 ft

Concrete Demo Volume = 12,221 CY

Demo Reinforced Concrete Parapet

LB Length = 1,568 lf

* FW on LB from Station 330+00 to Station 314+32.21

RB Length = 1,568 lf

* FW on RB from Station 330+00 to Station 314+32.21

Height = 5 ft

* Estimated. As-built drawings say, "varies"

Thickness = 1.0 ft

* Estimated

Concrete Demo Volume = 581 CY

Demo Grouted Riprap Slope Paving

Length = 1,498 lf

* Grouted Riprap on RB from Sta 366+79.60 to 351+82

Width = 63 ft

* $W = 60/\cos(3H:1V)$

Thickness = 1.0 ft

Grouted Riprap Demo Volume = 3,508 CY

Remove Spalls Below Grouted Riprap Slope Paving

Length = 1,498 lf

* RB from Station 366+79.60 to Station 351+82

Width = 63 ft

* $W = 60/\cos(3H:1V)$

Thickness = 0.75 ft

Spalls Demo Volume = 2,631 CY



PROJECT: **LA River Feasibility**
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REACH 3 - DEMOLITION CALCULATIONS

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Remove Spalls Below Concrete Slope Paving

LB Length = 2,568 lf * From 366+79.60 to 356+79.60 & 330+00 to 314+32.21
RB Length = 2,650 lf * From Sta 351+82 to 341+00 and 330+00 to 314+32.21
Width = 63 ft * $W = 60/\cos(3H:1V)$
Thickness = 0.75 ft

Spalls Demo Volume = 9,166 CY

Demo Existing 4-Foot-High Chain-Link Fence

Length = 10,495 lf * Chain-link fences on both banks

Chain-Link Fence Length = 10,495 LF

Demo Asphalt-Concrete Access Road

Length = 10,495 lf * Access road along the majority of both banks
Width = 16 ft
Thickness = 0.25 ft * Assumed above grade

Asphalt-Concrete Pavement Demo Volume = 1,555 CY

Clearing and Grubbing Landside Vegetation

Length = 5,247 lf
Width = 20 ft * Est. to be 20 feet out from access road on RB only

Clear and Grub Area = 2.4 AC

Utility Pole Structures to Demo

No. of Structures = 7 ea * Estimated from aerial photographs

Number = 7 EA

Hauling of Material

Concrete Volume = 28,350 cy
Concrete Unit Weight = 2 tons/cy
Grouted Riprap Volume = 3,508 cy
Grouted Riprap Unit Weight = 2 tons/cy
Spalls Volume = 11,797 cy
Spalls Unit Weight = 1.35 tons/cy
Asphalt Volume = 1,555 cy
Asphalt Unit Weight = 1.35 tons/cy

Weight of material to be hauled = 81,741 tons



PROJECT: **LA River Feasibility**
DETAIL: *Verdugo Wash Quantity Calculations*
COMPUTED BY: SKV
CHECKED BY: IGP

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VERDUGO WASH 1 QUANTITY CALCULATIONS

VERDUGO WASH 1

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Reach Length

Length = 1,000 lf

Total Length = 1,000 LF

Excavation Left Bank

Length = 1,000 lf

Cross Section Area* = 11,183 sf

* Measured in CAD from typical section

Retaining Wall Height = 18 lf

Retaining Wall Width = 1 lf

Retaining Wall Area = 18 sf

Excavation Area = 11,165 sf

Excavation Volume = 413,519 CY

Riprap Toe Protection

Length = 1,000 lf

Cross Section Area* = 248 sf

* Measured in CAD from typical section

Riprap Volume = 9,196 CY

Hauling of Material

Excavation Volume = 413,519 lf

Compacted Fill Volume = 0 sf

Volume to be Hauled = 413,519 CY

Pyramat Turf Reinforcement Mat

Length = 1,000 lf

Width = 105 lf

Extra Pyramat at Tie-Ins = 15 lf

Reinforcement Mat Area = 13,333 SY

Rock at Pyramat Tie-In

Length = 1,000 lf

Width = 3 lf

Height = 3 lf

No. of Rock Tie-Ins = 1 ea

Rock Volume = 333 CY

Fencing

Length = 1,000 lf

No. of Fences = 2 ea

Fencing Length = 2,000 LF



PROJECT: **LA River Feasibility**
DETAIL: *Verdugo Wash Quantity Calculations*
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VERDUGO WASH 1 QUANTITY CALCULATIONS

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Aggregate Base Layer

Length = 1,000 lf
No. of Roads = 1 ea
Width = 16 ft
Thickness = 0.5 ft

Aggregate Base Volume = 296 CY

Asphalt Pavement

Length = 1,000 lf
No. of Roads = 1 ea
Width = 16 ft

Asphalt Area = 1,778 SY

Top Soil

Length = 1,000 lf
Width = 105 ft
Thickness = 0.5 ft

Top Soil Volume = 1,944 CY

Revegetation

Length = 1,000 lf
Width = 105 ft

Revegetation Area = 2.4 ACRE



PROJECT: **LA River Feasibility**
DETAIL: *Verdugo Wash Quantity Calculations*
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CHECKED BY: IGP

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VERDUGO WASH 2 QUANTITY CALCULATIONS

VERDUGO WASH 2

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Reach Length

Length = 1,000 lf

Total Length = 1,000 LF

Excavation Embankment

Length = 1,000 lf

Cross Section Area* = 13,784 sf

* Measured in CAD from typical section

Excavation Volume = 510,507 CY

Riprap Toe Protection

Length = 1,000 lf

Cross Section Area* = 248 sf

* Measured in CAD from typical section

Riprap Volume = 9,196 CY

Hauling of Material

Excavation Volume = 510,507 lf

Compacted Fill Volume = 0 sf

Volume to be Hauled = 510,507 CY

Pyramat Turf Reinforcement Mat

Length = 1,000 lf

Width = 97 lf

Extra Pyramat at Tie-Ins = 15 lf

Reinforcement Mat Area = 12,444 SY

Rock at Pyramat Tie-In

Length = 1,000 lf

Width = 3 lf

Height = 3 lf

No. of Rock Tie-Ins = 1 ea

Rock Volume = 333 CY

Fencing

Length = 1,000 lf

No. of Fences = 2 ea

Fencing Length = 2,000 LF



PROJECT: **LA River Feasibility**
DETAIL: *Verdugo Wash Quantity Calculations*
COMPUTED BY: SKV
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/17/2011

VERDUGO WASH 2 QUANTITY CALCULATIONS

Page 2 of 2

Aggregate Base Layer

Length = 1,000 lf
No. of Roads = 1 ea
Width = 16 ft
Thickness = 0.5 ft

Aggregate Base Volume = 296 CY

Asphalt Pavement

Length = 1,000 lf
No. of Roads = 1 ea
Width = 16 ft

Asphalt Area = 1,778 SY

Top Soil

Length = 1,000 lf
Width = 97 ft
Thickness = 0.5 ft

Top Soil Volume = 1,796 CY

Revegetation

Length = 1,000 lf
Width = 97 ft

Revegetation Area = 2.2 ACRE



PROJECT: **LA River Feasibility**
DETAIL: *Verdugo Wash Quantity Calculations*
COMPUTED BY: SKV
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/17/2011

VERDUGO WASH 3 QUANTITY CALCULATIONS

VERDUGO WASH 3

Page 1 of 2

Reach Length

Length = 1,000 lf

Total Length = 1,000 LF

Excavation Embankment

Length = 1,000 lf

Cross Section Area* = 16,215 sf

* Measured in CAD from typical section

Excavation Volume = 600,567 CY

Riprap Toe Protection

Length = 1,000 lf

Cross Section Area* = 248 sf

* Measured in CAD from typical section

Riprap Volume = 9,196 CY

Hauling of Material

Excavation Volume = 600,567 lf

Compacted Fill Volume = 0 sf

Volume to be Hauled = 600,567 CY

Pyramat Turf Reinforcement Mat

Length = 1,000 lf

Width = 97 lf

Extra Pyramat at Tie-Ins = 15 lf

Reinforcement Mat Area = 12,444 SY

Rock at Pyramat Tie-In

Length = 1,000 lf

Width = 3 lf

Height = 3 lf

No. of Rock Tie-Ins = 1 ea

Rock Volume = 333 CY

Fencing

Length = 1,000 lf

No. of Fences = 2 ea

Fencing Length = 2,000 LF



PROJECT: **LA River Feasibility**
DETAIL: *Verdugo Wash Quantity Calculations*
COMPUTED BY: SKV
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/17/2011

VERDUGO WASH 3 QUANTITY CALCULATIONS

Page 2 of 2

Aggregate Base Layer

Length = 1,000 lf
No. of Roads = 1 ea
Width = 16 ft
Thickness = 0.5 ft

Aggregate Base Volume = 296 CY

Asphalt Pavement

Length = 1,000 lf
No. of Roads = 1 ea
Width = 16 ft

Asphalt Area = 1,778 SY

Top Soil

Length = 1,000 lf
Width = 97 ft
Thickness = 0.5 ft

Top Soil Volume = 1,796 CY

Revegetation

Length = 1,000 lf
Width = 97 ft

Revegetation Area = 2.2 ACRE



PROJECT: **LA River Feasibility**
DETAIL: *Verdugo Wash Demo Quantity Calculations*
COMPUTED BY: NSS
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/19/2011

VERDUGO WASH DEMOLITION QUANTITY CALCULATIONS

VERDUGO WASH

Page 1 of 1

Reach Length

Length = 1,860 lf

* Length estimated by Scott E.

Total Length = 1,860 LF

Demo Left Bank Reinforced Concrete Channel Wall

Length = 1,860 lf

Height = 25 lf

Top of Wall Thickness = 1.0 ft

Base of Wall Thickness = 2.0 ft

* Height obtained from as-built drawing LARI0000090

* Estimated based on dims. of similar USACE channels

* Estimated based on dims. of similar USACE channels

Concrete Demo Volume = 2,583 CY

Demo Subdrainage System

Length = 1,860 lf

No. of Pipes = 1 ea

Pipe Demo Length = 1,860 LF

Demo Existing Chain-Link Fence

Length = 1,860 lf

* Assume chain-link fence at top of channel wall

Chain-Link Fence Length = 1,860 LF

Hauling of Concrete

Concrete Volume = 2,583 cy

Concrete Unit Weight = 2 tons/cy

Weight of concrete to be hauled = 5,167 tons



PROJECT: **LA River Feasibility**
DETAIL: *Reach 3 Side Channel Quantity Calculations*
COMPUTED BY: NSS
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PROJECT NO: T26313
DATE: 10/13/2011

REACH 3 - SIDE CHANNEL QUANTITY CALCULATIONS

[10] Divert Tributary & River Flow Into Side Channel (E)

Page 1 of 1

SITE E

Side Channel Excavation

Length = 4,100 LF
Depth = 5 LF
Top Width = 170 LF
Side Slopes = 3H:1V
Base Width = 140 LF

Excavation Volume = 117,685 CY

Riprap Toe Protection

Length = 4,100 LF
Cross Sectional Area = 148 sf * Measured in CAD from typical section
of Sides = 2 ea

Riprap Volume = 45,040 CY



PROJECT: **LA River Feasibility**
DETAIL: *Reach 4 Quantity Calculations*
COMPUTED BY: SKV
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/17/2011

REACH 4 - INSTALLATION CALCULATIONS

Page 1 of 3

Reach Length

Length = 9,337 lf

Total Length = **9,337 LF**

[03] Create Geomorphology and Plant for Freshwater Marsh

Excavation for Grade Control Structures

Length = 8,944 lf

Distance Between Structures = 500 lf

of Structures = 18 ea

Cross Section Area* = 709 sf

* Measured in CAD from typical section

Channel Width = 190 lf

Excavation Volume = **89,807 CY**

Grouted Riprap Structures

Length = 8,944 lf

Distance Between Structures = 500 lf

of Structures = 18 ea

Cross Section Area* = 215 sf

* Measured in CAD from typical section

Channel Width = 190 lf

Low Flow Channel Area = 33 sf

* Measured in CAD from typical section

Low Flow Channel Width = 24 lf

Grouted Riprap Volume = **26,705 CY**

Compacted Backfill for Grade Control Structure

Length = 8,944 lf

Distance Between Structures = 500 lf

of Structures = 18 ea

Cross Section Area* = 534 sf

* Measured in CAD from typical section

Channel Width = 190 lf

Compacted Backfill Volume = **67,640 CY**

[09] Culverts or Underground Basins

Underground Basin

Length = 4,100 lf

Width = 1,200 lf

Height = 9 lf

Underground Basin Volume = **44,280,000 CF**

[16] Bioengineer Channel Walls

Revegetation

Length = 8,944 lf

Width = 148 ft

Revegetation Area = **30.4 ACRE**



PROJECT: **LA River Feasibility**
DETAIL: *Reach 4 Quantity Calculations*
COMPUTED BY: SKV
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PROJECT NO: T26313
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REACH 4 - INSTALLATION CALCULATIONS

Page 2 of 3

[22] Channel Banks Mainstem/Widen Channel

Top Soil

Length = 4,472 lf
Width = 148 ft
Thickness = 0.5 ft

Top Soil Volume = **12,257 CY**

[26] Terrace Banks

Excavation Left Bank

Length = 8,944 lf
Cross Section Area* = 444 sf
Concrete & Spalls Width = 63 lf
Concrete & Spalls Depth = 1.75 lf
Concrete & Spalls Volume = 36,521 cy

* Measured in CAD from typical section
* 63' slope and 36' channel width

Excavation Volume = **110,488 CY**

Excavation Right Bank

Length = 8,944 lf
Cross Section Area* = 444 sf
Concrete & Spalls Width = 63 lf
Concrete & Spalls Depth = 1.75 lf
Concrete & Spalls Length = 2,373 lf
Concrete & Spalls Volume = 9,690 cy
Riprap & Spalls Width = 63 lf
Riprap & Spalls Depth = 1.75 lf
Riprap & Spalls Length = 6,672 lf
Riprap & Spalls Volume = 27,244 cy

* Measured in CAD from typical section

Excavation Volume = **110,076 CY**

Riprap Toe Protection

Length = 8,944 lf
Cross Section Area* = 350 sf

* Measured in CAD from typical section

Riprap Volume = **115,941 CY**

Compacted Fill Embankment

Length = 8,944 lf
Cross Section Area* = 341 sf

* Measured in CAD from typical section

Compacted Fill Volume = **112,959 CY**

Compacted Fill Planters

Length = 8,944 lf
Cross Section Area* = 242 sf

* Measured in CAD from typical section

Compacted Fill Volume = **80,165 CY**



PROJECT: **LA River Feasibility**
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REACH 4 - INSTALLATION CALCULATIONS

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Concrete Planters

Length = 8,944 lf
Cross Section Area* = 360 sf * Measured in CAD from typical section

Concrete Volume = 119,253 CY

Fencing

Length = 8,944 lf
No. of Fences = 4 ea

Fencing Length = 35,776 LF

Aggregate Base Layer

Length = 8,944 lf
No. of Roads = 2 ea
Width = 16 ft
Thickness = 0.5 ft

Aggregate Base Volume = 5,300 CY

Asphalt Pavement

Length = 8,944 lf
No. of Roads = 2 ea
Width = 16 ft

Asphalt Area = 31,801 SY

Top Soil

Length = 4,472 lf
Width = 148 ft
Thickness = 0.5 ft

Top Soil Volume = 12,257 CY

Hauling of Material

Excavation Volume = 310,371 lf
Compacted Fill Volume = 260,764 sf * Measured in CAD from typical section

Volume to be Hauled = 49,607 CY



PROJECT: **LA River Feasibility**
DETAIL: *Reach 4 Demo Quantity Calculations*
COMPUTED BY: NSS
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PROJECT NO: T26313
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REACH 4 - DEMOLITION CALCULATIONS

Page 1 of 3

Reach Length

Length = 9,337 lf

* From Sta 314+32.21 to 220+95.50, but assumed
protect-in-place Los Feliz Bridge Structure

Total Length = 9,337 LF

[22] Channel Banks Mainstem/Widen Channel

Demo Reinforced Concrete Channel Slope Paving

RB Length = 2,273 lf

Width = 63 ft

Thickness = 1 ft

* On RB from Station 314+32.21 to Station 291+59.65
* $W = 60'/\cos(3H:1V)$

Concrete Demo Volume = 5,323 CY

Demo Grouted Riprap Slope Paving

LB Length = 8,944 lf

RB Length = 6,672 lf

Width = 63 ft

Thickness = 1 ft

* On LB from Station 314+32.21 to Station 224+88
* On RB from Station 291+59.65 to Station 224+88
* $W = 60'/\cos(3H:1V)$

Grouted Riprap Demo Volume = 36,578 CY

Demo Grouted Riprap Toe Protection

Length 1 = 2,200 lf

of Banks = 2 ea

Width 1 = 6 lf

Depth 1 = 1.5 ft

Length 2 = 15,688 lf

of Banks = 2 ea

Width 2 = 6 lf

Depth 2 = 1.5 ft

* From 314+32-310+82, 287+96-284+46, 251+50-248+00

* Toe down grouted a minimum of 1.5 feet per as-builts
* From 310+82-287+96, 284+46-251+50, 247+50-224+88

* Toe down grouted a minimum of 1.5 feet per as-builts

Grouted Riprap Demo Volume = 5,963 CY

Demo Riprap Toe Protection

Length 1 = 2,200 lf

of Banks = 2 ea

Width 1 = 6 lf

Depth 1 = 7.8 ft

Length 2 = 15,688 lf

of Banks = 2 ea

Width 2 = 6 lf

Depth 2 = 5.5 ft

Length 3 = 964 lf

of Banks = 2 ea

Width 3 = 6 lf

Depth 3 = 9.3 ft

* From 314+32-310+82, 287+96-284+46, 251+50-248+00

* Loose rock placed below 1.5' thick grouted toe down
* From 310+82-287+96, 284+46-251+50, 247+50-224+88

* Loose rock placed below 1.5' thick grouted toe down
* Extra loose rock from 313+82-312+00, 287+46-284+46

Riprap Demo Volume = 24,946 CY



PROJECT: **LA River Feasibility**
DETAIL: *Reach 4 Demo Quantity Calculations*
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REACH 4 - DEMOLITION CALCULATIONS

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Remove Spalls Below Grouted Riprap Slope Paving

Length = 15,616 lf * LB from Sta 314+32 to 224+88, RB 291+59 to 224+88
Width = 63 ft * W = $60/\cos(3H:1V)$
Thickness = 0.75 ft

Spalls Demo Volume = 27,433 CY

Remove Spalls Below Concrete Slope Paving

Length = 2,273 lf * RB from Station 314+32.21 to Station 291+59.65
Width = 63 ft * W = $60/\cos(3H:1V)$
Thickness = 0.75 ft

Spalls Demo Volume = 3,992 CY

Demo 15-Foot-Long Steel Sheet Piles

Length = 1,823 lf * RB from Station 310+82.21 to Station 292+59.65

Steel Sheet Pile Demo Length = 1,823 LF

Demo 20-Foot-Long Steel Sheet Piles

Longitudinal Length = 2,100 lf * From 314+32-310+82.21, 287+96-284+46, 251+50-248+0
of Banks = 2 ea
Cross Channel Length = 498 lf * Crosses 180'W channel in two locations

Steel Sheet Pile Demo Length = 2,598 LF

Demo Existing 4-Foot-High Chain-Link Fence

Length = 18,673 lf * Chain-link fences on both banks

Chain-Link Fence Length = 18,673 LF

Demo Asphalt-Concrete Access Road

Length = 18,673 lf * Access road along the majority of both banks
Width = 16 ft
Thickness = 0.25 ft * Assumed above grade

Asphalt-Concrete Pavement Demo Volume = 2,766 CY

[23] Channel Bed

Demo Grouted Riprap Grade Stabilizer

No. of grade stabilizers = 5
Length = 50 lf
Width = 178 ft
Depth = 3 ft

Grouted Riprap Demo Volume = 4,944 CY



PROJECT: **LA River Feasibility**
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REACH 4 - DEMOLITION CALCULATIONS

Page 3 of 3

Demo Riprap Grade Stabilizer

No. of grade stabilizers = 5

* No. of aprons on Sheet LARI0000095 (315/91) in profile.

Length 1 = 50 lf

Width 1 = 178 ft

Depth 1 = 5 ft

Length 2 = 25 lf

Width 2 = 178 ft

Depth 2 = 6 ft

Riprap Demo Volume = 13,185 CY

Hauling of Material

Concrete Volume = 5,323 cy

Concrete Unit Weight = 2 tons/cy

Grouted Riprap Volume = 47,485 cy

Grouted Riprap Unit Weight = 2 tons/cy

Riprap Volume = 38,131 cy

Riprap Unit Weight = 1.5 tons/cy

Spalls Volume = 31,426 cy

Spalls Unit Weight = 1.35 tons/cy

Asphalt Volume = 2,766 cy

Asphalt Unit Weight = 1.35 tons/cy

Weight of material to be hauled = 208,973 tons



PROJECT: **LA River Feasibility**
DETAIL: *Reach 4 Side Channel Quantity Calculations*
COMPUTED BY: NSS
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PROJECT NO: T26313
DATE: 10/13/2011

REACH 4 - SIDE CHANNEL QUANTITY CALCULATIONS

[10] Divert Tributary & River Flow Into Side Channel (F)

Page 1 of 1

SITE F**Side Channel Excavation**

Length = 3,300 LF
Depth = 10 LF
Top Width = 80 LF
Side Slopes = 3H:1V
Base Width = 20 LF

Excavation Volume = 61,111 CY

Riprap Toe Protection

Length = 3,300 LF
Toe Down Depth = 10 LF
Toe Down Thickness = 10 LF
Slope Protection Thickness = 3 LF
Slope Protection Width = 20 LF
Cross Sectional Area = 148 sf * Measured in CAD from typical section

Riprap Volume = 36,251 CY

[04] Grade Adjacent Areas to Lower Elevation (G)**SITE G****Side Channel Excavation**

Area = 392,040 sf
Depth = 5 LF

Excavation Volume = 72,600 CY



PROJECT: **LA River Feasibility**
DETAIL: *Reach 5 Quantity Calculations*
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PROJECT NO: T26313
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REACH 5 - INSTALLATION CALCULATIONS

Page 1 of 4

Reach Length

Length = 8,756 lf

Total Length = **8,756 LF**

[16] Bioengineer Channel Walls

Revegetation

Length = 8,756 lf

Width = 45 ft

Revegetation Area = **9.0 ACRE**

[26] Terrace Banks

Excavation Left Bank

Length = 8,756 lf

Cross Section Area* = 421 sf

* Measured in CAD from typical section

Concrete & Spalls Width = 75 lf

Concrete & Spalls Depth = 1.75 lf

Concrete & Spalls Length = 1,461 lf

Concrete & Spalls Volume = 7,102 cy

Riprap & Spalls Width = 75 lf

Riprap & Spalls Depth = 1.75 lf

Riprap & Spalls Length = 7,295 lf

Riprap & Spalls Volume = 35,462 cy

Excavation Volume = **94,065 CY**

Concrete Planters

Length = 8,756 lf

Cross Section Area* = 90 sf

* Measured in CAD from typical section

Concrete Volume = **29,187 CY**

Aggregate Base Layer

Length = 8,756 lf

No. of Roads = 1 ea

Width = 16 ft

Thickness = 0.5 ft

Aggregate Base Volume = **2,594 CY**

Asphalt Pavement

Length = 8,756 lf

No. of Roads = 1 ea

Width = 16 ft

Asphalt Area = **15,566 SY**



PROJECT: **LA River Feasibility**
DETAIL: *Reach 5 Quantity Calculations*
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REACH 5 - INSTALLATION CALCULATIONS

Page 2 of 4

Top Soil

Length = 4,378 lf
Width = 45 ft
Thickness = 0.5 ft

Top Soil Volume = **3,648 CY**

[27] Modify Trapezoidal Channel to Vertical Sides

Excavation Right Bank

Length = 8,756 lf
Cross Section Area* = 788 sf * Measured in CAD from typical section
Concrete & Spalls Width = 75 lf
Concrete & Spalls Depth = 1.75 lf
Concrete & Spalls Length = 7,622 lf
Concrete & Spalls Volume = 37,051 cy
Riprap & Spalls Width = 75 lf
Riprap & Spalls Depth = 1.75 lf
Riprap & Spalls Length = 1,134 lf
Riprap & Spalls Volume = 5,513 cy

Excavation Volume = **213,092 CY**

Excavation Retaining Wall

Length = 8,756 lf
Cross Section Area* = 645 sf * Measured in CAD from typical section

Excavation Volume = **209,197 CY**

Riprap Toe Protection

Length = 8,756 lf
Cross Section Area* = 341 sf * Measured in CAD from typical section

Riprap Volume = **110,656 CY**

Compacted Fill Embankment

Length = 8,756 lf
Cross Section Area* = 52 sf * Measured in CAD from typical section

Compacted Fill Volume = **16,938 CY**

Compacted Fill Retaining Wall

Length = 8,756 lf
Cross Section Area* = 556 sf * Measured in CAD from typical section
Sub-Drain Area = 4 sf

Compacted Fill Volume = **178,892 CY**



PROJECT: **LA River Feasibility**
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REACH 5 - INSTALLATION CALCULATIONS

Page 3 of 4

Concrete Retaining Wall

Length = 8,756 lf
Cross Section Area* = 89 sf

* Measured in CAD from typical section

Concrete Volume = 28,843 CY

Retaining Wall Gravel

Wall Length = 8,756 lf
Gravel Length = 18.5 lf
Gravel Thickness = .5 lf

Gravel Volume = 2,996 CY

Fencing

Length = 8,756 lf
No. of Fences = 4 ea

Fencing Length = 35,024 LF

Aggregate Base Layer

Length = 8,756 lf
No. of Roads = 1 ea
Width = 16 ft
Thickness = 0.5 ft

Aggregate Base Volume = 2,594 CY

Asphalt Pavement

Length = 8,756 lf
No. of Roads = 1 ea
Width = 16 ft

Asphalt Area = 15,566 SY

Top Soil

Length = 4,378 lf
Width = 45 ft
Thickness = 0.5 ft

Top Soil Volume = 3,648 CY

Sub Drainage System

Length = 8,756 lf
No. of Systems = 1 ea

Length of Drainage System = 8,756 LF



PROJECT: **LA River Feasibility**
DETAIL: *Reach 5 Quantity Calculations*
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REACH 5 - INSTALLATION CALCULATIONS

Page 4 of 4

Sub Drainage Bedding

Length = 8,756 lf
Width = 2 ft
Height = 2 ft

* Total quantity subtracts volume of piping

Bedding Stone Volume = 1,043 CY

Sub Drainage Geotextile Wrap

Length = 8,756 lf
Width = 2 ft
Height = 2 ft

Geotextile Wrap Area = 7,783 SY

Sub Drainage Weep Holes

Length = 8,756 lf
Distance Between Holes = 10 ft

Weep Holes = 876 EA

Hauling of Material

Excavation Volume = 516,354 lf
Compacted Fill Volume = 195,830 sf

* Measured in CAD from typical section

Volume to be Hauled = 320,525 CY



PROJECT: **LA River Feasibility**
DETAIL: *Reach 5 Demo Quantity Calculations*
COMPUTED BY: NSS
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REACH 5 - DEMOLITION CALCULATIONS

Page 1 of 3

Reach Length

Length = 8,756 lf

* From Station 220+95.50 to Station 133+39.50

Total Length = 8,756 LF

[26] Terrace Banks

Demo Reinforced Concrete Channel Slope Paving

LB Length = 1,461 lf

* From Sta 220+95 to 218+00 and 145+04 to 133+39

Width = 75 ft

* Average estimated width

Thickness = 1 ft

Concrete Demo Volume = 4,057 CY

Demo Grouted Riprap Slope Paving

LB Length = 7,295 lf

* On LB from Station 218+00 to Station 145+04.55

Width = 75 ft

* Average estimated width

Thickness = 1 ft

Grouted Riprap Demo Volume = 20,265 CY

Demo Grouted Riprap Toe Protection

LB Length 1 = 350 lf

* LB from Station 218+00 to Station 214+50

LB Width 1 = 15 lf

LB Depth 1 = 3 ft

* Special grouted toe protection per as-built drawings

LB Length 2 = 2,500.0 ft

* LB from Station 214+50 to Station 189+50

LB Width 2 = 6 ft

LB Depth 2 = 1.5 ft

Grouted Riprap Demo Volume = 1,417 CY

Demo Riprap Toe Protection

LB Length = 2,500.0 ft

* LB from Station 214+50 to Station 189+50

Width = 6 ft

Depth = 5.5 lf

* Loose rock placed below 1.5' thick grouted toe down

Riprap Demo Volume = 3,056 CY

Remove Spalls Below Concrete Slope Paving

Length = 8,430 lf

* Spalls below conc. on both banks

Width = 75 ft

* Average estimated width

Thickness = 0.75 ft

Spalls Demo Volume = 17,562 CY

Remove Spalls Below Grouted Riprap Slope Paving

Length = 9,082 lf

* Spalls below grouted RR on both banks

Width = 75 ft

* Average estimated width

Thickness = 0.75 ft

Spalls Demo Volume = 18,921 CY



PROJECT: **LA River Feasibility**
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REACH 5 - DEMOLITION CALCULATIONS

Page 2 of 3

Demo 15-Foot-Long Steel Sheet Piles

LB Length = 911 lf
Cross Channel Length = 550 lf
* LB from Station 142+50 to Station 133+39.50
* Crosses channel horizontally at Station 189+50 and diagonally at Station 184+00

Steel Sheet Pile Demo Length = 1,185 LF

Demo 20-Foot-Long Steel Sheet Piles

Length = 805 lf
* LB from Station 185+05.16 to Station 177+00

Steel Sheet Pile Demo Length = 805 LF

Demo Existing 4-Foot-High Chain-Link Fence

Length = 8,756 lf
* Chain-link fences on both banks

Chain-Link Fence Length = 8,756 LF

Demo Asphalt-Concrete Access Road

Length = 8,756 lf
Width = 16 ft
Thickness = 0.25 ft
* Access road along the majority of both banks
* Assumed above grade

Asphalt-Concrete Pavement Demo Volume = 1,297 CY

[27] Modify Trapezoidal Channel to Vertical Sides

Demo Reinforced Concrete Channel Slope Paving

RB Length = 7,622 lf
Width = 75 ft
Thickness = 1 ft
* From Sta 220+95 to 218+00 and 206+65 to 133+39
* Average estimated width

Concrete Demo Volume = 21,171 CY

Demo Grouted Riprap Slope Paving

RB Length = 1,134 lf
Width = 75 ft
Thickness = 1 ft
* On RB from Station 218+00 to Station 206+65.67
* Average estimated width

Grouted Riprap Demo Volume = 3,151 CY

Demo Grouted Riprap Toe Protection

RB Length 1 = 1,123 lf
RB Width 1 = 15 lf
RB Depth 1 = 3 ft
RB Length 2 = 1,726.6 ft
RB Width 2 = 6 ft
RB Depth 2 = 1.5 ft
* RB from Station 218+00 to Station 206+76.62
* Special grouted toe protection per as-built drawings
* RB from Station 206+76.62 to Station 189+50

Grouted Riprap Demo Volume = 2,448 CY



PROJECT: **LA River Feasibility**
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REACH 5 - DEMOLITION CALCULATIONS

Page 3 of 3

Demo Riprap Toe Protection

RB Length = 1,726.6 ft
Width = 6 ft
Depth = 5.5 lf

* RB from Station 206+76.62 to Station 189+50

* Loose rock placed below 1.5' thick grouted toe down

Riprap Demo Volume = 2,110 CY

Remove Spalls Below Grouted Riprap Slope Paving

Length = 8,756 lf
Width = 75 ft
Thickness = 0.75 ft

* Spalls below grouted RR on both banks

* Average estimated width

Spalls Demo Volume = 18,242 CY

Demo 15-Foot-Long Steel Sheet Piles

RB Length = 6,579 lf
Cross Channel Length = 550 lf

* From Sta 206+76 to 189+50 and 181+92 to 133+39

* Crosses channel horizontally at Station 189+50 and diagonally at Station 184+00

Steel Sheet Pile Demo Length = 6,854 LF

Demo Existing 4-Foot-High Chain-Link Fence

Length = 8,756 lf

* Chain-link fences on both banks

Chain-Link Fence Length = 8,756 LF

Demo Asphalt-Concrete Access Road

Length = 8,756 lf
Width = 16 ft
Thickness = 0.3 ft

* Access road along the majority of both banks

* Assumed above grade

Asphalt-Concrete Pavement Demo Volume = 1,297 CY

Hauling of Material

Concrete Volume = 25,228 cy
Concrete Unit Weight = 2 tons/cy
Grouted Riprap Volume = 27,281 cy
Grouted Riprap Unit Weight = 2 tons/cy
Riprap Volume = 5,166 cy
Riprap Unit Weight = 1.5 tons/cy
Spalls Volume = 54,725 cy
Spalls Unit Weight = 1.35 tons/cy
Asphalt Volume = 2,594 cy
Asphalt Unit Weight = 1.35 tons/cy

Weight of material to be hauled = 190,148 tons



PROJECT: **LA River Feasibility**
DETAIL: *Reach 6a Quantity Calculations*
COMPUTED BY: SKV
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/6/2011

REACH 6a - INSTALLATION CALCULATIONS

Page 1 of 3

Reach Length

Length = 3,048 lf

Total Length = 3,048 LF

[4] Grade adjacent areas to lower elevation

Excavation Left Bank

Length = 3,048 lf

Cross Section Area* = 200 sf

* Measured in CAD from typical section

Concrete & Spalls Width = 75 lf

Concrete & Spalls Depth = 1.75 lf

Concrete & Spalls Length = 1,981 lf

Concrete & Spalls Volume = 9,631 cy

Riprap & Spalls Width = 75 lf

Riprap & Spalls Depth = 1.75 lf

Riprap & Spalls Length = 1,067 lf

Riprap & Spalls Volume = 5,186 cy

Excavation Volume = 7,725 CY

Riprap Toe Protection

Length = 1,524 lf

Cross Section Area* = 297 sf

* Measured in CAD from typical section

Riprap Volume = 16,754 CY

Compacted Fill Embankment

Length = 1,524 lf

Cross Section Area* = 32 sf

* Measured in CAD from typical section

Compacted Fill Volume = 1,802 CY

Aggregate Base Layer

Length = 3,048 lf

No. of Roads = 2 ea

Width = 16 ft

Thickness = 0.5 ft

Aggregate Base Volume = 1,806 CY

Asphalt Pavement

Length = 3,048 lf

No. of Roads = 2 ea

Width = 16 ft

Asphalt Area = 10,837 SY

Top Soil

Length = 3,048 lf

Width = 103 ft

Thickness = 0.5 ft

Top Soil Volume = 5,814 CY



PROJECT: **LA River Feasibility**
DETAIL: *Reach 6a Quantity Calculations*
COMPUTED BY: SKV
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REACH 6a - INSTALLATION CALCULATIONS

Page 2 of 3

[09] Culverts or Underground Basins

Underground Basin

Length = 3,000 lf
Width = 90 lf
Height = 9 lf

Rock Volume = **2,430,000 CF**

[26] Terrace banks

Excavation Right Bank

Length = 3,048 lf
Cross Section Area* = 200 sf
Concrete & Spalls Width = 75 lf
Concrete & Spalls Depth = 1.75 lf
Concrete & Spalls Length = 1,311 lf
Concrete & Spalls Volume = 6,371 cy
Riprap & Spalls Width = 75 lf
Riprap & Spalls Depth = 1.75 lf
Riprap & Spalls Length = 1,737 lf
Riprap & Spalls Volume = 8,446 cy

* Measured in CAD from typical section

Excavation Volume = **7,705 CY**

Riprap Toe Protection

Length = 1,524 lf
Cross Section Area* = 297 sf

* Measured in CAD from typical section

Rip Rap Volume = **16,754 CY**

Compacted Fill Embankment

Length = 1,524 lf
Cross Section Area* = 32 sf

* Measured in CAD from typical section

Compacted Fill Volume = **1,802 CY**

[16] Bioengineer channel walls

Pyramat Turf Reinforcement Mat

Length = 3,048 lf
Width = 134 lf

Reinforcement Mat Area = **45,381 SY**

Rock at Pyramat Tie-In

Length = 3,048 lf
Width = 3 lf
Height = 3 lf
No. of Rock Tie-Ins = 2 ea

Rock Volume = **2,032 CY**



PROJECT: **LA River Feasibility**
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REACH 6a - INSTALLATION CALCULATIONS

Page 3 of 3

Fencing

Length = 3,048 lf
No. of Fences = 4 ea

Fencing Length = 12,192 LF

Hauling of Material

Excavation Volume = 15,430 cy
Compacted Fill Volume = 3,605 cy * Measured in CAD from typical section

Volume to be Hauled = 11,825 CY



PROJECT: **LA River Feasibility**
DETAIL: *Reach 6b Quantity Calculations*
COMPUTED BY: SKV
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REACH 6b - INSTALLATION CALCULATIONS

Page 1 of 4

Reach Length

Length = 3,928 lf

Total Length = 3,928 LF

[4] Grade adjacent areas to lower elevation

Excavation Left Bank

Length = 3,928 lf

Cross Section Area* = 6,584 sf

* Measured in CAD from typical section

Concrete & Spalls Width = 75 lf

Concrete & Spalls Depth = 1.75 lf

Concrete & Spalls Length = 2,553 lf

Concrete & Spalls Volume = 12,411 cy

Riprap & Spalls Width = 75 lf

Riprap & Spalls Depth = 1.75 lf

Riprap & Spalls Length = 1,375 lf

Riprap & Spalls Volume = 6,683 cy

Excavation Volume = 938,796 CY

Riprap Toe Protection

Length = 1,964 lf

Cross Section Area* = 445 sf

* Measured in CAD from typical section

Riprap Volume = 32,368 CY

Compacted Fill Embankment

Length = 1,964 lf

Cross Section Area* = 37 sf

* Measured in CAD from typical section

Compacted Fill Volume = 2,693 CY

[16] Bioengineer channel walls

Pyramat Turf Reinforcement Mat

Length = 3,928 lf

Width = 130 lf

Reinforcement Mat Area = 56,738 SY

Rock at Pyramat Tie-In

Length = 3,928 lf

Width = 3 lf

Height = 3 lf

No. of Rock Tie-Ins = 2 ea

Rock Volume = 2,619 CY



PROJECT: **LA River Feasibility**
DETAIL: *Reach 6b Quantity Calculations*
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REACH 6b - INSTALLATION CALCULATIONS

Page 2 of 4

[17] Habitat corridors/Riparian planting on banks

Revegetation

Length = 3,928 lf

Width = 400 ft

Revegetation Area = **36.1 ACRE**

[19] Bioengineer channel walls

Pyramat Turf Reinforcement Mat

Length = 3,500 lf

Width = 130 lf

Reinforcement Mat Area = **50,556 SY**

Rock at Pyramat Tie-In

Length = 3,500 lf

Width = 3 lf

Height = 3 lf

No. of Rock Tie-Ins = 2 ea

Rock Volume = **2,333 CY**

[21] Lower channel banks and provide setback levees or berms

Excavation Taylor Yard

Length = 3,500 lf

Cross Section Area* = 1,412 sf

* Measured in CAD from typical section

Concrete & Spalls Width = 88 lf

Concrete & Spalls Depth = 1.75 lf

Concrete & Spalls Length = 3,500 lf

Concrete & Spalls Volume = 19,963 cy

Excavation Volume = **163,116 CY**

Excavation Retaining Wall, Left Bank

Length = 3,500 lf

Cross Section Area* = 850 sf

* Measured in CAD from typical section

Excavation Volume = **110,185 CY**

Excavation Retaining Wall, Right Bank

Length = 3,500 lf

Cross Section Area* = 1,256 sf

* Measured in CAD from typical section

Excavation Volume = **162,842 CY**

Fencing

Length = 3,500 lf

No. of Fences = 4 ea

Fencing Length = **14,000 LF**



PROJECT: **LA River Feasibility**
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REACH 6b - INSTALLATION CALCULATIONS

Page 3 of 4

Aggregate Base Layer

Length = 3,500 lf
No. of Roads = 2 ea
Width = 16 ft
Thickness = 0.5 ft

Aggregate Base Volume = 2,074 CY

Asphalt Pavement

Length = 3,500 lf
No. of Roads = 2 ea
Width = 16 ft

Asphalt Area = 12,444 SY

[26] Terrace banks

Excavation Right Bank

Length = 3,928 lf
Cross Section Area* = 200 sf
Concrete & Spalls Width = 75 lf
Concrete & Spalls Depth = 1.75 lf
Concrete & Spalls Length = 1,689 lf
Concrete & Spalls Volume = 8,211 cy
Riprap & Spalls Width = 75 lf
Riprap & Spalls Depth = 1.75 lf
Riprap & Spalls Length = 2,239 lf
Riprap & Spalls Volume = 10,884 cy

* Measured in CAD from typical section

Excavation Volume = 9,996 CY

Riprap Toe Protection

Length = 1,964 lf
Cross Section Area* = 445 sf

* Measured in CAD from typical section

Riprap Volume = 32,368 CY

Compacted Fill Embankment

Length = 1,964 lf
Cross Section Area* = 37 sf

* Measured in CAD from typical section

Compacted Fill Volume = 2,693 CY

Fencing

Length = 3,928 lf
No. of Fences = 4 ea

Fencing Length = 15,712 LF

Aggregate Base Layer

Length = 3,928 lf
No. of Roads = 2 ea
Width = 16 ft
Thickness = 0.5 ft

Aggregate Base Volume = 2,328 CY



PROJECT: **LA River Feasibility**
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REACH 6b - INSTALLATION CALCULATIONS

Page 4 of 4

Asphalt Pavement

Length = 3,928 lf
No. of Roads = 2 ea
Width = 16 ft

Asphalt Area = 13,966 SY

Top Soil

Length = 3,928 lf
Width = 400 ft
Thickness = 0.5 ft

Top Soil Volume = 29,096 CY

Hauling of Material

Excavation Volume = 948,792 cy
Compacted Fill Volume = 5,386 cy

* Measured in CAD from typical section

Volume to be Hauled = 943,407 CY



PROJECT: **LA River Feasibility**
DETAIL: *Reach 6c Quantity Calculations*
COMPUTED BY: SKV
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REACH 6c - INSTALLATION CALCULATIONS

Page 1 of 3

Reach Length

Length = 5,772 lf

Total Length = **5,772 LF**

[16] Bioengineer channel walls

Pyramat Turf Reinforcement Mat

Length = 5,772 lf

Width = **158 lf**

Reinforcement Mat Area = **101,331 SY**

Rock at Pyramat Tie-In

Length = 5,772 lf

Width = **3 lf**

Height = **3 lf**

No. of Rock Tie-Ins = **2 ea**

Rock Volume = **3,848 CY**

[17] Habitat corridors/Riparian planting on banks

Revegetation

Length = 5,772 lf

Width = **151 ft**

Revegetation Area = **20.0 ACRE**

[26] Terrace banks

Excavation Left Bank

Length = 5,772 lf

Cross Section Area* = **278 sf**

* Measured in CAD from typical section

Concrete & Spalls Width = **75 lf**

Concrete & Spalls Depth = **1.75 lf**

Concrete & Spalls Length = 3,752 lf

Concrete & Spalls Volume = 18,238 cy

Riprap & Spalls Width = **75 lf**

Riprap & Spalls Depth = **1.75 lf**

Riprap & Spalls Length = 2,020 lf

Riprap & Spalls Volume = 9,820 cy

Excavation Volume = **31,368 CY**



PROJECT: **LA River Feasibility**
DETAIL: *Reach 6c Quantity Calculations*
COMPUTED BY: SKV
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REACH 6c - INSTALLATION CALCULATIONS

Page 2 of 3

Excavation Right Bank

Length = 5,772 lf
Cross Section Area* = 278 sf * Measured in CAD from typical section
Concrete & Spalls Width = 75 lf
Concrete & Spalls Depth = 1.75 lf
Concrete & Spalls Length = 2,482 lf
Concrete & Spalls Volume = 12,065 cy
Riprap & Spalls Width = 75 lf
Riprap & Spalls Depth = 1.75 lf
Riprap & Spalls Length = 3,290 lf
Riprap & Spalls Volume = 15,993 cy

Excavation Volume = 31,368 CY

Riprap Toe Protection

Length = 5,772 lf
Cross Section Area* = 591 sf * Measured in CAD from typical section

Riprap Volume = 126,368 CY

Compacted Fill Embankment

Length = 5,772 lf
Cross Section Area* = 167 sf * Measured in CAD from typical section

Compacted Fill Volume = 35,720 CY

Fencing

Length = 5,772 lf
No. of Fences = 4 ea

Fencing Length = 23,088 LF

Aggregate Base Layer

Length = 5,772 lf
No. of Roads = 2 ea
Width = 16 ft
Thickness = 0.5 ft

Aggregate Base Volume = 3,420 CY

Asphalt Pavement

Length = 5,772 lf
No. of Roads = 2 ea
Width = 16 ft

Asphalt Area = 20,523 SY



PROJECT: **LA River Feasibility**
DETAIL: *Reach 6c Quantity Calculations*
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REACH 6c - INSTALLATION CALCULATIONS

Page 3 of 3

Top Soil

Length = 5,772 lf
Width = 151 ft
Thickness = 0.5 ft

Top Soil Volume = 16,115 CY

Hauling of Material

Excavation Volume = 62,735 cy
Compacted Fill Volume = 35,720 cy * Measured in CAD from typical section

Volume to be Hauled = 27,015 CY



PROJECT: **LA River Feasibility**
DETAIL: *Reach 6 Demo Quantity Calculations*
COMPUTED BY: NSS
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REACH 6 - DEMOLITION CALCULATIONS

Page 1 of 6

Reach Length

Length = 12,748 lf

* From Station 1417+37.25 to Station 1289+89.25

Cross Section 6a Length = **3,048 LF**

* From Station 1417+37.25 to Station 1386+89.25

Cross Section 6b Length = **3,928 LF**

* From Station 1386+89.25 to Station 1347+61.25

Cross Section 6c Length = **5,772 LF**

* From Station 1347+61.25 to Station 1289+89.25

Total Length = **12,748 LF**

[4] Grade adjacent areas to lower elevation

Demo Reinforced Concrete Channel Slope Paving

LB Length = 8,318 lf * From 1417+37 - 1375+69, 1366+00 - 1362+50, 1342+00 - 1304+00

RB Length = 5,441 lf * On RB from Sta. 1386+40.82 to Sta. 1332+00

Width = 75 ft * Average estimated width

Thickness = 1 ft

6a Concrete Demo Volume = **4,233 CY**

6b Concrete Demo Volume = **7,430 CY**

6c Concrete Demo Volume =

Total Concrete Demo Volume = **11,663 CY**

Demo Grouted Riprap Slope Paving

LB Length = 3,719 lf * From 1375+69 - 1366+00, 1362+50 - 1342+00, 1304+00 - 1297+00

RB Length = 6,596 lf * From Sta 1417+37.25 to 1386+40.82, and 1332+00 to 1297+00

Width = 75 ft * Average estimated width

Thickness = 1 ft

6a Grouted Riprap Demo Volume = **4,233 CY**

6b Grouted Riprap Demo Volume = **3,481 CY**

6c Grouted Riprap Demo Volume =

Total Grouted Riprap Demo Volume = **7,714 CY**

Demo Grouted Riprap Toe Protection

LB Length 1 = 8,318 lf

* LB with concrete slope paving

LB Width 1 = 6 ft

* See Typical Section B

LB Depth 1 = 1.5 ft

* See Typical Section B

LB Length 2 = 3,719 lf

* LB with grouted rock slope paving

LB Width 2 = 17 ft

* See Typical Section B

LB Depth 2 = 1.5 ft

RB Length 1 = 5,441 lf

* RB with concrete slope paving

RB Width 1 = 6 ft

RB Depth 1 = 1.5 ft

RB Length 2 = 6,596 lf

* RB with grouted rock slope paving

RB Width 2 = 17 ft

RB Depth 2 = 1.5 ft

6a Grouted Riprap Demo Volume = **1,713 CY**

6b Grouted Riprap Demo Volume = **2,208 CY**

6c Grouted Riprap Demo Volume =

Total Grouted Riprap Demo Volume = **3,921 CY**



PROJECT: **LA River Feasibility**
DETAIL: *Reach 6 Demo Quantity Calculations*
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REACH 6 - DEMOLITION CALCULATIONS

Page 2 of 6

Demo Riprap Toe Protection

LB Length 1 = 8,318 lf	* LB with concrete slope paving
LB Width 1 = 6 ft	* See Typical Section B
LB Depth 1 = 5.5 ft	* See Typical Section B
LB Length 2 = 3,719 lf	* LB with grouted rock slope paving
Cross Sectional Area 2a = 30 sf	* See Typical Section B
Cross Sectional Area 2b = 33 sf	
RB Length 1 = 5,441 lf	* RB with concrete slope paving
RB Width 1 = 6 ft	
RB Depth 1 = 5.5 ft	
RB Length 2 = 6,596 lf	* RB with grouted rock slope paving
Cross Sectional Area 2a = 30 sf	* See Typical Section B
Cross Sectional Area 2b = 33 sf	

6a Riprap Demo Volume =	4,899 CY
6b Riprap Demo Volume =	6,314 CY
6c Riprap Demo Volume =	
Total Riprap Demo Volume =	11,213 CY

Remove Spalls Below Grouted Riprap Slope Paving

Length = 10,316 lf	* Spalls below grouted RR on both banks
Width = 75 ft	* Average estimated width
Thickness = 0.75 ft	

6a Spalls Demo Volume =	2,569 CY
6b Spalls Demo Volume =	3,311 CY
6c Spalls Demo Volume =	
Total Spalls Demo Volume =	5,880 CY

Remove Spalls Below Concrete Slope Paving

Length = 13,759 lf	* Spalls below conc. on both banks
Width = 75 ft	* Average estimated width
Thickness = 0.75 ft	

6a Spalls Demo Volume =	3,427 CY
6b Spalls Demo Volume =	4,416 CY
6c Spalls Demo Volume =	
Total Spalls Demo Volume =	7,843 CY

Demo 20-Foot-Long Steel Sheet Piles

LB Length = 7,945 lf
RB Length = 5,441 lf

6a Steel Sheet Pile Demo Length =	1,738 LF
6b Steel Sheet Pile Demo Length =	2,825 LF
6c Steel Sheet Pile Demo Length =	
Total Steel Sheet Pile Demo Length =	4,562 LF



PROJECT: **LA River Feasibility**
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REACH 6 - DEMOLITION CALCULATIONS

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Demo Existing 4-Foot-High Chain-Link Fence

Length = 25,496 lf * Chain-link fences on both banks

6a Chain-Link Fence Length = 3,048 LF
6b Chain-Link Fence Length = 3,928 LF
6c Chain-Link Fence Length =
Total Chain-Link Fence Length = 6,976 LF

Demo Asphalt-Concrete Access Road

Length = 25,496 lf * Access road on both banks
Width = 16 ft
Thickness = 0.25 ft * Assumed above grade

6a Asphalt-Concrete Pavement Demo Volume = 452 CY
6b Asphalt-Concrete Pavement Demo Volume = 582 CY
6c Asphalt-Concrete Pavement Demo Volume =
Total Asphalt-Concrete Pavement Demo Volume = 1,033 CY

Utility Pole Structures to Demo

No. of Structures = 8 ea * Found on LB near XS 6b (estimated from aerial photo)

6b (Total) Utility Pole Structure Demo Number = 4 EA

[26] Terrace banks

Demo Reinforced Concrete Channel Slope Paving

LB Length = 8,318 lf * From 1417+37 - 1375+69, 1366+00 - 1362+50, 1342+00 - 1304+00
RB Length = 5,441 lf * On RB from Sta. 1386+40.82 to Sta. 1332+00
Width = 75 ft * Average estimated width
Thickness = 1.0 ft

6a Concrete Demo Volume = 4,233 CY
6b Concrete Demo Volume = 7,430 CY
6c Concrete Demo Volume = 14,892 CY
Total Concrete Demo Volume = 26,556 CY

Demo Grouted Riprap Slope Paving

LB Length = 3,719 lf * From 1375+69 - 1366+00, 1362+50 - 1342+00, 1304+00 - 1297+00
RB Length = 6,596 lf * From Sta 1417+37 to 1386+40, 1332+00 to 1297+00
Width = 75 ft * Average estimated width
Thickness = 1 ft

6a Grouted Riprap Demo Volume = 4,233 CY
6b Grouted Riprap Demo Volume = 3,481 CY
6c Grouted Riprap Demo Volume = 13,226 CY
Total Grouted Riprap Demo Volume = 20,940 CY



PROJECT: **LA River Feasibility**
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REACH 6 - DEMOLITION CALCULATIONS

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Demo Grouted Riprap Toe Protection

LB Length 1 = 8,318 lf	* LB with concrete slope paving
LB Width 1 = 6 ft	* See Typical Section B
LB Depth 1 = 1.5 ft	* See Typical Section B
LB Length 2 = 3,719 ft	* LB with grouted rock slope paving
LB Width 2 = 17 ft	* See Typical Section B
LB Depth 2 = 1.5 ft	
RB Length 1 = 5,441 lf	* RB with concrete slope paving
RB Width 1 = 6 ft	
RB Depth 1 = 1.5 ft	
RB Length 2 = 6,596 ft	* RB with grouted rock slope paving
RB Width 2 = 17 ft	
RB Depth 2 = 1.5 ft	

6a Grouted Riprap Demo Volume =	1,713 CY
6b Grouted Riprap Demo Volume =	2,208 CY
6c Grouted Riprap Demo Volume =	6,488 CY
Total Grouted Riprap Demo Volume =	10,408 CY

Demo Riprap Toe Protection

LB Length 1 = 8,318 lf	* LB with concrete slope paving
LB Width 1 = 6 ft	* See Typical Section B
LB Depth 1 = 5.5 ft	* See Typical Section B
LB Length 2 = 3,719 ft	* LB with grouted rock slope paving
Cross Sectional Area 2a = 30 sf	* See Typical Section B
Cross Sectional Area 2b = 33 sf	
RB Length 1 = 5,441 lf	* RB with concrete slope paving
RB Width 1 = 6 ft	
RB Depth 1 = 5.5 ft	
RB Length 2 = 6,596 ft	* RB with grouted rock slope paving
Cross Sectional Area 2a = 30 sf	* See Typical Section B
Cross Sectional Area 2b = 33 sf	

6a Riprap Demo Volume =	4,899 CY
6b Riprap Demo Volume =	6,314 CY
6c Riprap Demo Volume =	18,556 CY
Total Riprap Demo Volume =	29,769 CY

Remove Spalls Below Grouted Riprap Slope Paving

Length = 10,316 lf	* Spalls below grouted RR on both banks
Width = 75 ft	* Average estimated width
Thickness = 0.75 ft	

6a Spalls Demo Volume =	2,569 CY
6b Spalls Demo Volume =	3,311 CY
6c Spalls Demo Volume =	9,731 CY
Total Spalls Demo Volume =	15,611 CY



PROJECT: **LA River Feasibility**
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REACH 6 - DEMOLITION CALCULATIONS

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Remove Spalls Below Concrete Slope Paving

Length = 13,759 lf * Spalls below conc. on both banks
Width = 75 ft * Average estimated width
Thickness = 0.75 ft

6a Spalls Demo Volume = 3,427 CY
6b Spalls Demo Volume = 4,416 CY
6c Spalls Demo Volume = 12,979 CY
Total Spalls Demo Volume = 20,821 CY

Demo 20-Foot-Long Steel Sheet Piles

LB Length = 7,945 lf
RB Length = 5,441 lf

6a Steel Sheet Pile Demo Length = 1,738 LF
6b Steel Sheet Pile Demo Length = 2,825 LF
6c Steel Sheet Pile Demo Length = 4,261 LF
Total Steel Sheet Pile Demo Length = 8,824 LF

Demo Existing 4-Foot-High Chain-Link Fence

Length = 25,496 lf * Chain-link fences on both banks

6a Chain-Link Fence Length = 3,048 LF
6b Chain-Link Fence Length = 3,928 LF
6c Chain-Link Fence Length = 11,544 LF
Total Chain-Link Fence Length = 18,520 LF

Demo Asphalt-Concrete Access Road

Length = 25,496 lf * Access road on both banks
Width = 16 ft
Thickness = 0.25 ft * Assumed above grade

6a Asphalt-Concrete Pavement Demo Volume = 452 CY
6b Asphalt-Concrete Pavement Demo Volume = 582 CY
6c Asphalt-Concrete Pavement Demo Volume = 1,710 CY
Total Asphalt-Concrete Pavement Demo Volume = 2,744 CY

Utility Pole Structures to Demo

No. of Structures = 8 ea * Found on LB near XS 6b (estimated from aerial photo)

6b (Total) Utility Pole Structure Demo Number = 4 EA



PROJECT: **LA River Feasibility**
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REACH 6 - DEMOLITION CALCULATIONS

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Hauling of Material

Concrete Volume = 38,219 cy
Concrete Unit Weight = 2 tons/cy
Grouted Riprap Volume = 42,983 cy
Grouted Riprap Unit Weight = 2 tons/cy
Riprap Volume = 40,982 cy
Riprap Unit Weight = 1.5 tons/cy
Spalls Volume = 50,155 cy
Spalls Unit Weight = 1.35 tons/cy
Asphalt Volume = 3,777 cy
Asphalt Unit Weight = 1.35 tons/cy

6a Weight of material to be hauled =	72,825 tons
6b Weight of material to be hauled =	93,850 tons
6c Weight of material to be hauled =	130,011 tons
Total Weight of material to be hauled =	296,686 tons



PROJECT: **LA River Feasibility**
DETAIL: *Reach 7 Quantity Calculations*
COMPUTED BY: SKV
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/6/2011

REACH 7 - INSTALLATION CALCULATIONS

Page 1 of 4

Reach Length

Length = 4,403 lf

Total Length = **4,403 LF**

[3] Create geomorphology and plant for freshwater marsh

Riprap Below Vegetation Area

Length = 4,403 lf

Cross Section Area* = **589 sf**

* Measured in CAD from typical section

Riprap Volume = **96,002 CY**

Compacted Fill Inside Vegetation Area

Length Left Bank = 4,403 lf

Fill Area Left Bank* = **300 sf**

* Measured in CAD from typical section

Length Right Bank = 4,403 lf

Fill Area Right Bank* = **300 sf**

* Measured in CAD from typical section

Top Soil Depth = 0.5 lf

Top Soil Width = 117 lf

Compacted Fill Volume = **88,394 CY**

Vegetation Retaining Wall Concrete

Length = 4,403 lf

Cross Section Area* = **43 sf**

* Measured in CAD from typical section

No. of Walls = **4 ea**

Concrete Volume = **27,723 CY**

Top Soil

Length = 4,403 lf

Width = **116.5 ft**

Thickness = **0.5 ft**

Top Soil Volume = **9,499 CY**

[17] Habitat corridors/Riparian planting on banks

Revegetation

Length = 4,403 lf

Width = **117 ft**

Revegetation Area = **11.8 ACRE**



PROJECT: **LA River Feasibility**
DETAIL: *Reach 7 Quantity Calculations*
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REACH 7 - INSTALLATION CALCULATIONS

Page 2 of 4

[21] Lower channel banks and provide setback levees or berms

Excavation Left Bank

Length = 4,403 lf
Cross Section Area* = 1,413 sf * Measured in CAD from typical section
Concrete & Spalls Width = 88 lf
Concrete & Spalls Depth = 1.75 lf
Concrete & Spalls Length = 4,403 lf
Concrete & Spalls Volume = 25,113 cy

Excavation Volume = **205,239 CY**

Excavation Right Bank

Length = 4,403 lf
Cross Section Area* = 1,412 sf * Measured in CAD from typical section
Concrete & Spalls Width = 88 lf
Concrete & Spalls Depth = 1.75 lf
Concrete & Spalls Length = 4,403 lf
Concrete & Spalls Volume = 25,113 cy

Excavation Volume = **205,199 CY**

Excavation Retaining Wall, Left Bank

Length = 4,403 lf
Cross Section Area* = 850 sf * Measured in CAD from typical section

Excavation Volume = **138,613 CY**

Excavation Retaining Wall, Right Bank

Length = 4,403 lf
Cross Section Area* = 1,256 sf * Measured in CAD from typical section

Excavation Volume = **204,855 CY**

Fencing

Length = 4,403 lf
No. of Fences = 4 ea

Fencing Length = **17,612 LF**

Aggregate Base Layer

Length = 4,403 lf
No. of Roads = 2 ea
Width = 16 ft
Thickness = 0.5 ft

Aggregate Base Volume = **2,609 CY**

Asphalt Pavement

Length = 4,403 lf
No. of Roads = 2 ea
Width = 16 ft

Asphalt Area = **15,655 SY**



PROJECT: **LA River Feasibility**
DETAIL: *Reach 7 Quantity Calculations*
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REACH 7 - INSTALLATION CALCULATIONS

Page 3 of 4

[28] Widen channel/cantilever channel bank

Compacted Fill Embankment

Length = 4,403 lf
Cross Section Area LB* = 164 sf * Measured in CAD from typical section
Length = 4,403 lf
Cross Section Area RB* = 22 sf * Measured in CAD from typical section

Compacted Fill Volume = 30,405 CY

Compacted Fill Retaining Walls

Length = 4,403 lf
Cross Section Area* = 1,821 sf * Measured in CAD from typical section
Sub-Drain Area = 8 sf

Compacted Fill Volume = 295,691 CY

Concrete Retaining Walls

Length = 4,403 lf
Cross Section Area = 140 sf * Measured in CAD from typical section
No. of Walls = 2 ea

Concrete Volume = 45,661 CY

Concrete Elevated Platforms

Length = 4,403 lf
Width = 25 lf
Thickness = 3 lf
No. of Platforms = 2 ea

Concrete Volume = 24,461 CY

Concrete Slabs

Length = 4,403 lf
Width = 6 lf
Thickness = 1 lf
No. of Slabs = 2 ea

Concrete Volume = 1,957 CY

Concrete Piers

Length = 4,403 lf
Distance Between Piers = 25 lf
No. of Walls = 2 ea
No. of Piers = 353 ea
Cross Section Area* = 132 sf * Measured in CAD from typical section
Pier Thickness = 4 lf

Concrete Volume = 6,903 CY

Sub Drainage System

Length = 4,403 lf
No. of Systems = 2 ea

Length of Drainage System = 8,806 LF



PROJECT: **LA River Feasibility**
DETAIL: *Reach 7 Quantity Calculations*
COMPUTED BY: SKV
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REACH 7 - INSTALLATION CALCULATIONS

Page 4 of 4

Sub Drainage Bedding

Length = 4,403 lf
Width = 2 ft
Height = 2 ft

* Total quantity subtracts volume of pipe

Bedding Stone Volume = 524 CY

Sub Drainage Geotextile Wrap

Length = 8,806 lf
Width = 2 ft
Height = 2 ft

Geotextile Wrap Area = 7,828 SY

Sub Drainage Weep Holes

Length = 8,806 lf
Distance Between Holes = 10 ft

Weep Holes = 881 EA

Hauling of Material

Excavation Volume = 753,906 cy
Compacted Fill Volume = 414,490 cy

* Measured in CAD from typical section

Volume to be Hauled = 339,416 CY



PROJECT: **LA River Feasibility**
DETAIL: *Reach 7 Demo Quantity Calculations*
COMPUTED BY: NSS
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/19/2011

REACH 7 - DEMOLITION CALCULATIONS

Page 1 of 1

Reach Length

Length = 4,403 lf

* No work assumed between I-5 and SR-110

Total Length = 4,403 LF

[21] Lower channel banks and provide setback levees or berms

Demo Reinforced Concrete Channel Slope Paving

LB Length = 4,060 lf

* Along trap. reach and transition reach from 1273+10 to 1232+50

RB Length = 4,060 lf

* Along trap. reach and transition reach from 1273+10 to 1232+50

Average Width = 55 ft

* $W = 52.6 / \cos(3H:1V)$; Width scaled off as-built drawings

Thickness = 1 ft

Concrete Demo Volume = 16,674 CY

Remove Spalls Below Concrete Slope Paving

Length = 4,060 lf

* Spalls below conc. along the trap. reach and the transition reach

Width = 175 ft

* Width includes 2 banks and two 32' wide sections of invert panels

Thickness = 0.75 ft

Spalls Demo Volume = 19,723 CY

Demo Existing 4-Foot-High Chain-Link Fence

Length = 8,120 lf

* Fences on both banks along the trap. reach and the transition reach

Chain-Link Fence Length = 8,120 LF

Utility Pole Structures to Demo

No. of Structures = 15 ea

* Includes both banks along the trap. reach and the transition reach

Utility Pole Structure Demo Number = 15 EA

[23] Channel bed

Demo Reinforced Concrete Channel Invert

Length = 8,120 lf

* 2 banks along trap. reach and transition reach, 1273+10 to 1220+50

Width = 32 lf

* Width scaled off LA River Feasibility Study preliminary drawings (Crc

Thickness = 1.0 ft

Concrete Demo Volume = 9,624 CY

Hauling of Material

Concrete Volume = 26,298 cy

Concrete Unit Weight = 2 tons/cy

Spalls Volume = 19,723 cy

Spalls Unit Weight = 1.35 tons/cy

Weight of material to be hauled = 79,222 tons



PROJECT: **LA River Feasibility**
DETAIL: *Corn Field Cross Section Quantity Calculations*
COMPUTED BY: SKV
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/17/2011

REACH 7 - CORN FIELD QUANTITY CALCULATIONS

Page 1 of 2

Reach Length

Length = 1,000 lf

Total Length = **1,000 LF**

[08] Creation of Wetlands Flood Control Basin

Excavation Embankment

Length = 1,000 lf

Cross Section Area* = **3,003 sf**

* Measured in CAD from typical section

Excavation Volume = **111,208 CY**

Hauling of Material

Excavation Volume = 111,208 lf

Compacted Fill Volume = 0 sf

Volume to be Hauled = **111,208 CY**

Impermeable Liner

Length = 1,000 lf

Width = **194 lf**

Impermeable Liner Area = **21,556 SY**

Fencing

Length = 1,000 lf

No. of Fences = **2 ea**

Fencing Length = **2,000 LF**

Aggregate Base Layer

Length = 1,000 lf

No. of Roads = **1 ea**

Width = **16 ft**

Thickness = **0.5 ft**

Aggregate Base Volume = **296 CY**

Asphalt Pavement

Length = 1,000 lf

No. of Roads = **1 ea**

Width = **16 ft**

Asphalt Area = **1,778 SY**



PROJECT: **LA River Feasibility**
DETAIL: *Corn Field Cross Section Quantity Calculations*
COMPUTED BY: SKV
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/17/2011

REACH 7 - CORN FIELD QUANTITY CALCULATIONS

Page 2 of 2

Top Soil

Length = 1,000 lf
Width = 194 ft
Thickness = 0.5 ft

Top Soil Volume = 3,593 CY

Revegetation

Length = 1,000 lf
Width = 194 ft

Revegetation Area = 4.5 ACRE



PROJECT: **LA River Feasibility**
DETAIL: *Arroyo Seco Cross Section Quantity Calculations*
COMPUTED BY: SKV
CHECKED BY:

PROJECT NO: T26313
DATE: 10/17/2011

REACH 7 - ARROYO SECO INSTALLATION CALCULATIONS

Page 1 of 2

Reach Length

Length = 1,000 lf

Total Length = 1,000 LF

[27] Tributary Channels/Widen Channel

Excavation Embankment

Length = 1,000 lf

Cross Section Area* = 1,437 sf

* Measured in CAD from typical section

Excavation Volume = 53,217 CY

Hauling of Material

Excavation Volume = 53,217 lf

Compacted Fill Volume = 0 sf

Volume to be Hauled = 53,217 CY

Pyramat Turf Reinforcement Mat

Length = 1,000 lf

Width = 149 lf

Extra Pyramat at Tie-Ins = 30 lf

Reinforcement Mat Area = 19,879 SY

Rock at Pyramat Tie-In

Length = 1,000 lf

Width = 3 lf

Height = 3 lf

No. of Rock Tie-Ins = 2 ea

Rock Volume = 667 CY

Fencing

Length = 1,000 lf

No. of Fences = 2 ea

Fencing Length = 2,000 LF

Aggregate Base Layer

Length = 1,000 lf

No. of Roads = 1 ea

Width = 16 ft

Thickness = 0.5 ft

Aggregate Base Volume = 296 CY



PROJECT: **LA River Feasibility**
DETAIL: *Arroyo Seco Cross Section Quantity Calculations*
COMPUTED BY: SKV
CHECKED BY:

PROJECT NO: T26313
DATE: 10/17/2011

REACH 7 - ARROYO SECO INSTALLATION CALCULATIONS

Page 2 of 2

Asphalt Pavement

Length = 1,000 lf
No. of Roads = 1 ea
Width = 16 ft

Asphalt Area = 1,778 SY

Top Soil

Length = 1,000 lf
Width = 149 ft
Thickness = 0.5 ft

Top Soil Volume = 2,758 CY

Revegetation

Length = 1,000 lf
Width = 149 ft

Revegetation Area = 3.4 ACRE



PROJECT: **LA River Feasibility**
DETAIL: *Arroyo Seco Demo Quantity Calculations*
COMPUTED BY: NSS
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/19/2011

REACH 7 - ARROYO SECO DEMOLITION CALCULATIONS

Page 1 of 1

Reach Length

RB Length = 300 lf * Length estimated by Scott E.
LB Length = 700 lf * Length estimated by Scott E.

Total Length = 1,000 LF

[27] Tributary Channels/Widen Channel

Demo Left Bank Reinforced Concrete Channel Wall

RB Length = 300 lf
RB Height = 24 ft * Height shown on LA River Feasibility Study preliminary drawings
LB Length = 700 lf
LB Height = 4 ft * Height shown on LA River Feasibility Study preliminary drawings
Thickness = 1.0 ft

Concrete Demo Volume = 370 CY

Demo Existing Chain-Link Fence

Length = 300 lf * Fence shown on typical section in O&M Manual

Chain-Link Fence Length = 300 LF

Hauling of Concrete

Concrete Volume = 370 cy
Concrete Unit Weight = 2 tons/cy

Weight of concrete to be hauled = 741 tons



PROJECT: **LA River Feasibility**
DETAIL: *Reach 8a Quantity Calculations*
COMPUTED BY: SKV
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/6/2011

REACH 8a - INSTALLATION CALCULATIONS

Page 1 of 3

Reach Length

Length = 4,806 lf

Total Length = **4,806 LF**

[3] Create geomorphology and plant for freshwater marsh

Excavation for Grade Control Structures

Length = 4,806 lf

Distance Between Structures = 500 lf

of Structures = 10 ea

Cross Section Area* = 709 sf

* Measured in CAD from typical section

Channel Width = 150 lf

Concrete Invert Length = 103 lf

Concrete Invert Width = 150 lf

Concrete Invert Thickness = 1 lf

Concrete Demo per Structure = 572 cy

Excavation Volume = **33,667 CY**

Grouted Riprap Structures

Length = 4,806 lf

Distance Between Structures = 500 lf

of Structures = 10 ea

Cross Section Area* = 215 sf

* Measured in CAD from typical section

Structure Width = 150 lf

Low Flow Channel Area = 33 sf

* Measured in CAD from typical section

Low Flow Channel Width = 24 lf

Grouted Riprap Volume = **11,651 CY**

[09] Culverts or Underground Basins

Underground Basin

Length = 2,000 lf

Width = 1,600 lf

Height = 9 lf

Underground Basin Volume = **28,800,000 CF**

[16] Bioengineer channel walls

Pyramat Turf Reinforcement Mat

Length = 4,806 lf

Width = 135 lf

Reinforcement Mat Area = **72,090 SY**



PROJECT: **LA River Feasibility**
DETAIL: *Reach 8a Quantity Calculations*
COMPUTED BY: SKV
CHECKED BY: IGP

PROJECT NO: T26313
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REACH 8a - INSTALLATION CALCULATIONS

Page 2 of 3

Rock at Pyramat Tie-In

Length = 4,806 lf
Width = 3 lf
Height = 3 lf
No. of Rock Tie-Ins = 2 ea

Rock Volume = **3,204 CY**

[17] Habitat corridors/Riparian planting on banks

Revegetation

Length = 4,806 lf
Width = 105 ft

Revegetation Area = **11.6 ACRE**

[17] Habitat corridors/Riparian planting on banks

Revegetation

Area = 61.0 acre * Area of vegetation measured from aerials.

Revegetation Area = **61.0 ACRE**

[21] Lower channel banks and provide setback levees or berms

Excavation Left Bank

Length = 4,806 lf
Cross Section Area* = 6,775 sf * Measured in CAD from typical section
Concrete & Spalls Width = 96 lf
Concrete & Spalls Depth = 1.75 lf
Concrete & Spalls Length = 4,806 lf
Concrete & Spalls Volume = 29,904 cy

Excavation Volume = **1,176,105 CY**

Excavation Right Bank

Length = 4,806 lf
Cross Section Area* = 266 sf * Measured in CAD from typical section
Concrete & Spalls Width = 96 lf
Concrete & Spalls Depth = 1.75 lf
Concrete & Spalls Length = 4,806 lf
Concrete & Spalls Volume = 29,904 cy

Excavation Volume = **17,510 CY**

Riprap Toe Protection

Length = 4,806 lf
Cross Section Area* = 268 sf * Measured in CAD from typical section

Riprap Volume = **47,642 CY**



PROJECT: **LA River Feasibility**
DETAIL: *Reach 8a Quantity Calculations*
COMPUTED BY: SKV
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REACH 8a - INSTALLATION CALCULATIONS

Page 3 of 3

Fencing

Length = 4,806 lf
No. of Fences = 4 ea

Fencing Length = 19,224 LF

Aggregate Base Layer

Length = 4,806 lf
No. of Roads = 2 ea
Width = 16 ft
Thickness = 0.5 ft

Aggregate Base Volume = 2,848 CY

Asphalt Pavement

Length = 4,806 lf
No. of Roads = 2 ea
Width = 16 ft

Asphalt Area = 17,088 SY

Top Soil

Length = 4,806 lf
Width = 105 ft
Thickness = 0.5 ft

Top Soil Volume = 9,345 CY

Hauling of Material

Excavation Volume = 1,227,281 cy
Compacted Fill Volume = 0 cy

* Measured in CAD from typical section

Volume to be Hauled = 1,227,281 CY



PROJECT: **LA River Feasibility**
DETAIL: *Reach 8b Quantity Calculations*
COMPUTED BY: SKV
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PROJECT NO: T26313
DATE: 10/6/2011

REACH 8b - INSTALLATION CALCULATIONS

Page 1 of 4

Reach Length

Length = 2,734 lf

Total Length = **2,734 LF**

[3] Create geomorphology and plant for freshwater marsh

Riprap Below Vegetation Area

Length = 2,734 lf

Cross Section Area* = **589 sf**

* Measured in CAD from typical section

Riprap Volume = **59,611 CY**

Compacted Fill Inside Vegetation Area

Length Left Bank = 2,734 lf

Fill Area Left Bank* = **300 sf**

* Measured in CAD from typical section

Length Right Bank = 2,734 lf

Fill Area Right Bank* = **300 sf**

* Measured in CAD from typical section

Top Soil Depth = 0.5 lf

Top Soil Width = 100 lf

Compacted Fill Volume = **55,723 CY**

Revegetation

Length = 2,734 lf

Width = **139 ft**

Revegetation Area = **8.7 ACRE**

[16] Bioengineer channel walls

Compacted Fill Planters

Length = 2,734 lf

Cross Section Area* = **136 sf**

* Measured in CAD from typical section

Top Soil Depth = 0.5 lf

Top Soil Width = 39 lf

Compacted Fill Volume = **11,788 CY**

Compacted Fill Retaining Walls

Length = 2,734 lf

Cross Section Area* = **905 sf**

* Measured in CAD from typical section

Sub-Drain Area = 4 sf

Compacted Fill Volume = **91,280 CY**

Concrete Planters

Length = 2,734 lf

Cross Section Area* = **102 sf**

* Measured in CAD from typical section

Concrete Volume = **10,344 CY**



PROJECT: **LA River Feasibility**
DETAIL: *Reach 8b Quantity Calculations*
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REACH 8b - INSTALLATION CALCULATIONS

Page 2 of 4

[26] Terrace banks

Excavation Left Bank

Length = 2,734 lf
Cross Section Area* = 1,213 sf * Measured in CAD from typical section
Concrete & Spalls Width = 96 lf
Concrete & Spalls Depth = 1.75 lf
Concrete & Spalls Length = 2,734 lf
Concrete & Spalls Volume = 17,012 cy

Excavation Volume = **105,864 CY**

Riprap Toe Protection

Length = 1,367 lf
Cross Section Area* = 130 sf * Measured in CAD from typical section

Riprap Volume = **6,579 CY**

[27] Modify trapezoidal channel to vertical sides

Excavation Right Bank

Length = 2,734 lf
Cross Section Area* = 1,412 sf * Measured in CAD from typical section
Concrete & Spalls Width = 96 lf
Concrete & Spalls Depth = 1.75 lf
Concrete & Spalls Length = 2,734 lf
Concrete & Spalls Volume = 17,012 cy

Excavation Volume = **126,003 CY**

Excavation Retaining Wall

Length = 2,734 lf
Cross Section Area* = 1,045 sf * Measured in CAD from typical section

Excavation Volume = **105,803 CY**

Riprap Toe Protection

Length = 1,367 lf
Cross Section Area* = 130 sf * Measured in CAD from typical section

Riprap Volume = **6,579 CY**

Fencing

Length = 2,734 lf
No. of Fences = 4 ea

Fencing Length = **10,936 LF**

Aggregate Base Layer

Length = 2,734 lf
No. of Roads = 2 ea
Width = 16 ft
Thickness = 0.5 ft

Aggregate Base Volume = **1,620 CY**



PROJECT: **LA River Feasibility**
DETAIL: *Reach 8b Quantity Calculations*
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REACH 8b - INSTALLATION CALCULATIONS

Page 3 of 4

Asphalt Pavement

Length = 2,734 lf
No. of Roads = 2 ea
Width = 16 ft

Asphalt Area = **9,721 SY**

Top Soil

Length = 2,734 lf
Width = 139 ft
Thickness = 0.5 ft

Top Soil Volume = **7,038 CY**

[28] Widen channel/cantilever channel bank

Concrete Retaining Walls

Length = 2,734 lf
Cross Section Area* = 139 sf
No. of Walls = 1 ea

* Measured in CAD from typical section

Concrete Volume = **14,118 CY**

Vegetation Retaining Wall Concrete

Length = 2,734 lf
Cross Section Area* = 43 sf
No. of Walls = 4 ea

* Measured in CAD from typical section

Concrete Volume = **17,214 CY**

Concrete Elevated Platforms

Length = 2,734 lf
Width = 25 lf
Thickness = 3 lf
No. of Platforms = 1 ea

Concrete Volume = **7,594 CY**

Concrete Piers

Length = 2,734 lf
Distance Between Piers = 25 lf
No. of Walls = 1 ea
No. of Piers = 110 ea
Cross Section Area* = 132 sf
Pier Thickness = 4 lf

* Measured in CAD from typical section

Concrete Volume = **2,151 CY**

Sub Drainage System

Length = 2,734 lf
No. of Systems = 1 ea

Length of Drainage System = **2,734 LF**



PROJECT: **LA River Feasibility**
DETAIL: *Reach 8b Quantity Calculations*
COMPUTED BY: SKV
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REACH 8b - INSTALLATION CALCULATIONS

Page 4 of 4

Sub Drainage Bedding

Length = 2,734 lf
Width = 2 ft
Height = 2 ft

* Total quantity subtracts pipe volume

Bedding Stone Volume = 326 CY

Sub Drainage Geotextile Wrap

Length = 2,734 lf
Width = 2 ft
Height = 2 ft

Geotextile Wrap Area = 2,430 SY

Sub Drainage Weep Holes

Length = 2,734 lf
Distance Between Holes = 10 ft

Weep Holes = 273 EA

Hauling of Material

Excavation Volume = 337,669 cy
Compacted Fill Volume = 158,791 cy

* Measured in CAD from typical section

Volume to be Hauled = 178,879 CY



PROJECT: **LA River Feasibility**
DETAIL: *Reach 8 Demo Quantity Calculations*
COMPUTED BY: NSS
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/19/2011

REACH 8 - DEMOLITION CALCULATIONS

Page 1 of 3

Reach Length

Length = 7,554 lf

* Station 1232+50 to Station 1156+96.34

8a Length = 5,650 LF
8b Length = 1,904 LF
Total Length = 7,554 LF

[23] Channel bed

Demo Reinforced Concrete Channel Invert

Length 1 = 5,650 lf * XS 8a From Main St. to 101 Fwy (Sta 1232+50 to 1176+00.28)

Width 1 = 160 lf * Average channel width along this reach is 80'

Length 2 = 1,904 lf * XS 8b from 101 Fwy to 1st St. (Sta 1176+00 to 1156+96)

Width 2 = 96 lf * Width scaled off LA River Feasibility Study preliminary drawings (Cr

Thickness = 1.0 ft

8a Concrete Demo Volume = 33,480 CY
8b Concrete Demo Volume = 6,770 CY
Total Concrete Demo Volume = 40,249 CY

Demo 15-Foot-Long Steel Sheet Piles

Length = 180 lf

* Crosses invert latitudinally at Station 1173+01.50

8a Steel Sheet Pile Demo Length = 180 LF
Total Steel Sheet Pile Demo Length = 180 LF

[26] Terrace banks

Demo Reinforced Concrete Channel Slope Paving

Length = 7,554 lf

* Remove slope paving along both banks

Average Width = 47 ft

* $W = 45/\cos(3H:1V)$; Width averaged of as-built drawings

Thickness = 1 ft

8a Concrete Demo Volume = 9,926 CY
8b Concrete Demo Volume = 3,345 CY
Total Concrete Demo Volume = 13,271 CY

Demo Reinforced Concrete Parapet

Length = 7,554 lf

* Along both banks

Height = 3 ft

* From as-built drawing sheet LARI0000115

Thickness = 1.0 ft

* From as-built drawing sheet LARI0000115

8a Concrete Demo Volume = 628 CY
8b Concrete Demo Volume = 212 CY
Total Concrete Demo Volume = 839 CY



PROJECT: **LA River Feasibility**
DETAIL: *Reach 8 Demo Quantity Calculations*
COMPUTED BY: NSS
CHECKED BY: IGP

PROJECT NO: T26313
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REACH 8 - DEMOLITION CALCULATIONS

Page 2 of 3

Remove Spalls Below Concrete Slope Paving

Length 1 = 2,825 lf * XS Section 8a from Main St. to 101 Fwy (Sta 1232+50 to 1176+00)
Width 1 = 255 lf
Length 2 = 952 lf
Width 2 = 191 ft * Width includes 2 banks and two 32' wide sections of invert panels to
Thickness = 0.8 ft

8a Spalls Demo Volume = 19,999 CY
8b Spalls Demo Volume = 5,047 CY
Total Spalls Demo Volume = 25,046 CY

Demo Existing 4-Foot-High Chain-Link Fence

Length = 7,554 lf * Chain-link fences on both banks

8a Chain-Link Fence Length = 5,650 LF
8b Chain-Link Fence Length = 1,904 LF
Total Chain-Link Fence Length = 7,554 LF

Utility Pole Structures to Demo

No. of Structures = 10 ea

8a Utility Pole Structure Demo Number = 4 EA
8b Utility Pole Structure Demo Number = 1 EA
Total Utility Pole Structure Demo Number = 5 EA

[27] Modify trapezoidal channel to vertical sides

Demo Reinforced Concrete Channel Slope Paving

Length = 7,554 lf * Remove slope paving along both banks
Average Width = 47 ft * $W = 45/\cos(3H:1V)$; Width averaged of as-built drawings
Thickness = 1 ft

8a Concrete Demo Volume = 9,926 CY
8b Concrete Demo Volume = 3,345 CY
Total Concrete Demo Volume = 13,271 CY

Demo Reinforced Concrete Parapet

Length = 7,554 lf * Along both banks
Height = 3 ft * From as-built drawing sheet LARI0000115
Thickness = 1.0 ft * From as-built drawing sheet LARI0000115

8a Concrete Demo Volume = 628 CY
8b Concrete Demo Volume = 212 CY
Total Concrete Demo Volume = 839 CY



PROJECT: **LA River Feasibility**
DETAIL: *Reach 8 Demo Quantity Calculations*
COMPUTED BY: NSS
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/19/2011

REACH 8 - DEMOLITION CALCULATIONS

Page 3 of 3

Remove Spalls Below Concrete Slope Paving

Length 1 = 2,825 lf * XS Section 8a from Main St. to 101 Fwy (Sta 1232+50 to 1176+00)
Width 1 = 255 lf
Length 2 = 952 lf
Width 2 = 191 ft * includes the 2 banks and two 32' wide sections of invert panels to be
Thickness = 0.8 ft

8a Spalls Demo Volume = 19,999 CY
8b Spalls Demo Volume = 5,047 CY
Total Spalls Demo Volume = 25,046 CY

Demo Existing 4-Foot-High Chain-Link Fence

Length = 7,554 lf * Chain-link fences on both banks

8a Chain-Link Fence Length = 5,650 LF
8b Chain-Link Fence Length = 1,904 LF
Total Chain-Link Fence Length = 7,554 LF

Utility Pole Structures to Demo

No. of Structures = 5 ea

8a Utility Pole Structure Demo Number = 4 EA
8b Utility Pole Structure Demo Number = 1 EA
Total Utility Pole Structure Demo Number = 5 EA

Hauling of Material

Concrete Volume = 68,469 cy
Concrete Unit Weight = 2 tons/cy
Spalls Volume = 50,092 cy
Spalls Unit Weight = #####

8a Weight of material to be hauled = 163,171 tons
8b Weight of material to be hauled = 41,392 tons
Total Weight of material to be hauled = 204,563 tons



PROJECT: **LA River Feasibility**
DETAIL: *Piggyback Yard Quantity Calculations*
COMPUTED BY: NSS
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/14/2011

REACH 8 - PIGGYBACK YARD QUANTITY CALCULATIONS

Page 1 of 2

[06] Rebuild Geomorphology for Historic Wash

Side Channel Excavation

Length = 3,100 LF
Depth = 10 LF
Top Width = 300 LF
Side Slopes = 5H:1V
Base Width = 200 LF

Excavation Volume = **287,037 CY**

Riprap Toe Protection

Length = 3,100 LF
Cross Sectional Area = 142 sf * Measured in CAD from typical section
of Sides = 2 ea

Riprap Volume = **32,523 CY**

[10] Divert Tributary and River Flow Into Side Channels

North Channel Excavation

Length = 3,200 LF
Depth = 5 LF
Top Width = 50 LF
Side Slopes = 3H:1V
Base Width = 20 LF

Excavation Volume = **20,741 CY**

South Channel Excavation

Length = 4,500 LF
Depth = 5 LF
Top Width = 50 LF
Side Slopes = 3H:1V
Base Width = 20 LF

Excavation Volume = **29,167 CY**

Riprap Toe Protection

Length = 7,700 LF
Cross Sectional Area = 148 sf * Measured in CAD from typical section
of Sides = 2 ea

Riprap Volume = **84,586 CY**



PROJECT: **LA River Feasibility**
DETAIL: *Piggyback Yard Quantity Calculations*
COMPUTED BY: NSS
CHECKED BY: IGP

PROJECT NO: T26313
DATE: 10/14/2011

REACH 8 - PIGGYBACK YARD QUANTITY CALCULATIONS

Page 2 of 2

Side Channel/Wetland Excavation

Length = 1,700 LF
Depth 1 = 7 LF
Top Width 1 = 72 LF
Side Slopes 1 = 3H:1V
Base Width 1 = 30 LF
Depth 2 = 3 LF
Top Width 2 = 300 LF
Side Slopes 2 = 5H:1V
Base Width 2 = 270 LF

Excavation Volume = 76,311 CY

Side Channel/Wetland Riprap Toe Protection

Length = 1,700 LF
Cross Sectional Area = 148 sf * Measured in CAD from typical section
of Sides = 2 ea

Riprap Volume = 18,675 CY

Input and Output Channel Excavation

Length = 2,200 LF
Depth 1 = 5 LF
Top Width 1 = 50 LF
Side Slopes 1 = 3H:1V
Base Width 1 = 20 LF

Excavation Volume = 14,259 CY

Riprap Toe Protection

Length = 2,200 LF
Cross Sectional Area = 148 sf * Measured in CAD from typical section
of Sides = 2 ea

Riprap Volume = 24,168 CY

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**US Army Corps
of Engineers®**
Los Angeles District

Los Angeles River Ecosystem Restoration Feasibility Study

Cost Appendix

Attachment 3 Spreadsheet Estimates

August 2013

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**LOS ANGELES RIVER FEASIBILITY
REACH 1**

Page: 1 of 2
Date: 24-Apr-13

CONSTRUCTION COSTS

MEASURE	MEASURE / ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	TOTAL COST
MOB	<u>Mobilization / Demobilization (7.5% of Construction Cost)</u>				\$ 13,840,408
2	<u>Expose Storm Drain Outlets</u>				\$ 300,000
	.01 Storm Drain Daylighting	EA	3	\$ 100,000.00	\$ 300,000
3	<u>Create Geomorphology and Plant Freshwater Marsh</u>				\$ 3,602,720
	.01 Excavation Grade Control - Limited Haul Off	CY	49,602	\$ 7.00	\$ 347,216
	.02 Grouted Riprap	CY	17,214	\$ 165.00	\$ 2,840,270
	.03 Compacted Fill - No Borrow	CY	43,709	\$ 9.50	\$ 415,234
7	<u>Create Underground Basins for Attenuation</u>				\$ 113,400,000
	.01 Underground Basins	CF	18,900,000	\$ 6.00	\$ 113,400,000
10	<u>Divert Tributary & River Flow Into Side Channels (A, B, & C)</u>				\$ 17,771,927
	.01 Excavation Grade Control - All Haul Off	CY	226,588	\$ 28.50	\$ 6,457,757
	.02 Excavation Embankment - All Haul Off	CY	14,907	\$ 27.25	\$ 406,227
	.03 Riprap	CY	108,479	\$ 100.00	\$ 10,847,944
	.04 Grading	SY	60,000	\$ 1.00	\$ 60,000
16	<u>Bioengineer Channel Walls</u>				\$ 2,703,283
	.01 Pyramat Turf Reinforcement Mat	SY	67,628	\$ 34.50	\$ 2,333,158
	.02 Rock at Pyramat Tie-In	CY	5,483	\$ 67.50	\$ 370,125
17	<u>Habitat Corridors/Riparian Planting on Banks</u>				\$ 1,460,173
	.01 Topsoil	CY	24,980	\$ 38.00	\$ 949,226
	.02 Vegetation	ACRE	31.0	\$ 16,500.00	\$ 510,947
23	<u>Channel Bed</u>				\$ 16,707,980
	.01 Concrete Demolition	CY	40,824	\$ 400.00	\$ 16,329,630
	.02 Subdrainage System Demolition	LF	32,900	\$ 11.50	\$ 378,350
25	<u>Tributary Channels - Burbank Channel</u>				\$ 6,767,099
	.01 Concrete Demolition	CY	1,691	\$ 400.00	\$ 676,278
	.02 Subdrainage System Demolition	LF	1,645	\$ 11.50	\$ 18,918
	.03 Chain Link Fence Demolition	LF	1,645	\$ 5.00	\$ 8,225
	.04 Clearing and Grubbing	ACRE	4.6	\$ 4,000.00	\$ 18,365
	.05 Excavation Embankment - All Haul Off	CY	133,112	\$ 27.25	\$ 3,627,290
	.06 Riprap	CY	14,425	\$ 100.00	\$ 1,442,543
	.07 Pyramat Turf Reinforcement Mat	SY	15,536	\$ 34.50	\$ 535,996
	.08 Rock at Pyramat Tie-In	CY	548	\$ 67.50	\$ 37,013
	.09 6' Chain Link Fence	LF	3,290	\$ 30.00	\$ 98,700
	.10 Aggregate Base Course	CY	487	\$ 67.50	\$ 32,900

**LOS ANGELES RIVER FEASIBILITY
REACH 1**

Page: 2 of 2
Date: 24-Apr-13

CONSTRUCTION COSTS

MEASURE	MEASURE / ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	TOTAL COST
	.11 Asphalt Pavement	SY	2,924	\$ 50.00	\$ 146,222
	.12 Topsoil	CY	2,132	\$ 38.00	\$ 81,031
	.13 Vegetation	ACRE	2.6	\$ 16,500.00	\$ 43,617
26	<u>Terrace Banks</u>				\$ 20,888,649
	.01 Concrete Demolition	CY	8,869	\$ 400.00	\$ 3,547,778
	.02 Chain Link Fence Demolition	LF	16,450	\$ 5.00	\$ 82,250
	.03 Asphalt Demolition	CY	741	\$ 270.00	\$ 200,000
	.04 Clearing and Grubbing	ACRE	17	\$ 4,000.00	\$ 67,975
	.05 Utility Pole Relocation	EA	10	\$ 85,000.00	\$ 850,000
	.06 Excavation Embankment - Medium Haul Off	CY	146,356	\$ 14.75	\$ 2,158,755
	.07 Riprap	CY	92,912	\$ 100.00	\$ 9,291,204
	.08 Compacted Fill - Medium Borrow Material	CY	88,952	\$ 21.50	\$ 1,912,465
	.09 6' Chain Link Fence	LF	32,900	\$ 30.00	\$ 987,000
	.10 Aggregate Base Course	CY	4,874	\$ 67.50	\$ 329,000
	.11 Asphalt Pavement	SY	29,244	\$ 50.00	\$ 1,462,222
27	<u>Modify Trapezoidal Channel to Vertical Sides</u>				\$ 936,944
	.01 Concrete Demolition	CY	2,342	\$ 400.00	\$ 936,944

Note: Not reflective of E&D, S&A, or contingency.

Construction Cost:	\$	198,379,183
Reach Length (LF):		8,225
Cost per LF:	\$	24,119

**LOS ANGELES RIVER FEASIBILITY
REACH 2**

Page: 1 of 2
Date: 24-Apr-13

CONSTRUCTION COSTS

MEASURE	MEASURE / ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	TOTAL COST
MOB	<u>Mobilization / Demobilization (7.5% of Construction Cost)</u>			\$	3,694,944
2	<u>Expose Storm Drain Outlets</u>			\$	300,000
	.01 Storm Drain Daylighting	EA	3	\$ 100,000.00	\$ 300,000
3	<u>Create Geomorphology and Plant Freshwater Marsh</u>			\$	3,332,465
	.01 Excavation Grade Control - Limited Haul Off	CY	52,519	\$ 7.00	\$ 367,630
	.02 Grouted Riprap	CY	15,691	\$ 165.00	\$ 2,589,058
	.03 Compacted Fill - No Borrow	CY	39,556	\$ 9.50	\$ 375,778
9	<u>Culverts or Underground Basins</u>			\$	10,530,000
	.01 Underground Basins	CF	1,755,000	\$ 6.00	\$ 10,530,000
10	<u>Divert Tributary & River Flow Into Side Channels (D)</u>			\$	3,959,245
	.01 Excavation Embankment - All Haul Off	CY	30,000	\$ 27.25	\$ 817,500
	.02 Riprap	CY	29,660	\$ 100.00	\$ 2,966,020
	.03 Subdrainage System	LF	3,300	\$ 53.25	\$ 175,725
16	<u>Bioengineer Channel Walls</u>			\$	935,263
	.01 Pyramat Turf Reinforcement Mat	SY	24,618	\$ 34.50	\$ 849,313
	.02 Rock at Pyramat Tie-In	CY	1,273	\$ 67.50	\$ 85,950
17	<u>Habitat Corridors/Riparian Planting on Banks</u>			\$	41,962
	.01 Vegetation	ACRE	2.5	\$ 16,500.00	\$ 41,962
23	<u>Channel Bed</u>			\$	1,381,401
	.01 Concrete Demolition	CY	2,200	\$ 400.00	\$ 880,000
	.02 Grouted Riprap Demolition	CY	3,992	\$ 80.00	\$ 319,387
	.03 Riprap Demolition	CY	2,889	\$ 57.75	\$ 166,833
	.04 Subdrainage System Demolition	LF	1,320	\$ 11.50	\$ 15,180
26	<u>Terrace Banks</u>			\$	5,356,628
	.01 Concrete Demolition	CY	1,839	\$ 400.00	\$ 735,501
	.02 Grouted Riprap Demolition	CY	7,110	\$ 80.00	\$ 568,800
	.03 Riprap Demolition	CY	6,018	\$ 57.75	\$ 347,555
	.04 Remove Spalls	CY	6,712	\$ 19.00	\$ 127,520
	.05 Sheet Pile Wall Demolition	LF	1,005	\$ 80.00	\$ 80,400
	.06 Clearing and Grubbing	ACRE	7	\$ 4,000.00	\$ 28,065
	.07 Excavation Embankment - Med. Haul Off	CY	231,345	\$ 14.75	\$ 3,412,336
	.08 Topsoil	CY	1,486	\$ 38.00	\$ 56,451
27	<u>Modify Trapezoidal Channel to Vertical Sides</u>			\$	23,428,962
	.01 Concrete Demolition	CY	1,297	\$ 400.00	\$ 518,852

**LOS ANGELES RIVER FEASIBILITY
REACH 2**

Page: 2 of 2
Date: 24-Apr-13

CONSTRUCTION COSTS

MEASURE	MEASURE / ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	TOTAL COST
.02	Grouted Riprap Demolition	CY	7,652	\$ 80.00	\$ 612,130
.03	Riprap Demolition	CY	5,401	\$ 57.75	\$ 311,901
.04	Remove Spalls	CY	6,712	\$ 19.00	\$ 127,520
.05	Sheet Pile Wall Demolition	LF	1,760	\$ 80.00	\$ 140,790
.06	Chain Link Fence Demolition	LF	7,641	\$ 5.00	\$ 38,204
.07	Asphalt Demolition	CY	1,132	\$ 270.00	\$ 305,632
.08	Utility Pole Relocation	LF	5	\$ 85,000.00	\$ 425,000
.09	Riprap	CY	42,020	\$ 100.00	\$ 4,202,000
.10	Compacted Fill - No Borrow Material	CY	67,932	\$ 9.50	\$ 645,357
.11	Reinforced Concrete Retaining Wall	CY	12,592	\$ 1,150.00	\$ 14,480,630
.12	Retaining Wall Gravel	CY	1,307	\$ 67.50	\$ 88,242
.13	6' Chain Link Fence	LF	15,280	\$ 30.00	\$ 458,400
.14	Aggregate Base Course	CY	2,264	\$ 67.50	\$ 152,800
.15	Asphalt Pavement	SY	13,582	\$ 50.00	\$ 679,111
.16	Topsoil	CY	1,026	\$ 38.00	\$ 38,978
.17	Subdrainage System	LF	3,820	\$ 53.25	\$ 203,415

Note: Not reflective of E&D, S&A, or contingency.

Construction Cost:	\$	52,960,871
Reach Length (LF):		3,820
Cost per LF:	\$	13,864

**LOS ANGELES RIVER FEASIBILITY
REACH 3**

Page: 1 of 2
Date: 24-Apr-13

CONSTRUCTION COSTS

MEASURE	MEASURE / ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	TOTAL COST
MOB	<u>Mobilization / Demobilization (7.5% of Construction Cost)</u>			\$	16,182,731
2	<u>Expose Storm Drain Outlets</u>			\$	600,000
	.01 Storm Drain Daylighting	EA	6	\$ 100,000.00	\$ 600,000
3	<u>Create Geomorphology and Plant for Freshwater Marsh</u>			\$	8,030,949
	.01 Riprap	CY	73,217	\$ 100.00	\$ 7,321,684
	.02 Compacted Fill - No Borrow Material	CY	74,660	\$ 9.50	\$ 709,266
9	<u>Culverts or Underground Basins</u>			\$	75,600,000
	.01 Underground Basins	CF	12,600,000	\$ 6.00	\$ 75,600,000
10	<u>Divert Tributary & River Flow Into Side Channels (E)</u>			\$	6,239,813
	.01 Excavation Embankment - Med. Haul Off	CY	117,685	\$ 14.75	\$ 1,735,856
	.02 Riprap	CY	45,040	\$ 100.00	\$ 4,503,956
17	<u>Habitat Corridors/Riparian Planting on Banks</u>			\$	134,979
	.01 Vegetation	ACRE	8.2	\$ 16,500.00	\$ 134,979
23	<u>Channel Bed</u>			\$	6,339,819
	.01 Concrete Demolition	CY	15,548	\$ 400.00	\$ 6,219,129
	.02 Subdrainage System Demolition	LF	10,495	\$ 11.50	\$ 120,690
25	<u>Tribuary Channels - Verdugo Wash</u>			\$	47,584,437
	.01 Concrete Demolition	CY	2,583	\$ 400.00	\$ 1,033,333
	.02 Subdrainage System Demolition	LF	1,860	\$ 11.50	\$ 21,390
	.03 Chain Link Fence Demolition	LF	1,860	\$ 5.00	\$ 9,300
	.04 Excavation Embankment - All Haul Off	CY	1,524,592	\$ 27.25	\$ 41,545,138
	.05 Riprap	CY	27,588	\$ 100.00	\$ 2,758,778
	.06 Pyramat Turf Reinforcement Mat	SY	38,222	\$ 34.50	\$ 1,318,667
	.07 Rock at Pyramat Tie-In	CY	1,000	\$ 67.50	\$ 67,500
	.08 6' Chain Link Fence	LF	6,000	\$ 30.00	\$ 180,000
	.09 Aggregate Base Course	CY	889	\$ 67.50	\$ 60,000
	.10 Asphalt Pavement	SY	5,333	\$ 50.00	\$ 266,667
	.11 Topsoil	CY	5,537	\$ 38.00	\$ 210,407
	.12 Vegetation	ACRE	6.9	\$ 16,500.00	\$ 113,258
27	<u>Modify Trapezoidal Channel to Vertical Sides</u>			\$	71,239,755
	.01 Concrete Demolition	CY	12,802	\$ 400.00	\$ 5,120,846
	.02 Grouted Riprap Demolition	CY	3,508	\$ 80.00	\$ 280,634
	.03 Remove Spalls	CY	11,797	\$ 19.00	\$ 224,144
	.04 Chain Link Fence Demolition	LF	10,495	\$ 5.00	\$ 52,474

**LOS ANGELES RIVER FEASIBILITY
REACH 3**

Page: 2 of 2
Date: 24-Apr-13

CONSTRUCTION COSTS

MEASURE	MEASURE / ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	TOTAL COST
.05	Asphalt Demolition	CY	1,555	\$ 270.00	\$ 419,791
.06	Clearing and Grubbing	ACRE	2.4	\$ 4,000.00	\$ 9,637
.07	Utility Pole Relocation	EA	7	\$ 85,000.00	\$ 595,000
.08	Excavation Embankment - Med. Haul Off	CY	448,083	\$ 14.75	\$ 6,609,217
.09	Riprap	CY	37,163	\$ 100.00	\$ 3,716,283
.10	Compacted Fill - No Borrow Material	CY	162,663	\$ 9.50	\$ 1,545,295
.11	Reinforced Concrete Retaining Wall	CY	43,592	\$ 1,150.00	\$ 50,130,587
.12	Retaining Wall Gravel	CY	2,298	\$ 67.50	\$ 155,140
.13	6' Chain Link Fence	LF	20,988	\$ 30.00	\$ 629,640
.14	Aggregate Base Course	CY	3,109	\$ 67.50	\$ 209,880
.15	Asphalt Pavement	SY	18,656	\$ 50.00	\$ 932,800
.16	Topsoil	CY	6,599	\$ 38.00	\$ 250,761
.17	Subdrainage System	LF	6,716	\$ 53.25	\$ 357,627

Note: Not reflective of E&D, S&A, or contingency.

Construction Cost:	\$	231,952,484
Reach Length (LF):		5,247
Cost per LF:	\$	44,207

**LOS ANGELES RIVER FEASIBILITY
REACH 4**

Page: 1 of 2
Date: 24-Apr-13

CONSTRUCTION COSTS

MEASURE	MEASURE / ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	TOTAL COST
MOB	<u>Mobilization / Demobilization (7.5% of Construction Cost)</u>			\$	30,304,227
2	<u>Expose Storm Drain Outlets</u>			\$	900,000
	.01 Storm Drain Daylighting	EA	9	\$ 100,000.00	\$ 900,000
3	<u>Create Geomorphology and Plant for Freshwater Marsh</u>			\$	5,677,607
	.01 Excavation Grade Control - Limited Haul Off	CY	89,807	\$ 7.00	\$ 628,647
	.02 Grouted Riprap	CY	26,705	\$ 165.00	\$ 4,406,380
	.03 Compacted Fill - No Borrow Material	CY	67,640	\$ 9.50	\$ 642,580
4	<u>Grade Adjacent Areas to Lower Elevation (G)</u>			\$	1,978,350
	.01 Excavation Embankment - All Haul Off	CY	72,600	\$ 27.25	\$ 1,978,350
9	<u>Culverts or Underground Basins</u>			\$	265,680,000
	.01 Underground Basins	CF	44,280,000	\$ 6.00	\$ 265,680,000
10	<u>Divert Tributary & River Flow Into Side Channels (F)</u>			\$	5,290,413
	.01 Excavation Embankment - All Haul Off	CY	61,111	\$ 27.25	\$ 1,665,278
	.02 Riprap	CY	36,251	\$ 100.00	\$ 3,625,136
16	<u>Bioengineer Channel Walls</u>			\$	501,406
	.01 Vegetation	ACRE	30.4	\$ 16,500.00	\$ 501,406
22	<u>Channel Banks Mainstem/Widen Channel</u>			\$	9,229,949
	.01 Concrete Demolition	CY	5,323	\$ 400.00	\$ 2,129,262
	.02 Grouted Riprap Demolition	CY	42,541	\$ 80.00	\$ 3,403,262
	.03 Riprap Demolition	CY	24,946	\$ 57.75	\$ 1,440,634
	.04 Remove Spalls	CY	31,426	\$ 19.00	\$ 597,091
	.05 Sheet Pile Wall Demolition	LF	4,421	\$ 80.00	\$ 353,645
	.06 Chain Link Fence Demolition	LF	18,673	\$ 5.00	\$ 93,367
	.07 Asphalt Demolition	CY	2,766	\$ 270.00	\$ 746,937
	.08 Topsoil	CY	12,257	\$ 38.00	\$ 465,751
23	<u>Channel Bed</u>			\$	1,157,000
	.01 Grouted Riprap Demolition	CY	4,944	\$ 80.00	\$ 395,556
	.02 Riprap Demolition	CY	13,185	\$ 57.75	\$ 761,444
26	<u>Terrace Banks</u>			\$	113,641,639
	.01 Excavation Emankment - Limited Haul Off	CY	220,564	\$ 6.00	\$ 1,323,384
	.02 Riprap	CY	115,941	\$ 100.00	\$ 11,594,074
	.03 Compacted Fill - No Borrow Material	CY	193,124	\$ 9.50	\$ 1,834,679
	.04 Reinforced Concrete Planters	CY	119,253	\$ 800.00	\$ 95,402,667
	.05 6' Chain Link Fence	LF	35,776	\$ 30.00	\$ 1,073,280

LOS ANGELES RIVER FEASIBILITY
REACH 4

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CONSTRUCTION COSTS

MEASURE	MEASURE / ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	TOTAL COST
.06	Aggregate Base Course	CY	5,300	\$ 67.50	\$ 357,760
.07	Asphalt Pavement	SY	31,801	\$ 50.00	\$ 1,590,044
.08	Topsoil	CY	12,257	\$ 38.00	\$ 465,751

Note: Not reflective of E&D, S&A, or contingency.

Construction Cost:	\$	434,360,591
Reach Length (LF):		9,337
Cost per LF:	\$	46,520

**LOS ANGELES RIVER FEASIBILITY
REACH 5**

Page: 1 of 2
Date: 24-Apr-13

CONSTRUCTION COSTS

MEASURE	MEASURE / ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	TOTAL COST
MOB	<u>Mobilization / Demobilization (7.5% of Construction Cost)</u>			\$	6,555,137
2	<u>Expose Storm Drain Outlets</u>			\$	100,000
	.01 Storm Drain Daylighting	EA	1	\$ 100,000.00	\$ 100,000
16	<u>Bioengineer Channel Walls</u>			\$	149,250
	.01 Vegetation	ACRE	9.0	\$ 16,500.00	\$ 149,250
26	<u>Terrace Banks</u>			\$	31,784,946
	.01 Concrete Demolition	CY	4,057	\$ 400.00	\$ 1,622,833
	.02 Grouted Riprap Demolition	CY	21,682	\$ 80.00	\$ 1,734,544
	.03 Riprap Demolition	CY	3,056	\$ 57.75	\$ 176,458
	.04 Remove Spalls	CY	36,483	\$ 19.00	\$ 693,183
	.05 Sheet Pile Wall Demolition	LF	1,990	\$ 80.00	\$ 159,234
	.06 Chain Link Fence Demolition	LF	8,756	\$ 5.00	\$ 43,779
	.07 Asphalt Demolition	CY	1,297	\$ 270.00	\$ 350,231
	.08 Excavation Embankment - All Haul Off	CY	94,065	\$ 27.25	\$ 2,563,282
	.09 Reinforced Concrete Planters	CY	29,187	\$ 800.00	\$ 23,349,333
	.10 Aggregate Base Course	CY	2,594	\$ 67.50	\$ 175,120
	.11 Asphalt Pavement	SY	15,566	\$ 50.00	\$ 778,311
	.12 Topsoil	CY	3,648	\$ 38.00	\$ 138,637
27	<u>Modify Trapezoidal Channel to Vertical Sides</u>			\$	55,367,624
	.01 Concrete Demolition	CY	21,171	\$ 400.00	\$ 8,468,522
	.02 Grouted Riprap Demolition	CY	5,599	\$ 80.00	\$ 447,901
	.03 Riprap Demolition	CY	2,110	\$ 57.75	\$ 121,871
	.04 Remove Spalls	CY	18,242	\$ 19.00	\$ 346,592
	.05 Sheet Pile Wall Demolition	LF	6,854	\$ 80.00	\$ 548,311
	.06 Chain Link Fence Demolition	LF	8,756	\$ 5.00	\$ 43,779
	.07 Asphalt Demolition	CY	1,297	\$ 270.00	\$ 350,231
	.08 Excavation Embankment - Med. Haul Off	CY	422,289	\$ 14.75	\$ 6,228,761
	.09 Riprap	CY	110,656	\$ 100.00	\$ 11,065,638
	.10 Compacted Fill - No Borrow Material	CY	195,830	\$ 9.50	\$ 1,860,381
	.11 Reinforced Concrete Planters	CY	28,843	\$ 800.00	\$ 23,074,330
	.12 Retaining Wall Gravel	CY	2,996	\$ 67.50	\$ 202,264
	.13 6' Chain Link Fence	LF	35,024	\$ 30.00	\$ 1,050,720
	.14 Aggregate Base Course	CY	2,594	\$ 67.50	\$ 175,120
	.15 Asphalt Pavement	SY	15,566	\$ 50.00	\$ 778,311

LOS ANGELES RIVER FEASIBILITY
REACH 5

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Date: 24-Apr-13

CONSTRUCTION COSTS

MEASURE	MEASURE / ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	TOTAL COST
.16	Topsoil	CY	3,648	\$ 38.00	\$ 138,637
.17	Subdrainage System	LF	8,756	\$ 53.25	\$ 466,257
Note: Not reflective of E&D, S&A, or contingency.				Construction Cost: \$	93,956,957
				Reach Length (LF):	8,756
				Cost per LF: \$	10,731

**LOS ANGELES RIVER FEASIBILITY
REACH 6**

Page: 1 of 2
Date: 24-Apr-13

CONSTRUCTION COSTS

ITEM #	ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	TOTAL COST
MOB	<u>Mobilization / Demobilization (7.5% of Construction Cost)</u>			\$	7,645,290.74
2	<u>Expose Storm Drain Outlets</u>			\$	100,000
	.01 Storm Drain Daylighting	EA	1	\$ 100,000.00	\$ 100,000
4	<u>Grade adjacent areas to lower elevation</u>			\$	27,324,195
	.01 Concrete Demolition	CY	11,663	\$ 400.00	\$ 4,665,339
	.02 Grouted Riprap Demolition	CY	11,635	\$ 80.00	\$ 930,797
	.03 Riprap Demolition	CY	11,213	\$ 57.75	\$ 647,555
	.04 Remove Spalls	CY	13,723	\$ 19.00	\$ 260,738
	.05 Sheet Pile Wall Demolition	LF	4,562	\$ 80.00	\$ 364,984
	.06 Chain Link Fence Demolition	LF	6,976	\$ 5.00	\$ 34,880
	.07 Asphalt Demolition	CY	1,033	\$ 270.00	\$ 279,040
	.08 Utility Pole Relocaion	EA	4	\$ 85,000.00	\$ 340,000
	.09 Excavation Embankment - Med. Haul Off	CY	946,521	\$ 14.75	\$ 13,961,190
	.10 Riprap	CY	49,123	\$ 100.00	\$ 4,912,258
	.11 Compacted Fill - No Borrow Material	CY	4,495	\$ 9.50	\$ 42,704
	.12 Aggregate Base Course	CY	1,806	\$ 67.50	\$ 121,920
	.13 Asphalt Pavement	SY	10,837	\$ 50.00	\$ 541,867
	.14 Topsoil	CY	5,814	\$ 38.00	\$ 220,924
9	<u>Culverts or Underground Basins</u>			\$	14,580,000
	.01 Underground Basins	CF	2,430,000	\$ 6.00	\$ 14,580,000
16	<u>Bioengineer channel walls</u>			\$	7,958,437
	.01 Pyramat Turf Reinforcement Mat	SY	203,450	\$ 34.50	\$ 7,019,017
	.02 Rock at Pyramat Tie-In	CY	8,499	\$ 67.50	\$ 573,660
	.03 6' Chain Link Fence	LF	12,192	\$ 30.00	\$ 365,760
17	<u>Habitat corridors/Riparian planting on banks</u>			\$	924,768
	.01 Vegetation	ACRE	56.0	\$ 16,500.00	\$ 924,768
19	<u>Bioengineer channel walls</u>			\$	1,901,667
	.01 Pyramat Turf Reinforcement Mat	SY	50,556	\$ 34.50	\$ 1,744,167
	.02 Rock at Pyramat Tie-In	CY	2,333	\$ 67.50	\$ 157,500
21	<u>Lower channel banks and provide setback levees or berms</u>			\$	7,615,328
	.01 Excavation Embankment - Med. Haul Off	CY	436,143	\$ 14.75	\$ 6,433,106
	.02 6' Chain Link Fence	LF	14,000	\$ 30.00	\$ 420,000
	.03 Aggregate Base Course	CY	2,074	\$ 67.50	\$ 140,000
	.04 Asphalt Pavement	SY	12,444	\$ 50.00	\$ 622,222

**LOS ANGELES RIVER FEASIBILITY
REACH 6**

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Date: 24-Apr-13

CONSTRUCTION COSTS

ITEM #	ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	TOTAL COST
26	<u>Terrace Banks</u>				\$ 41,532,815
.01	Concrete Demolition	CY	26,556	\$ 400.00	\$ 10,622,283
.02	Grouted Riprap Demolition	CY	31,348	\$ 80.00	\$ 2,507,874
.03	Riprap Demolition	CY	29,769	\$ 57.75	\$ 1,719,140
.04	Remove Spalls	CY	36,432	\$ 19.00	\$ 692,211
.05	Sheet Pile Wall Demolition	LF	8,824	\$ 80.00	\$ 705,884
.06	Chain Link Fence Demolition	LF	18,520	\$ 5.00	\$ 92,600
.07	Asphalt Demolition	CY	2,744	\$ 270.00	\$ 740,800
.08	Utility Pole Relocation	EA	4	\$ 85,000.00	\$ 340,000
.09	Excavation Embankment - Med. Haul Off	CY	80,436	\$ 14.75	\$ 1,186,430
.10	Riprap	CY	175,491	\$ 100.00	\$ 17,549,090
.11	Compacted Fill - No Borrow Material	CY	40,215	\$ 9.50	\$ 382,045
.12	6' Chain Link Fence	LF	38,800	\$ 30.00	\$ 1,164,000
.13	Aggregate Base Course	CY	5,748	\$ 67.50	\$ 388,000
.14	Asphalt Pavement	SY	34,489	\$ 50.00	\$ 1,724,444
.15	Topsoil	CY	45,211	\$ 38.00	\$ 1,718,013

Note: Not reflective of E&D, S&A, or contingency.

Construction Cost:	\$	109,582,501
Reach Length (LF):		12,748
Cost per LF:	\$	8,596

**LOS ANGELES RIVER FEASIBILITY
REACH 7**

Page: 1 of 2
Date: 24-Apr-13

CONSTRUCTION COSTS

MEASURE	MEASURE / ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	TOTAL COST
MOB	<u>Mobilization / Demobilization (7.5% of Construction Cost)</u>			\$	12,560,232
1	<u>Elevate Railroads on Trestles</u>			\$	5,000,000
	.01 Railroad Trestle	LF	1,000	\$ 5,000.00	\$ 5,000,000
2	<u>Expose Storm Drain Outlets</u>			\$	300,000
	.01 Storm Drain Daylighting	EA	3	\$ 100,000.00	\$ 300,000
3	<u>Create geomorphology and plant for freshwater marsh</u>			\$	42,681,863
	.01 Riprap	CY	96,002	\$ 100.00	\$ 9,600,171
	.02 Compacted Fill - No Borrow Material	CY	88,394	\$ 9.50	\$ 839,746
	.03 Reinforced Concrete Retaining Wall	CY	27,723	\$ 1,150.00	\$ 31,880,981
	.04 Topsoil	CY	9,499	\$ 38.00	\$ 360,964
8	<u>Creation of Wetlands Flood Control Basin (Corn Field)</u>			\$	3,775,759
	.01 Excavation Embankment - All Haul Off	CY	111,208	\$ 27.25	\$ 3,030,422
	.02 Impermeable Liner	SY	21,556	\$ 17.00	\$ 366,444
	.03 6' Chain Link Fence	LF	2,000	\$ 30.00	\$ 60,000
	.04 Aggregate Base Course	CY	296	\$ 67.50	\$ 20,000
	.05 Asphalt Pavement	SY	1,778	\$ 50.00	\$ 88,889
	.06 Topsoil	CY	3,593	\$ 38.00	\$ 136,519
	.07 Vegetation	ACRE	4.5	\$ 16,500.00	\$ 73,485
17	<u>Habitat corridors/Riparian planting on banks</u>			\$	194,299
	.01 Vegetation	ACRE	11.8	\$ 16,500.00	\$ 194,299
21	<u>Lower channel banks and provide setback levees or berms</u>			\$	20,967,364
	.01 Excavation Embankment - Med. Haul Off	CY	753,906	\$ 14.75	\$ 11,120,115
	.02 6' Chain Link Fence	LF	17,612	\$ 30.00	\$ 528,360
	.03 Aggregate Base Course	CY	2,609	\$ 67.50	\$ 176,120
	.04 Asphalt Pavement	SY	15,655	\$ 50.00	\$ 782,756
	.05 Concrete Demolition	CY	16,674	\$ 400.00	\$ 6,669,668
	.06 Remove Spalls	CY	19,723	\$ 19.00	\$ 374,745
	.07 Chain Link Fence Demolition	LF	8,120	\$ 5.00	\$ 40,600
	.08 Utility Pole Relocation	EA	15	\$ 85,000.00	\$ 1,275,000
23	<u>Channel Bed</u>			\$	3,849,481
	.01 Concrete Demolition	CY	9,624	\$ 400.00	\$ 3,849,481
27	<u>Tributary Channels/Widen Channel (Arroyo Seco)</u>			\$	2,660,707
	.01 Concrete Demolition	CY	370	\$ 400.00	\$ 148,148
	.02 Chain Link Fence Demolition	LF	300	\$ 5.00	\$ 1,500

**LOS ANGELES RIVER FEASIBILITY
REACH 7**

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Date: 24-Apr-13

CONSTRUCTION COSTS

MEASURE	MEASURE / ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	TOTAL COST
	.03 Excavation Embankment - All Haul Off	CY	53,217	\$ 27.25	\$ 1,450,154
	.04 Pyramat Turf Reinforcement Mat	SY	19,879	\$ 34.50	\$ 685,822
	.05 Rock at Pyramat Tie-In	CY	667	\$ 67.50	\$ 45,000
	.06 6' Chain Link Fence	LF	2,000	\$ 30.00	\$ 60,000
	.07 Aggregate Base Course	CY	296	\$ 67.50	\$ 20,000
	.08 Asphalt Pavement	SY	1,778	\$ 50.00	\$ 88,889
	.09 Top Soil	CY	2,758	\$ 38.00	\$ 104,789
	.10 Vegetation	ACRE	3.4	\$ 16,500.00	\$ 56,405
28	<u>Widen channel/cantilever channel bank</u>			\$	88,040,283
	.01 Compacted Fill - No Borrow Material	CY	326,096	\$ 9.50	\$ 3,097,912
	.02 Reinforced Concrete Retaining Wall	CY	45,661	\$ 1,150.00	\$ 52,509,852
	.03 Reinforced Concrete Elevated Slab	CY	24,461	\$ 1,050.00	\$ 25,684,167
	.04 Reinforced Concrete Slab	CY	1,957	\$ 475.00	\$ 929,522
	.05 Reinforced Concrete Piers	CY	6,903	\$ 775.00	\$ 5,349,911
	.06 Subdrainage System	LF	8,806	\$ 53.25	\$ 468,920

Note: Not reflective of E&D, S&A, or contingency.

Construction Cost:	\$	180,029,987
Reach Length (LF):		4,403
Cost per LF:	\$	40,888

**LOS ANGELES RIVER FEASIBILITY
REACH 8**

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Date: 24-Apr-13

CONSTRUCTION COSTS

MEASURE	MEASURE / ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	TOTAL COST
MOB	<u>Mobilization / Demobilization (7.5% of Construction Cost)</u>			\$	27,545,045
1	<u>Railroad trestle</u>			\$	24,030,000
	.01 Railroad Trestle	LF	4,806	\$ 5,000.00	\$ 24,030,000
2	<u>Expose Storm Drain Outlets</u>			\$	200,000
	.01 Storm Drain Daylighting	EA	2	\$ 100,000.00	\$ 200,000
3	<u>Create geomorphology and plant for freshwater marsh</u>			\$	9,516,383
	.01 Excavation Grade Control - All Haul Off	CY	33,667	\$ 28.50	\$ 959,500
	.02 Grouted Riprap	CY	11,651	\$ 165.00	\$ 1,922,433
	.03 Riprap	CY	59,611	\$ 100.00	\$ 5,961,133
	.04 Compacted Fill - No Borrow Material	CY	55,723	\$ 9.50	\$ 529,368
	.05 Vegetation	ACRE	8.7	\$ 16,500.00	\$ 143,949
6	<u>Rebuild Geomorphology for Historic Wash (Piggyback Yard)</u>			\$	11,074,093
	.01 Excavation Embankment - All Haul Off	CY	287,037	\$ 27.25	\$ 7,821,759
	.02 Riprap	CY	32,523	\$ 100.00	\$ 3,252,334
9	<u>Culverts or Underground Basins</u>			\$	172,800,000
	.01 Underground Basins	CF	28,800,000	\$ 6.00	\$ 172,800,000
10	<u>Divert Tributary & River Flow Into Side Channels (Piggyback Yard)</u>			\$	16,570,920
	.01 Excavation Embankment - All Haul Off	CY	140,478	\$ 27.25	\$ 3,828,019
	.02 Riprap	CY	127,429	\$ 100.00	\$ 12,742,901
16	<u>Bioengineer channel walls</u>			\$	11,957,425
	.01 Pyramat Turf Reinforcement Mat	SY	72,090	\$ 34.50	\$ 2,487,105
	.02 Rock at Pyramat Tie-In	CY	3,204	\$ 67.50	\$ 216,270
	.03 Compacted Fill - No Borrow Material	CY	103,068	\$ 9.50	\$ 979,144
	.04 Reinforced Concrete Planters	CY	10,344	\$ 800.00	\$ 8,274,907
17	<u>Habitat corridors/Riparian planting on banks</u>			\$	191,148
	.01 Vegetation	ACRE	11.6	\$ 16,500.00	\$ 191,148
17	<u>Habitat corridors/Riparian planting on banks (Piggyback Yard)</u>			\$	244,000
	.01 Vegetation	ACRE	61.0	\$ 4,000.00	\$ 244,000
21	<u>Lower channel banks and provide setback levees or berms</u>			\$	39,268,638
	.01 Excavation Embankment - All Haul Off	CY	1,193,615	\$ 27.25	\$ 32,525,998
	.02 Riprap	CY	47,642	\$ 100.00	\$ 4,764,170
	.03 6' Chain Link Fence	LF	19,224	\$ 30.00	\$ 576,720
	.04 Aggregate Base Course	CY	2,848	\$ 67.50	\$ 192,240
	.05 Asphalt Pavement	SY	17,088	\$ 50.00	\$ 854,400

**LOS ANGELES RIVER FEASIBILITY
REACH 8**

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Date: 24-Apr-13

CONSTRUCTION COSTS

MEASURE	MEASURE / ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	TOTAL COST
	.06 Topsoil	CY	9,345	\$ 38.00	\$ 355,110
23	<u>Channel Bed</u>				\$ 16,114,155
	.01 Concrete Demolition	CY	40,249	\$ 400.00	\$ 16,099,755
	.02 Sheet Pile Wall Demolition	LF	180	\$ 80.00	\$ 14,400
26	<u>Terrace Banks</u>				\$ 7,875,698
	.01 Concrete Demolition	CY	14,110	\$ 400.00	\$ 5,643,991
	.02 Remove Spalls	CY	25,046	\$ 19.00	\$ 475,875
	.03 Chain Link Fence Demolition	LF	7,554	\$ 5.00	\$ 37,770
	.04 Utility Pole Relocation	EA	5	\$ 85,000.00	\$ 425,000
	.05 Excavation Embankment - Limited Haul Off	CY	105,864	\$ 6.00	\$ 635,181
	.06 Riprap	CY	6,579	\$ 100.00	\$ 657,881
27	<u>Modify trapezoidal channel to vertical sides</u>				\$ 11,850,562
	.01 Concrete Demolition	CY	14,110	\$ 400.00	\$ 5,643,991
	.02 Remove Spalls	CY	25,046	\$ 19.00	\$ 475,875
	.03 Chain Link Fence Demolition	LF	7,554	\$ 5.00	\$ 37,770
	.04 Utility Pole Relocation	EA	5	\$ 85,000.00	\$ 425,000
	.05 Excavation Embankment - Med. Haul Off	CY	231,806	\$ 14.75	\$ 3,419,135
	.06 Riprap	CY	6,579	\$ 100.00	\$ 657,881
	.07 6' Chain Link Fence	LF	10,936	\$ 30.00	\$ 328,080
	.08 Aggregate Base Course	CY	1,620	\$ 67.50	\$ 109,360
	.09 Asphalt Pavement	SY	9,721	\$ 50.00	\$ 486,044
	.10 Topsoil	CY	7,038	\$ 38.00	\$ 267,426
28	<u>Widen channel/cantilever channel bank</u>				\$ 45,818,249
	.01 Reinforced Concrete Retaining Wall	CY	31,332	\$ 1,150.00	\$ 36,031,386
	.02 Reinforced Concrete Elevated Slab	CY	7,594	\$ 1,050.00	\$ 7,974,167
	.03 Reinforced Concrete Piers	CY	2,151	\$ 775.00	\$ 1,667,111
	0.4 Subdrainage System	LF	2,734	\$ 53.25	\$ 145,586

Note: Not reflective of E&D, S&A, or contingency.

Construction Cost:	\$	394,812,317
Reach Length (LF):		7,554
Cost per LF:	\$	52,265

**LOS ANGELES RIVER FEASIBILITY
ALL REACHES**

UNIT COSTS

Date: 29-Aug-13

ITEM #	ITEM DESCRIPTION	UOM	UNIT COST	NOTES
1	Excavation Grade Control Structre - All Material Haul	CY	\$ 28.50	2-cy Hydr. Excav; Assume 100% of material hauled off-site; assumes 20-mile haul distance
2	Excavation Grade Control Structre - Med. Material Haul	CY	\$ 16.00	2-cy Hydr. Excav; Assume 50% of material hauled off-site; assumes 20-mile haul distance
3	Excavation Grade Control Structre - Limited Material Haul	CY	\$ 7.00	2-cy Hydr. Excav; Assume 15% of material hauled off-site; assumes 20-mile haul distance
4	Grouted Riprap	CY	\$ 165.00	Based on recent cost quotes on other projects in the area; includes rock delivered, placed and grout placement
5	Excavation Embankment - All Material Haul	CY	\$ 27.25	28-cy Scrapers; Assume 100% haul off-site; assumes 20-mile haul distance
6	Excavation Embankment - Med. Material Haul	CY	\$ 14.75	28-cy Scrapers; Assume 50% haul off-site; assumes 20-mile haul distance
7	Excavation Embankment - Limited Material Haul	CY	\$ 6.00	28-cy Scrapers; Assume 15% haul off-site; assumes 20-mile haul distance
8	Riprap	CY	\$ 100.00	Includes costs for material delivered to project and placed; material price taken from quotes from other cost estimates in SoCal.
9	Grading	SY	\$ 1.00	Assumes using an articulated grader with a 12-ft blade width to grade channel slopes.
10	Pyramat Turf Reinforcement Mat	SY	\$ 34.50	Cost quote provided by Propex Geotextile Systems (John Oldenburger, 916-416-1670); quote was based on recent construction bids by Propex in the LA area
11	Rock at Pyramat Tie-In	CY	\$ 67.50	Includes material costs for gravel material taken from recent projects; assumes placing crew uses a front end loader, grader, and vibratory roller
12	Topsoil	CY	\$ 38.00	Assumes all borrow material, and placement would be performed with front end loaders, vibratory rollers for compaction and a watering truck for dust control
13	Vegetation	ACRE	\$ 16,500.00	Cost based on recent estimates for planting along channels; work to be done by sub.
14	Concrete Demolition	CY	\$ 400.00	Includes costs for demolishing, loading, hauling (20-miles) and tipping fees.
15	Subdrainage System Demolition	LF	\$ 11.50	Assumes demolishing 12" diameter piping and removing off-site
16	Chain Link Fence Demolition	LF	\$ 5.00	Assumes demolishing 6' high chain linke fence and hauling off-site for disposal.
17	Clearing and Grubbing	ACRE	\$ 4,000.00	Includes costs for clearing and grubbing (med. density brush), and removing material off-site for disposal.
18	6' Chain Link Fence	LF	\$ 30.00	Includes costs for materials and installation of a 6' high chain link fence (no barbed wire)
19	Aggregate Base Course	CY	\$ 67.50	Includes costs for material and installation of agg. base under a roadway; placement to be performed with front end loader, articulated grader, and vibratory roller.
20	Asphalt Pavement	SY	\$ 50.00	Assumes a 6" thick layer of pavement to be placed; includes all materials and installation of binder and wearing course.
21	Asphalt Demolition	CY	\$ 270.00	Includes costs for demolishing, loading, hauling (20-miles) and tipping fees.
22	Utility Pole Relocation	EA	\$ 85,000.00	Assumes moving large steel utility towers with use of multiple cranes that would lift towers and place outside of construction zone. New footings to be constructed also.
23	Compacted Fill - All Borrow Material	CY	\$ 33.50	Assumes 100% borrow material delivered to project site; placement with front end loaders, vibratory roller and water truck for dust control

**LOS ANGELES RIVER FEASIBILITY
ALL REACHES**

UNIT COSTS

Date: 29-Aug-13

ITEM #	ITEM DESCRIPTION	UOM	UNIT COST	NOTES
24	Compacted Fill - Medium Borrow Material	CY	\$ 21.50	Assumes 50% borrow material delivered to project site; placement with front end loaders, vibratory roller and water truck for dust control
25	Compacted Fill - Limited Borrow Material	CY	\$ 13.00	Assumes 15% borrow material delivered to project site; placement with front end loaders, vibratory roller and water truck for dust control
26	Compacted Fill - No Borrow Material	CY	\$ 9.50	Assumes no borrow material, all material would be on-site from excavation; placement with front end loaders, vibratory roller and water truck for dust control
27	Sub Drainage System	LF	\$ 53.25	Includes costs for 12" perforated pvc, bedding material, and a geotextile wrap to encase the bedding and pipe.
28	Grouted Riprap Demo	CY	\$ 80.00	Includes costs for demolishing, loading, and hauling (20-miles) of grouted rock.
29	Riprap Demolition	CY	\$ 57.75	Includes costs for removing riprap, crushing the rock, loading and hauling off-site for disposal
30	Remove Spalls	CY	\$ 19.00	Includes costs for excavating, loading and hauling spalls (20-miles) off-site for disposal.
31	Sheet Pile Wall Demolition	LF	\$ 80.00	Includes costs for removing sheet piles from ground, no tipping fee included as contractor could re-use or possibly salvage steel.
32	Reinforced Concrete Retaining Wall	CY	\$ 1,150.00	Cost based on estimate of several size retaining walls to be used in this project; costs include forms, concrete material/placing, and reinforcing steel.
33	Retaining Wall Gravel	CY	\$ 67.50	Includes costs for material and installation of gravel under the walls; placement to be performed with front end loader, articulated grader, and vibratory roller.
34	Reinforced Concrete Planters	CY	\$ 800.00	Cost includes formwork, concrete material, placement and reinforcing steel based on typical design drawings.
35	Railroad Trestle	LF	\$ 5,000.00	Engineers estimate for placing an elevated railroad trestle.
36	Impermeable Liner	SY	\$ 17.00	Cost includes material and installation of a membrane liner that is approx. 120 mil thick.
37	Reinforced Concrete Elevated Slab	CY	\$ 1,050.00	Cost includes formwork, concrete material, placement and reinforcing steel based on typical design drawings of the elevated slab.
38	Reinforced Concrete Slab	CY	\$ 475.00	Cost includes formwork, concrete material, placement and reinforcing steel based on typical design drawings of the reinforced slab.
39	Reinforced Concrete Piers	CY	\$ 775.00	Cost includes formwork, concrete material, placement and reinforcing steel based on typical design drawings of the piers.
40	Underground Basins	CF	\$ 6.00	Solutions LLC for materials and installation of underground basins.
41	Stormdrain Daylighting	EA	\$ 100,000.00	Costs include precast concrete stormdrain, 36" dia. piping (400-lf), and 1-acre of wetland plantings.
42	Four 24-ft Dia. Tunnels	LS	\$ 1,524,019,200	Costs provided by JF Shea Construction. Unit cost of \$8,800 per LF for one tunnel and assumes 8.2-miles long



**US Army Corps
of Engineers®**
Los Angeles District

Los Angeles River Ecosystem Restoration Feasibility Study

Cost Appendix

Attachment 4 Operation and Maintenance Costs

August 2013

PRELIMINARY DRAFT

LOS ANGELES RIVER FEASIBILITY ALL REACHES

O&M PERCENTAGES

Date: 24-Apr-13

ITEM #	ITEM DESCRIPTION	%	Notes
1	Excavation Grade Control Structure - All Material Haul	0.0%	No O&M costs anticipated
2	Excavation Grade Control Structure - Med. Material Haul	0.0%	No O&M costs anticipated
3	Excavation Grade Control Structure - Limited Material Haul	0.0%	No O&M costs anticipated
4	Grouted Riprap	1.0%	Percent of initial construction costs
5	Excavation Embankment - All Material Haul	0.0%	No O&M costs anticipated
6	Excavation Embankment - Med. Material Haul	0.0%	No O&M costs anticipated
7	Excavation Embankment - Limited Material Haul	0.0%	No O&M costs anticipated
8	Riprap	1.0%	Percent of initial construction costs
9	Grading	0.5%	Percent of initial construction costs
10	Pyramat Turf Reinforcement Mat	1.5%	Percent of initial construction costs
11	Rock at Pyramat Tie-In	1.5%	Percent of initial construction costs
12	Topsoil	0.5%	Percent of initial construction costs
13	Vegetation	1.5%	Percent of initial construction costs
14	Concrete Demolition	0.0%	No O&M costs anticipated
15	Subdrainage System Demolition	0.0%	No O&M costs anticipated
16	Chain Link Fence Demolition	0.0%	No O&M costs anticipated
17	Clearing and Grubbing	1.5%	Percent of initial construction costs
18	6' Chain Link Fence	2.5%	Percent of initial construction costs
19	Aggregate Base Course	0.5%	Percent of initial construction costs
20	Asphalt Pavement	0.5%	Percent of initial construction costs
21	Asphalt Demolition	0.0%	No O&M costs anticipated
22	Utility Pole Relocation	0.0%	No O&M costs anticipated
23	Compacted Fill - All Borrow Material	0.5%	Percent of initial construction costs
24	Compacted Fill - Medium Borrow Material	0.5%	Percent of initial construction costs
25	Compacted Fill - Limited Borrow Material	0.5%	Percent of initial construction costs
26	Compacted Fill - No Borrow Material	0.5%	Percent of initial construction costs
27	Sub Drainage System	0.0%	No O&M costs anticipated
28	Grouted Riprap Demo	0.0%	No O&M costs anticipated
29	Riprap Demolition	0.0%	No O&M costs anticipated
30	Remove Spalls	0.0%	No O&M costs anticipated
31	Sheet Pile Wall Demolition	0.0%	No O&M costs anticipated
32	Reinforced Concrete Retaining Wall	0.25%	Percent of initial construction costs
33	Retaining Wall Gravel	0.0%	No O&M costs anticipated
34	Reinforced Concrete Planters	0.25%	Percent of initial construction costs
35	Railroad Trestle	0.0%	No O&M costs anticipated
36	Impermeable Liner	1.0%	Percent of initial construction costs
37	Reinforced Concrete Elevated Slab	0.0%	No O&M costs anticipated
38	Reinforced Concrete Slab	0.0%	No O&M costs anticipated
39	Reinforced Concrete Piers	0.0%	No O&M costs anticipated
40	Underground Basins	0.1%	Percent of initial construction costs
41	Stormdrain Daylighting	1.0%	Percent of initial construction costs
42	Annual Inspections/Maintenance	\$ 50,000	Assumes 4-visits and clean-ups per year per reach

LOS ANGELES RIVER FEASIBILITY

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SUMMARY OF O&M COSTS

REACH NO.	REACH / SUB-MEASURE DESCRIPTION	UOM	QUANTITY	ANNUAL O&M COST
1	Pollywog Park/Headworks to Midpoint of Betty Davis Park			
2	Expose Storm Drain Outlets	LS	1	\$ 3,000
3	Create Geomorphology and Plant Freshwater Marsh	LS	1	\$ 30,479
7	Create Underground Basins for Attenuation	LS	1	\$ 113,400
10	Divert Tributary & River Flow Into Side Channels (A, B, & C)	LS	1	\$ 108,779
16	Bioengineer Channel Walls	LS	1	\$ 40,549
17	Habitat Corridors/Riparian Planting on Banks	LS	1	\$ 12,410
23	Channel Bed	LS	1	\$ -
25	Tributary Channels - Burbank Channel	LS	1	\$ 27,719
26	Terrace Banks	LS	1	\$ 137,125
27	Modify Trapezoidal Channel to Vertical Sides	LS	1	\$ -
	Misc. Annual Inspections and Maintenance	LS	1	\$ 50,000
2	Midpoint Betty Davis Park to upstream end of Ferraro Fields			
2	Expose Storm Drain Outlets	LS	1	\$ 3,000
3	Create Geomorphology and Plant Freshwater Marsh	LS	1	\$ 27,769
9	Culverts or Underground Basins	LS	1	\$ 10,530
10	Divert Tributary & River Flow Into Side Channels (A, B, & C)	LS	1	\$ 32,868
16	Bioengineer Channel Walls	LS	1	\$ 3,208
17	Habitat Corridors/Riparian Planting on Banks	LS	1	\$ 629
23	Channel Bed	LS	1	\$ -
26	Terrace Banks	LS	1	\$ 703
27	Modify Trapezoidal Channel to Vertical Sides	LS	1	\$ 97,263
	Misc. Annual Inspections and Maintenance	LS	1	\$ 50,000
3	Ferraro Fields to Brazil St			
2	Expose Storm Drain Outlets	LS	1	\$ 6,000
3	Create Geomorphology and Plant Freshwater Marsh	LS	1	\$ 76,763
9	Culverts or Underground Basins	LS	1	\$ 75,600
10	Divert Tributary & River Flow Into Side Channels (E)	LS	1	\$ 45,040
17	Habitat Corridors/Riparian Planting on Banks	LS	1	\$ 2,025
23	Channel Bed	LS	1	\$ -
25	Tributary Channels - Verdugo Wash	LS	1	\$ 57,265
27	Modify Trapezoidal Channel to Vertical Sides	LS	1	\$ 193,069
	Misc. Annual Inspections and Maintenance	LS	1	\$ 50,000

LOS ANGELES RIVER FEASIBILITY

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SUMMARY OF O&M COSTS

REACH NO.	REACH / SUB-MEASURE DESCRIPTION	UOM	QUANTITY	ANNUAL O&M COST
4	Brazil to Los Feliz Blvd			
2	Expose Storm Drain Outlets	LS	1	\$ 9,000
3	Create Geomorphology and Plant Freshwater Marsh	LS	1	\$ 47,277
4	Grade Adjacent Areas to Lower Elevation (G)	LS	1	\$ -
9	Culverts or Underground Basins	LS	1	\$ 265,680
10	Divert Tributary & River Flow Into Side Channels (A, B, & C)	LS	1	\$ 36,251
16	Bioengineer Channel Walls	LS	1	\$ 7,521
22	Channel Banks Mainstem/Widen Channel	LS	1	\$ 2,329
23	Channel Bed	LS	1	\$ -
26	Terrace Banks	LS	1	\$ 402,521
	Misc. Annual Inspections and Maintenance	LS	1	\$ 50,000
5	Los Feliz to Glendale Fwy (2)			
2	Expose Storm Drain Outlets	LS	1	\$ 1,000
16	Bioengineer Channel Walls	LS	1	\$ 2,239
26	Terrace Banks	LS	1	\$ 270,008
27	Modify Trapezoidal Channel to Vertical Sides	LS	1	\$ 209,372
	Misc. Annual Inspections and Maintenance	LS	1	\$ 50,000
6	Glendale Fwy (2) to I-5			
2	Expose Storm Drain Outlets	LS	1	\$ 1,000
4	Grade Adjacent Areas to Lower Elevation (G)	LS	1	\$ 341,255
9	Culverts or Underground Basins	LS	1	\$ 14,580
16	Bioengineer Channel Walls	LS	1	\$ 123,034
17	Habitat Corridors/Riparian Planting on Banks	LS	1	\$ 13,872
19	Bioengineer Channel Walls	LS	1	\$ 28,525
21	Lower Channel Banks and Provide Setback Levees or Berms	LS	1	\$ 14,311
26	Terrace Banks	LS	1	\$ 225,653
	Misc. Annual Inspections and Maintenance	LS	1	\$ 50,000

LOS ANGELES RIVER FEASIBILITY

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SUMMARY OF O&M COSTS

REACH NO.	REACH / SUB-MEASURE DESCRIPTION	UOM	QUANTITY	ANNUAL O&M COST
7	I-5 to Main			
1	Elevate Railroads on Trestles	LS	1	\$ -
2	Expose Storm Drain Outlets	LS	1	\$ 3,000
3	Create Geomorphology and Plant Freshwater Marsh	LS	1	\$ 181,708
8	Creation of Wetlands Flood Control Basin (Corn Field)	LS	1	\$ 7,494
17	Habitat Corridors/Riparian Planting on Banks	LS	1	\$ 2,914
21	Lower Channel Banks and Provide Setback Levees or Berms	LS	1	\$ 18,003
23	Channel Bed	LS	1	\$ -
27	Tributary Channels/Widen Channel (Arroyo Seco)	LS	1	\$ 14,377
28	Widen Channel/Cantilever Channel Bank.	LS	1	\$ 146,764
	Misc. Annual Inspections and Maintenance	LS	1	\$ 50,000
8	Main to First			
1	Elevate Railroads on Trestles	LS	1	\$ -
2	Expose Storm Drain Outlets	LS	1	\$ 2,000
3	Create Geomorphology and Plant Freshwater Marsh	LS	1	\$ 83,642
6	Rebuild Geomorphology for Historic Wash (Piggyback Yard)	LS	1	\$ 32,523
9	Culverts or Underground Basins	LS	1	\$ 172,800
10	Divert Tributary & River Flow Into Side Channels (Piggyback Yard)	LS	1	\$ 254,858
16	Bioengineer Channel Walls	LS	1	\$ 66,134
17	Habitat Corridors/Riparian Planting on Banks	LS	1	\$ 15,098
21	Lower Channel Banks and Provide Setback Levees or Berms	LS	1	\$ 240,407
23	Channel Bed	LS	1	\$ -
26	Terrace Banks	LS	1	\$ 141,426
27	Modify Trapezoidal Channel to Vertical Sides	LS	1	\$ 128,268
28	Widen Channel/Cantilever Channel Bank.	LS	1	\$ 90,078
	Misc. Annual Inspections and Maintenance	LS	1	\$ 50,000

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**US Army Corps
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Los Angeles District

Los Angeles River Ecosystem Restoration Feasibility Study

Cost Appendix

Attachment 5

Cost Breakdown for Final Array of Alternatives

August 2013

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COSTS FOR FINAL ARRAY OF ALTERNATIVES

10

ARBOR Riparian Transitions (ART)

R/A	Sub Measure	Item Description	UOM	Quantity	Unit Cost	Total Cost
R1A11	17	Topsoil	CY	24,980	\$ 38.00	\$ 949,226
		Vegetation	ACRE	31.0	\$ 16,500.00	\$ 510,947
R2A11	17	Vegetation	ACRE	2.5	\$ 16,500.00	\$ 41,962
R3A17	2	Storm Drain Daylighting	EA	6	\$ 100,000.00	\$ 600,000
	2	Storm Drain Daylighting	EA	9	\$ 100,000.00	\$ 900,000
	3/5	Excavation Grade Control - Limited Haul Off	CY	89,807	\$ 7.00	\$ 628,647
		Grouted Riprap	CY	26,705	\$ 165.00	\$ 4,406,380
		Compacted Fill - No Borrow Material	CY	67,640	\$ 9.50	\$ 642,580
	4	Excavation Embankment - All Haul Off	CY	72,600	\$ 27.25	\$ 1,978,350
	10	Excavation Embankment - All Haul Off	CY	61,111	\$ 27.25	\$ 1,665,278
		Riprap	CY	36,251	\$ 100.00	\$ 3,625,136
R5A16	2	Storm Drain Daylighting	EA	1	\$ 100,000.00	\$ 100,000
	17	Vegetation	ACRE	56.05	\$ 16,500.00	\$ 924,768
		Excavation Embankment - Med. Haul Off	CY	436,143	\$ 14.75	\$ 6,433,106
	21/22	6' Chain Link Fence	LF	14,000	\$ 30.00	\$ 420,000
		Aggregate Base Course	CY	2,074	\$ 67.50	\$ 140,000
		Asphalt Pavement	SY	12,444	\$ 50.00	\$ 622,222
R7A9	2	Storm Drain Daylighting	EA	3	\$ 100,000.00	\$ 300,000
		Excavation Embankment - All Haul Off	CY	287,037	\$ 27.25	\$ 7,821,759
R8A15	6	Riprap	CY	32,523	\$ 100.00	\$ 3,252,334
	17	Vegetation	ACRE	72.6	\$ 16,500.00	\$ 1,197,648

Total Construction Cost: \$ 37,160,342
Mobilization (7.5%): \$ 2,787,026
Construction Subtotal: \$ 39,947,368
PED/EDC (11%): \$ 4,394,210
S&A (6.5%): \$ 2,596,579
Total Cost Subtotal: \$ 46,938,157

13

ARBOR Corridor Extension (ACE)

R/A	Sub Measure	Item Description	UOM	Quantity	Unit Cost	Total Cost
R1A11	17	Topsoil	CY	24,980	\$ 38.00	\$ 949,226
		Vegetation	ACRE	31.0	\$ 16,500.00	\$ 510,947
R2A11	17	Vegetation	ACRE	2.5	\$ 16,500.00	\$ 41,962
	2	Storm Drain Daylighting	EA	6	\$ 100,000.00	\$ 600,000
	3/5	Riprap	CY	73,217	\$ 100.00	\$ 7,321,684
		Compacted Fill - No Borrow Material	CY	74,660	\$ 9.50	\$ 709,266
	10	Excavation Embankment - Med. Haul Off	CY	117,685	\$ 14.75	\$ 1,735,856
		Riprap	CY	45,040	\$ 100.00	\$ 4,503,956
	17	Vegetation	ACRE	8.2	\$ 16,500.00	\$ 134,979
	2	Storm Drain Daylighting	EA	9.0	\$ 100,000.00	\$ 900,000
	3/5	Excavation Grade Control - Limited Haul Off	CY	89,807	\$ 7.00	\$ 628,647
		Grouted Riprap	CY	26,705	\$ 165.00	\$ 4,406,380
		Compacted Fill - No Borrow Material	CY	67,640	\$ 9.50	\$ 642,580
	4	Excavation Embankment - All Haul Off	CY	72,600	\$ 27.25	\$ 1,978,350
	10	Excavation Embankment - All Haul Off	CY	61,111	\$ 27.25	\$ 1,665,278
		Riprap	CY	36,251	\$ 100.00	\$ 3,625,136
R5A16	2	Storm Drain Daylighting	EA	1	\$ 100,000.00	\$ 100,000
	16	Pyramat Turf Reinforcement Mat	SY	203,450	\$ 34.50	\$ 7,019,017
		Rock at Pyramat Tie-In	CY	8,499	\$ 67.50	\$ 573,660
		6' Chain Link Fence	LF	12,192	\$ 30.00	\$ 365,760
		Vegetation	ACRE	56	\$ 16,500.00	\$ 924,768
	19	Pyramat Turf Reinforcement Mat	SY	50,556	\$ 34.50	\$ 1,744,167
		Rock at Pyramat Tie-In	CY	2,333	\$ 67.50	\$ 157,500
	21/22	Excavation Embankment - Med. Haul Off	CY	436,143	\$ 14.75	\$ 6,433,106
		6' Chain Link Fence	LF	14,000	\$ 30.00	\$ 420,000
		Aggregate Base Course	CY	2,074	\$ 67.50	\$ 140,000
		Asphalt Pavement	SY	12,444	\$ 50.00	\$ 622,222
	17	Vegetation	ACRE	11.8	\$ 16,500.00	\$ 194,299
		Excavation Embankment - Med. Haul Off	CY	753,906	\$ 14.75	\$ 11,120,115
		6' Chain Link Fence	LF	17,612	\$ 30.00	\$ 528,360
		Aggregate Base Course	CY	2,609	\$ 67.50	\$ 176,120
		Asphalt Pavement	SY	15,655	\$ 50.00	\$ 782,756
		Concrete Demolition	CY	16,674	\$ 400.00	\$ 6,669,668
		Remove Spalls	CY	19,723	\$ 19.00	\$ 374,745
		Chain Link Fence Demolition	LF	8,120	\$ 5.00	\$ 40,600
		Utility Pole Relocation	EA	15	\$ 85,000.00	\$ 1,275,000
	6	Excavation Embankment - All Haul Off	CY	287,037	\$ 27.25	\$ 7,821,759
R8A15		Riprap	CY	32,523	\$ 100.00	\$ 3,252,334
	17	Vegetation	ACRE	72.6	\$ 16,500.00	\$ 1,197,648

Total Construction Cost: \$ 82,287,850
Mobilization (7.5%): \$ 6,171,589
Construction Subtotal: \$ 88,459,438
PED/EDC (11%): \$ 9,730,538
S&A (6.5%): \$ 5,749,864
Total Cost Subtotal: \$ 103,939,840

COSTS FOR FINAL ARRAY OF ALTERNATIVES

16

ARBOR Narrows to Downtown (AND)

R/A	Sub Measure	Item Description	UOM	Quantity	Unit Cost	Total Cost
R1A11	17	Topsoil	CY	24,980	\$ 38.00	\$ 949,226
		Vegetation	ACRE	31.0	\$ 16,500.00	\$ 510,947
R2A11	17	Vegetation	ACRE	2.5	\$ 16,500.00	\$ 41,962
	2	Storm Drain Daylighting	EA	6	\$ 100,000.00	\$ 600,000
	3/5	Riprap	CY	73,217	\$ 100.00	\$ 7,321,684
		Compacted Fill - No Borrow Material	CY	74,660	\$ 9.50	\$ 709,266
	10	Excavation Embankment - Med. Haul Off	CY	117,685	\$ 14.75	\$ 1,735,856
		Riprap	CY	45,040	\$ 100.00	\$ 4,503,956
	17	Vegetation	ACRE	8.2	\$ 16,500.00	\$ 134,979
	2	Storm Drain Daylighting	EA	9.0	\$ 100,000.00	\$ 900,000
	3/5	Excavation Grade Control - Limited Haul Off	CY	89,807	\$ 7.00	\$ 628,647
		Grouted Riprap	CY	26,705	\$ 165.00	\$ 4,406,380
		Compacted Fill - No Borrow Material	CY	67,640	\$ 9.50	\$ 642,580
	4	Excavation Embankment - All Haul Off	CY	72,600	\$ 27.25	\$ 1,978,350
	10	Excavation Embankment - All Haul Off	CY	61,111	\$ 27.25	\$ 1,665,278
		Riprap	CY	36,251	\$ 100.00	\$ 3,625,136
	2	Storm Drain Daylighting	EA	1	\$ 100,000.00	\$ 100,000
	16	Vegetation	ACRE	9	\$ 16,500.00	\$ 149,250
		Concrete Demolition	CY	4,057	\$ 400.00	\$ 1,622,833
		Grouted Riprap Demolition	CY	21,682	\$ 80.00	\$ 1,734,544
		Riprap Demolition	CY	3,056	\$ 57.75	\$ 176,458
		Remove Spalls	CY	36,483	\$ 19.00	\$ 693,183
		Sheet Pile Wall Demolition	LF	1,990	\$ 80.00	\$ 159,234
		Chain Link Fence Demolition	LF	8,756	\$ 5.00	\$ 43,779
		Asphalt Demolition	CY	1,297	\$ 270.00	\$ 350,231
		Excavation Embankment - All Haul Off	CY	94,065	\$ 27.25	\$ 2,563,282
		Reinforced Concrete Planters	CY	29,187	\$ 800.00	\$ 23,349,333
		Aggregate Base Course	CY	2,594	\$ 67.50	\$ 175,120
		Asphalt Pavement	SY	15,566	\$ 50.00	\$ 778,311
		Topsoil	CY	3,648	\$ 38.00	\$ 138,637
		Concrete Demolition	CY	21,171	\$ 400.00	\$ 8,468,522
		Grouted Riprap Demolition	CY	5,599	\$ 80.00	\$ 447,901
		Riprap Demolition	CY	2,110	\$ 57.75	\$ 121,871
		Remove Spalls	CY	18,242	\$ 19.00	\$ 346,592
		Sheet Pile Wall Demolition	LF	6,854	\$ 80.00	\$ 548,311
		Chain Link Fence Demolition	LF	8,756	\$ 5.00	\$ 43,779
		Asphalt Demolition	CY	1,297	\$ 270.00	\$ 350,231
		Excavation Embankment - Med. Haul Off	CY	422,289	\$ 14.75	\$ 6,228,761
		Riprap	CY	110,656	\$ 100.00	\$ 11,065,638
		Compacted Fill - No Borrow Material	CY	195,830	\$ 9.50	\$ 1,860,381
		Reinforced Concrete Planters	CY	28,843	\$ 800.00	\$ 23,074,330
		Retaining Wall Gravel	CY	2,996	\$ 67.50	\$ 202,264
		6' Chain Link Fence	LF	35,024	\$ 30.00	\$ 1,050,720
		Aggregate Base Course	CY	2,594	\$ 67.50	\$ 175,120
		Asphalt Pavement	SY	15,566	\$ 50.00	\$ 778,311
		Topsoil	CY	3,648	\$ 38.00	\$ 138,637
		Subdrainage System	LF	8,756	\$ 53.25	\$ 466,257
		Pyramat Turf Reinforcement Mat	SY	203,450	\$ 34.50	\$ 7,019,017
	16	Rock at Pyramat Tie-In	CY	8,499	\$ 67.50	\$ 573,660
		6' Chain Link Fence	LF	12,192	\$ 30.00	\$ 365,760
	17	Vegetation	ACRE	56	\$ 16,500.00	\$ 924,768
	19	Pyramat Turf Reinforcement Mat	SY	50,556	\$ 34.50	\$ 1,744,167
		Rock at Pyramat Tie-In	CY	2,333	\$ 67.50	\$ 157,500
		Excavation Embankment - Med. Haul Off	CY	436,143	\$ 14.75	\$ 6,433,106
	21/22	6' Chain Link Fence	LF	14,000	\$ 30.00	\$ 420,000
		Aggregate Base Course	CY	2,074	\$ 67.50	\$ 140,000
		Asphalt Pavement	SY	12,444	\$ 50.00	\$ 622,222
	17	Vegetation	ACRE	11.8	\$ 16,500.00	\$ 194,299
	21/22	Excavation Embankment - Med. Haul Off	CY	753,906	\$ 14.75	\$ 11,120,115
		6' Chain Link Fence	LF	17,612	\$ 30.00	\$ 528,360
		Aggregate Base Course	CY	2,609	\$ 67.50	\$ 176,120
		Asphalt Pavement	SY	15,655	\$ 50.00	\$ 782,756
		Concrete Demolition	CY	16,674	\$ 400.00	\$ 6,669,668
		Remove Spalls	CY	19,723	\$ 19.00	\$ 374,745
		Chain Link Fence Demolition	LF	8,120	\$ 5.00	\$ 40,600
		Utility Pole Relocation	EA	15	\$ 85,000.00	\$ 1,275,000
	1*	Railroad Trestle	LF	4,806	\$ 5,000.00	\$ 24,030,000
	3/5	Excavation Grade Control - All Haul Off	CY	33,667	\$ 28.50	\$ 959,500
		Grouted Riprap	CY	11,651	\$ 165.00	\$ 1,922,433
		Riprap	CY	59,611	\$ 100.00	\$ 5,961,133
		Compacted Fill - No Borrow Material	CY	55,723	\$ 9.50	\$ 529,368
		Vegetation	ACRE	8.7	\$ 16,500.00	\$ 143,949
	6	Excavation Embankment - All Haul Off	CY	287,037	\$ 27.25	\$ 7,821,759
		Riprap	CY	32,523	\$ 100.00	\$ 3,252,334
	10	Excavation Embankment - All Haul Off	CY	140,478	\$ 27.25	\$ 3,828,019
		Riprap	CY	127,429	\$ 100.00	\$ 12,742,901
	17	Vegetation	ACRE	12	\$ 16,500.00	\$ 191,148
	21/22	Excavation Embankment - All Haul Off	CY	1,193,615	\$ 27.25	\$ 32,525,998
		Riprap	CY	47,642	\$ 100.00	\$ 4,764,170
		6' Chain Link Fence	LF	19,224	\$ 30.00	\$ 576,720
		Aggregate Base Course	CY	2,848	\$ 67.50	\$ 192,240
		Asphalt Pavement	SY	17,088	\$ 50.00	\$ 854,400
		Topsoil	CY	9,345	\$ 38.00	\$ 355,110
	26	Concrete Demolition	CY	14,110	\$ 400.00	\$ 5,643,991
		Remove Spalls	CY	25,046	\$ 19.00	\$ 475,875
		Chain Link Fence Demolition	LF	7,554	\$ 5.00	\$ 37,770
		Utility Pole Relocation	EA	5	\$ 85,000.00	\$ 425,000
		Excavation Embankment - Limited Haul Off	CY	105,864	\$ 6.00	\$ 635,181
		Riprap	CY	6579	\$ 100.00	\$ 657,881

Total Construction Cost: \$ 265,844,810

Mobilization (7.5%): \$ 19,938,361

Construction Subtotal: \$ 285,783,170

PED/EDC (11%): \$ 31,436,149

S&A (6.5%): \$ 18,575,906

Total Cost Subtotal: \$ 335,795,225

COSTS FOR FINAL ARRAY OF ALTERNATIVES

20

ARBOR RIPARIAN INTEGRATION VIA VARIED ECOLOGICAL REINTRODUCTION (RIVER)

R/A	Sub Measure	Item Description	UOM	Quantity	Unit Cost	Total Cost
R1A11	17	Topsoil	CY	24,980	\$ 38.00	\$ 949,226
		Vegetation	ACRE	31.0	\$ 16,500.00	\$ 510,947
R2A13	16	Pyramat Turf Reinforcement Mat	SY	24,618	\$ 34.50	\$ 849,313
		Rock at Pyramat Tie-In	CY	1,273	\$ 67.50	\$ 85,950
	17	Vegetation	ACRE	2.5	\$ 16,500.00	\$ 41,962
		Concrete Demolition	CY	1,297	\$ 400.00	\$ 518,852
		Grouted Riprap Demolition	CY	7,652	\$ 80.00	\$ 612,130
		Riprap Demolition	CY	5,401	\$ 57.75	\$ 311,901
		Remove Spalls	CY	6,712	\$ 19.00	\$ 127,520
		Sheet Pile Wall Demolition	LF	1,760	\$ 80.00	\$ 140,790
		Chain Link Fence Demolition	LF	7,641	\$ 5.00	\$ 38,204
		Asphalt Demolition	CY	1,132	\$ 270.00	\$ 305,632
		Utility Pole Relocation	LF	5	\$ 85,000.00	\$ 425,000
		Riprap	CY	42,020	\$ 100.00	\$ 4,202,000
		Compacted Fill - No Borrow Material	CY	67,932	\$ 9.50	\$ 645,357
		Reinforced Concrete Retaining Wall	CY	12,592	\$ 1,150.00	\$ 14,480,630
		Retaining Wall Gravel	CY	1,307	\$ 67.50	\$ 88,242
		6' Chain Link Fence	LF	15,280	\$ 30.00	\$ 458,400
		Aggregate Base Course	CY	2,264	\$ 67.50	\$ 152,800
		Asphalt Pavement	SY	13,582	\$ 50.00	\$ 679,111
		Topsoil	CY	1,026	\$ 38.00	\$ 38,978
		Subdrainage System	LF	3,820	\$ 53.25	\$ 203,415
R3A18	3/5	Riprap	CY	73,217	\$ 100.00	\$ 7,321,684
		Compacted Fill - No Borrow Material	CY	74,660	\$ 9.50	\$ 709,266
	10	Excavation Embankment - Med. Haul Off	CY	117,685	\$ 14.75	\$ 1,735,856
		Riprap	CY	45,040	\$ 100.00	\$ 4,503,956
	17	Vegetation	ACRE	8.2	\$ 16,500.00	\$ 134,979
		Concrete Demolition	CY	2,583	\$ 400.00	\$ 1,033,333
		Subdrainage System Demolition	LF	1,860	\$ 11.50	\$ 21,390
		Chain Link Fence Demolition	LF	1,860	\$ 5.00	\$ 9,300
		Excavation Embankment - All Haul Off	CY	1,524,592	\$ 27.25	\$ 41,545,138
		Riprap	CY	27,588	\$ 100.00	\$ 2,758,778
		Pyramat Turf Reinforcement Mat	SY	38,222	\$ 34.50	\$ 1,318,667
		Rock at Pyramat Tie-In	CY	1,000	\$ 67.50	\$ 67,500
		6' Chain Link Fence	LF	6,000	\$ 30.00	\$ 180,000
		Aggregate Base Course	CY	889	\$ 67.50	\$ 60,000
		Asphalt Pavement	SY	5,333	\$ 50.00	\$ 266,667
		Topsoil	CY	5,537	\$ 38.00	\$ 210,407
		Vegetation	ACRE	6.9	\$ 16,500.00	\$ 113,258
R4A16	2	Storm Drain Daylighting	EA	9	\$ 100,000.00	\$ 900,000
		Excavation Grade Control - Limited Haul Off	CY	89,807	\$ 7.00	\$ 628,647
	3/5	Grouted Riprap	CY	26,705	\$ 165.00	\$ 4,406,380
		Compacted Fill - No Borrow Material	CY	67,640	\$ 9.50	\$ 642,580
	4	Excavation Embankment - All Haul Off	CY	72,600	\$ 27.25	\$ 1,978,350
		Excavation Embankment - All Haul Off	CY	61,111	\$ 27.25	\$ 1,665,278
	10	Riprap	CY	36,251	\$ 100.00	\$ 3,625,136
R5A5	2	Storm Drain Daylighting	EA	1	\$ 100,000.00	\$ 100,000
		Vegetation	ACRE	9.0	\$ 16,500.00	\$ 149,250
	26	Concrete Demolition	CY	4,057	\$ 400.00	\$ 1,622,833
		Grouted Riprap Demolition	CY	21,682	\$ 80.00	\$ 1,734,544
		Riprap Demolition	CY	3,056	\$ 57.75	\$ 176,458
		Remove Spalls	CY	36,483	\$ 19.00	\$ 693,183
		Sheet Pile Wall Demolition	LF	1,990	\$ 80.00	\$ 159,234
		Chain Link Fence Demolition	LF	8,756	\$ 5.00	\$ 43,779
		Asphalt Demolition	CY	1,297	\$ 270.00	\$ 350,231
		Excavation Embankment - All Haul Off	CY	94,065	\$ 27.25	\$ 2,563,282
		Reinforced Concrete Planters	CY	29,187	\$ 800.00	\$ 23,349,333
		Aggregate Base Course	CY	2,594	\$ 67.50	\$ 175,120
		Asphalt Pavement	SY	15,566	\$ 50.00	\$ 778,311
		Topsoil	CY	3,648	\$ 38.00	\$ 138,637
	27	Concrete Demolition	CY	21,171	\$ 400.00	\$ 8,468,522
		Grouted Riprap Demolition	CY	5,599	\$ 80.00	\$ 447,901
		Riprap Demolition	CY	2,110	\$ 57.75	\$ 121,871
		Remove Spalls	CY	18,242	\$ 19.00	\$ 346,592
		Sheet Pile Wall Demolition	LF	6,854	\$ 80.00	\$ 548,311
		Chain Link Fence Demolition	LF	8,756	\$ 5.00	\$ 43,779
		Asphalt Demolition	CY	1,297	\$ 270.00	\$ 350,231
		Excavation Embankment - Med. Haul Off	CY	422,289	\$ 14.75	\$ 6,228,761
		Riprap	CY	110,656	\$ 100.00	\$ 11,065,638
		Compacted Fill - No Borrow Material	CY	195,830	\$ 9.50	\$ 1,860,381
		Reinforced Concrete Planters	CY	28,843	\$ 800.00	\$ 23,074,330
		Retaining Wall Gravel	CY	2,996	\$ 67.50	\$ 202,264
		6' Chain Link Fence	LF	35,024	\$ 30.00	\$ 1,050,720
		Aggregate Base Course	CY	2,594	\$ 67.50	\$ 175,120
		Asphalt Pavement	SY	15,566	\$ 50.00	\$ 778,311
		Topsoil	CY	3,648	\$ 38.00	\$ 138,637
		Subdrainage System	LF	8,756	\$ 53.25	\$ 466,257
R6A13	16	Pyramat Turf Reinforcement Mat	SY	203,450	\$ 34.50	\$ 7,019,017
		Rock at Pyramat Tie-In	CY	8,499	\$ 67.50	\$ 573,660
		6' Chain Link Fence	LF	12,192	\$ 30.00	\$ 365,760
	17	Vegetation	ACRE	56.0	\$ 16,500.00	\$ 924,768
	19	Pyramat Turf Reinforcement Mat	SY	50,556	\$ 34.50	\$ 1,744,167
		Rock at Pyramat Tie-In	CY	2,333	\$ 67.50	\$ 157,500
	21/22	Excavation Embankment - Med. Haul Off	CY	436,143	\$ 14.75	\$ 6,433,106
		6' Chain Link Fence	LF	14,000	\$ 30.00	\$ 420,000
		Aggregate Base Course	CY	2,074	\$ 67.50	\$ 140,000
R7A16	1	Railroad Trestle	LF	1,000	\$ 5,000.00	\$ 5,000,000
		Storm Drain Daylighting	EA	3	\$ 100,000.00	\$ 300,000
	3	Riprap	CY	96,002	\$ 100.00	\$ 9,600,171
		Compacted Fill - No Borrow Material	CY	88,394	\$ 9.50	\$ 839,746
		Reinforced Concrete Retaining Wall	CY	27,723	\$ 1,150.00	\$ 31,880,981
		Topsoil	CY	9,499	\$ 38.00	\$ 360,964
	17	Vegetation	ACRE	11.8	\$ 16,500.00	\$ 194,299

COSTS FOR FINAL ARRAY OF ALTERNATIVES

20

ARBOR RIPARIAN INTEGRATION VIA VARIED ECOLOGICAL REINTRODUCTION (RIVER) (Continued)

R/A	Sub Measure	Item Description	UOM	Quantity	Unit Cost	Total Cost
R8A3	1	Railroad Trestle	LF	4,806	\$ 5,000.00	\$ 24,030,000
		Excavation Grade Control - All Haul Off	CY	33,667	\$ 28.50	\$ 959,500
	3	Grouted Riprap	CY	11,651	\$ 165.00	\$ 1,922,433
		Riprap	CY	59,611	\$ 100.00	\$ 5,961,133
		Compacted Fill - No Borrow Material	CY	55,723	\$ 9.50	\$ 529,368
		Vegetation	ACRE	8.7	\$ 16,500.00	\$ 143,949
	6	Excavation Embankment - All Haul Off	CY	287,037	\$ 27.25	\$ 7,821,759
		Riprap	CY	32,523	\$ 100.00	\$ 3,252,334
	10	Excavation Embankment - All Haul Off	CY	140,478	\$ 27.25	\$ 3,828,019
		Riprap	CY	127,429	\$ 100.00	\$ 12,742,901
	17	Vegetation	ACRE	72.6	\$ 16,500.00	\$ 1,197,648
	21	Excavation Embankment - All Haul Off	CY	1,193,615	\$ 27.25	\$ 32,525,998
		Riprap	CY	47,642	\$ 100.00	\$ 4,764,170
		6' Chain Link Fence	LF	19,224	\$ 30.00	\$ 576,720
		Aggregate Base Course	CY	2,848	\$ 67.50	\$ 192,240
		Asphalt Pavement	SY	17,088	\$ 50.00	\$ 854,400
	26	Topsoil	CY	9,345	\$ 38.00	\$ 355,110
		Concrete Demolition	CY	14,110	\$ 400.00	\$ 5,643,991
		Remove Spalls	CY	25,046	\$ 19.00	\$ 475,875
		Chain Link Fence Demolition	LF	7,554	\$ 5.00	\$ 37,770
		Utility Pole Relocation	EA	5	\$ 85,000.00	\$ 425,000
		Excavation Embankment - Limited Haul Off	CY	105,864	\$ 6.00	\$ 635,181
		Riprap	CY	6,579	\$ 100.00	\$ 657,881

Total Construction Cost: \$ 365,214,471
Mobilization (7.5%): \$ 27,391,085
Construction Subtotal: \$ 392,605,556
PED/EDC (11%): \$ 43,186,611
S&A (6.5%): \$ 25,519,361
Total Cost Subtotal: \$ 461,311,528



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Los Angeles River Ecosystem Restoration Feasibility Study

Cost Appendix

Attachment 6 Recreation Cost Estimates

August 2013

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**LOS ANGELES RIVER FEASIBILITY
RECREATION COMPONENTS**

Page: 1 of 1
Date: 23-Jul-13

CONSTRUCTION COST SUMMARY PAGE

ITEM #	ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	CONTINGENCY	TOTAL CONSTRUCTION COST
REC	<u>Recreation Construction Costs</u>					
MOB	Mobilization / Demobilization	LS	1	\$ 316,987.12	35.00%	\$ 427,933
1	Existing Acces Road to Un-Paved Multi Use Trail	LF	4,317	\$ 91.62	35.00%	\$ 533,974
2	Trail Improvement	LF	5,955	\$ 57.47	35.00%	\$ 462,049
3	New Unpaved Trail	LF	31,626	\$ 27.25	35.00%	\$ 1,163,568
4	Parking Lot 1	SF	13,800	\$ 7.06	35.00%	\$ 131,490
5	Parking Lot 2	SF	15,625	\$ 7.06	35.00%	\$ 148,888
6	Restrooms	EA	3	\$ 70,000.00	35.00%	\$ 283,500
7	Trail Access Point	EA	19	\$ 5,000.00	35.00%	\$ 128,250
8	Pedestrian Tunnel	LF	50	\$ 2,142.22	35.00%	\$ 144,600
9	Wildlife Viewpoint	EA	5	\$ 11,400.00	35.00%	\$ 76,950
10	Bridges	EA	3	\$ 650,000.00	35.00%	\$ 2,632,500
Total Construction Cost:						\$ 6,133,701

O&M COST SUMMARY PAGE

ITEM #	ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	CONTINGENCY	ANNUAL O&M COSTS
REC	<u>Recreation Construction Costs</u>					
MOB	Mobilization / Demobilization	YR	1	\$ -	35.00%	\$ -
1	Existing Acces Road to Un-Paved Multi Use Trail	YR	1	\$ 1,077.36	35.00%	\$ 1,454
2	Trail Improvement	YR	1	\$ 3,191.00	35.00%	\$ 4,308
3	New Unpaved Trail	YR	1	\$ 8,903.65	35.00%	\$ 12,020
4	Parking Lot 1	YR	1	\$ 1,043.00	35.00%	\$ 1,408
5	Parking Lot 2	YR	1	\$ 1,181.00	35.00%	\$ 1,594
6	Restrooms	YR	1	\$ 3,150.00	35.00%	\$ 4,253
7	Trail Access Point	YR	1	\$ 674.50	35.00%	\$ 911
8	Pedestrian Tunnel	YR	1	\$ 1,226.67	35.00%	\$ 1,656
9	Wildlife Viewpoint	YR	1	\$ 1,066.25	35.00%	\$ 1,439
10	Bridges	YR	1	\$ 9,750.00	35.00%	\$ 13,163
ANNUAL O&M:						\$ 42,206

**LOS ANGELES RIVER FEASIBILITY
RECREATION COMPONENTS**

Page: 1 of 2
Date: 23-Jul-13

CONSTRUCTION COSTS

MEASURE	MEASURE / ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	TOTAL COST
MOB	<u>Mobilization / Demobilization (7.5% of Construction Cost)</u>	LS	1	\$ 316,987.12	\$ 316,987
1	<u>Existing Access Road Conversion to Un-Paved Multi-Use Trail</u>	LF	4,317	\$ 91.62	\$ 395,536
	.01 Demo Asphalt	SY	5,756	\$ 50.00	287,800
	.02 Grading, Small Area	SY	5,756	\$ 0.50	2,878
	.03 Decomposed Granite, 3" Thick	SY	5,756	\$ 18.00	103,608
	.04 Trail Signs	EA	5	\$ 250.00	1,250
2	<u>Trail Improvement</u>	LF	5,955	\$ 57.47	\$ 342,258
	.01 Cold Mill Asphalt Trail	SY	7,940	\$ 1.25	9,925
	.02 Haul & Dispose of Asphalt	CY	662	\$ 20.00	13,233
	.03 Asphalt Paving, 3" Thick	SY	7,940	\$ 40.00	317,600
	.04 Trail Signs	EA	6	\$ 250.00	1,500
3	<u>New Unpaved Trail</u>	LF	31,626	\$ 27.25	\$ 861,902
	.01 Clear and Grub, Large Area	SF	379,512	\$ 0.15	56,927
	.02 Grading, Large Area	SF	379,512	\$ 0.10	37,951
	.03 Decomposed Granite, 3" Thick	SY	42,168	\$ 18.00	759,024
	.04 Trail Signs	EA	32	\$ 250.00	8,000
4	<u>Parking Lot 1</u>	SF	13,800	\$ 7.06	\$ 97,400
	.01 Clear and Grub, Small Area	SF	13,800	\$ 1.00	13,800
	.02 Grading, Small Area	SF	13,800	\$ 0.50	6,900
	.03 Asphalt Paving, 6" Thick	SY	1,534	\$ 50.00	76,700
5	<u>Parking Lot 2</u>	SF	15,625	\$ 7.06	\$ 110,288
	.01 Clear and Grub, Small Area	SF	15,625	\$ 1.00	15,625
	.02 Grading, Small Area	SF	15,625	\$ 0.50	7,813
	.03 Asphalt Paving, 6" Thick	SY	1,737	\$ 50.00	86,850
6	<u>Restrooms</u>	EA	3	\$ 70,000.00	\$ 210,000
	.01 Park Restroom	EA	3	\$ 70,000.00	210,000
7	<u>Trail Access Point</u>	EA	19	\$ 5,000.00	\$ 95,000
	.01 Clear and Grub, Small Area	SF	1,900	\$ 1.00	1,900
	.02 Grading, Small Area	SF	1,900	\$ 0.50	950
	.03 Vegetation Plantings	EA	190	\$ 50.00	9,500
	.04 Trash Receptacle	EA	19	\$ 450.00	8,550
	.05 Interpretive Signs	EA	19	\$ 2,000.00	38,000
	.06 Access Gate	EA	19	\$ 400.00	7,600
	.07 Concrete Stairs	SF	1,140	\$ 25.00	28,500

**LOS ANGELES RIVER FEASIBILITY
RECREATION COMPONENTS**

Page: 2 of 2
Date: 23-Jul-13

CONSTRUCTION COSTS

MEASURE	MEASURE / ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	TOTAL COST
8	<u>Pedestrian Tunnel</u>	LF	50	\$ 2,142.22	\$ 107,111
	.01 Tunnel Excavation	CY	222	\$ 200.00	\$ 44,444
	.02 Tunnel CIP Concrete Lining	LF	50	\$ 1,200.00	\$ 60,000
	.03 Asphalt Paving	SY	67	\$ 40.00	\$ 2,667
9	<u>Wildlife Viewpoint</u>	EA	5	\$ 11,400.00	\$ 57,000
	.01 Clear and Grub	SF	500	\$ 1.00	\$ 500
	.02 Elevated Wood Decking	SF	500	\$ 50.00	\$ 25,000
	.03 Wood Railing	LF	150	\$ 75.00	\$ 11,250
	.04 Benches	EA	10	\$ 800.00	\$ 8,000
	.05 Interpretive Sign	EA	5	\$ 2,000.00	\$ 10,000
	.06 Trash Receptacle	EA	5	\$ 450.00	\$ 2,250
10	<u>Bridges</u>	EA	3	\$ 650,000.00	\$ 1,950,000
	.01 Bridge 1 - R6 in Taylor Yard	SF	1,800	\$ 250.00	\$ 450,000
	.02 Bridge 2 - R7 Spans Arroyo Seco	SF	3,000	\$ 250.00	\$ 750,000
	.03 Bridge 5 - R8 Within Piggyback Yard	SF	3,000	\$ 250.00	\$ 750,000
Note: Not reflective of E&D, S&A, or contingency.				Construction Cost:	\$ 4,543,482
				Contingency:	35.00%
				Total Cost:	\$ 6,133,701

LOS ANGELES RIVER FEASIBILITY
RECREATION COMPONENTS

Page: 1 of 2
Date: 23-Jul-13

ANNUAL O&M COSTS

MEASURE	MEASURE / ITEM DESCRIPTION	UOM	QUANTITY	% of Total Construction Cost	TOTAL COST
MOB	<u>Mobilization / Demobilization (7.5% of Construction Cost)</u>	YR	1	0.00%	\$ -
1	<u>Existing Access Road Conversion to Un-Paved Multi-Use Trail</u>	YR	1	0.27%	\$ 1,077
	.01 Demo Asphalt	YR	1	0.00%	\$ -
	.02 Grading	YR	1	1.00%	\$ 29
	.03 Decomposed Granite, 3" Thick	YR	1	1.00%	\$ 1,036
	.04 Trail Signs	YR	1	1.00%	\$ 13
2	<u>Trail Improvement</u>	YR	1	0.93%	\$ 3,191
	.01 Cold Mill Asphalt Trail	YR	1	0.00%	\$ -
	.02 Haul & Dispose of Asphalt	YR	1	0.00%	\$ -
	.03 Asphalt Paving	YR	1	1.00%	\$ 3,176
	.04 Trail Signs	YR	1	1.00%	\$ 15
3	<u>New Unpaved Trail</u>	YR	1	1.03%	\$ 8,904
	.01 Clear and Grub	YR	1	1.50%	\$ 854
	.02 Grading	YR	1	1.00%	\$ 380
	.03 Decomposed Granite, 3" Thick	YR	1	1.00%	\$ 7,590
	.04 Trail Signs	YR	1	1.00%	\$ 80
4	<u>Parking Lot 1</u>	YR	1	1.07%	\$ 1,043
	.01 Clear and Grub	YR	1	1.50%	\$ 207
	.02 Grading	YR	1	1.00%	\$ 69
	.03 Asphalt Paving	YR	1	1.00%	\$ 767
5	<u>Parking Lot 2</u>	YR	1	1.07%	\$ 1,181
	.01 Clear and Grub	YR	1	1.50%	\$ 234
	.02 Grading	YR	1	1.00%	\$ 78
	.03 Asphalt Paving	YR	1	1.00%	\$ 869
6	<u>Restrooms</u>	YR	1	1.50%	\$ 3,150
	.01 Park Restroom	YR	1	1.50%	\$ 3,150
7	<u>Trail Access Point</u>	YR	1	0.71%	\$ 675
	.01 Clear and Grub	YR	1	1.50%	\$ 29
	.02 Grading	YR	1	1.00%	\$ 10
	.03 Vegetation Plantings	YR	1	1.50%	\$ 143
	.04 Trash Receptacle	YR	1	1.00%	\$ 86
	.05 Interpretive Signs	YR	1	0.50%	\$ 190
	.06 Access Gate	YR	1	1.00%	\$ 76
	.07 Concrete Stairs	YR	1	0.50%	\$ 143

LOS ANGELES RIVER FEASIBILITY
RECREATION COMPONENTS

Page: 2 of 2
Date: 23-Jul-13

ANNUAL O&M COSTS

MEASURE	MEASURE / ITEM DESCRIPTION	UOM	QUANTITY	UNIT COST	TOTAL COST
8	<u>Pedestrian Tunnel</u>	YR	1	1.15%	\$ 1,227
	.01 Tunnel Excavation	YR	1	0.00%	\$ -
	.02 Tunnel CIP Concrete Lining	YR	1	2.00%	\$ 1,200
	.03 Asphalt Paving	YR	1	1.00%	\$ 27
9	<u>Wildlife Viewpoint</u>	YR	1	1.87%	\$ 1,066
	.01 Clear and Grub	YR	1	1.50%	\$ 8
	.02 Elevated Wood Decking	YR	1	2.50%	\$ 625
	.03 Wood Railing	YR	1	2.50%	\$ 281
	.04 Benches	YR	1	1.00%	\$ 80
	.05 Interpretive Sign	YR	1	0.50%	\$ 50
	.06 Trash Receptacle	YR	1	1.00%	\$ 23
10	<u>Bridges</u>	YR	1	0.50%	\$ 9,750
	.01 Bridge 1 - R6 in Taylor Yard	YR	1	0.50%	\$ 2,250
	.02 Bridge 2 - R7 Spans Arroyo Seco	YR	1	0.50%	\$ 3,750
	.03 Bridge 5 - R8 Within Piggyback Yard	YR	1	0.50%	\$ 3,750
Note: Not reflective of E&D, S&A, or contingency.				Annual O&M Cost:	\$ 31,263
				Contingency:	35.00%
				Total O&M Cost:	\$ 42,206

**LOS ANGELES RIVER FEASIBILITY
RECREATION COMPONENTS**

UNIT COSTS

Date: 18-Jun-13

ITEM #	ITEM DESCRIPTION	UOM	UNIT COST	NOTES
1	Clearing and Grubbing (Small Area)	SF	\$ 1.00	
2	Grading and Land Form (Small Area)	SF	\$ 0.50	
3	Clearing and Grubbing (Large Area)	SF	\$ 0.15	
4	Grading and Land Form (Large Area)	SF	\$ 0.10	
5	Vegetative Plantings	EA	\$ 50.00	Estimate from RS Means cost book for plant material and installation.
6	Trash Receptacles	EA	\$ 450.00	RS Means #129323104500
7	Interpretive Signs	EA	\$ 2,000.00	From Tres rios Environmental Restoration MII cost estimate.
8	Access Gate	EA	\$ 400.00	RS Means #323113201400, for 6' chain link fence gate.
9	Asphalt Pavement - 3" Thick	SY	\$ 40.00	From unit costs generated for LA River alternatives construction costs; Reduced due to 3" vs. 6" in alternatives.
10	Asphalt Pavement - 6" Thick	SY	\$ 50.00	From unit costs generated for LA River alternatives construction costs
11	Decomposed Granite, 3" Thick	SY	\$ 18.00	From SAR Phase III construction cost estimate.
12	Park Restroom	EA	\$ 70,000.00	Cost for arched metal roof restroom estimated for Tres Rios Recreation project in MII.
13	Trail Sign	EA	\$ 250.00	
14	Wood Railing	LF	\$ 75.00	RS Means #064316100100
15	Elevated Wood Decking	SF	\$ 50.00	RS Means #061333501400; used more expensive cost for a wood dock structure since this is elevated.
16	Bench	EA	\$ 800.00	RS Means #129343130012
17	Demo Asphalt	SY	\$ 50.00	From LA River alternatives cost estimates.
18	Cold Mill Pavement	SY	\$ 1.25	From RS Means #320116715350; Round up from \$1.19
19	Haul and Dispose of Asphalt	CY	\$ 20.00	From unit costs generated for LA River alternatives construction costs; Includes tipping fees at recycling plants.
20	Concrete Stairs	SF	\$ 25.00	From RS Means cost for free standing concrete stairs, cast-in-place
21	Tunnel Excavation	CY	\$ 200.00	RS Means #317116200410 for tunnel shaft excavation; doubled to account for working under/near RR
22	Tunnel CIP Concrete Lining	LF	\$ 1,200.00	RS Means #317413100500 for cip tunnel liner; doubled ot account for working under/near RR
23	Pedestrian Bridge	SF	\$ 250.00	RS Means #32342010400

**LOS ANGELES RIVER FEASIBILITY
ALL REACHES**

O&M PERCENTAGES

Date: 18-Jun-13

ITEM #	ITEM DESCRIPTION	%	Notes
1	Clearing and Grubbing (Small Area)	1.5%	Percent of initial construction costs
2	Grading and Land Form (Small Area)	1.0%	Percent of initial construction costs
3	Clearing and Grubbing (Large Area)	1.5%	Percent of initial construction costs
4	Grading and Land Form (Large Area)	1.0%	Percent of initial construction costs
5	Vegetative Plantings	1.5%	Percent of initial construction costs
6	Trash Receptacles	1.0%	Percent of initial construction costs
7	Interpretive Signs	0.5%	Percent of initial construction costs
8	Access Gate	1.0%	Percent of initial construction costs
9	Asphalt Pavement - 3" Thick	1.0%	Percent of initial construction costs
10	Asphalt Pavement - 6" Thick	1.0%	Percent of initial construction costs
11	Decomposed Granite, 3" Thick	1.0%	Percent of initial construction costs
12	Park Restroom	1.5%	Percent of initial construction costs
13	Trail Sign	1.0%	Percent of initial construction costs
14	Wood Railing	2.5%	Percent of initial construction costs
15	Elevated Wood Decking	2.5%	Percent of initial construction costs
16	Bench	1.0%	Percent of initial construction costs
17	Demo Asphalt	0.0%	No O&M costs anticipated
18	Cold Mill Pavement	0.0%	No O&M costs anticipated
19	Haul and Dispose of Asphalt	0.0%	No O&M costs anticipated
20	Concrete Stairs	0.5%	Percent of initial construction costs
21	Tunnel Excavation	0.0%	No O&M costs anticipated
22	Tunnel CIP Concrete Lining	2.0%	Percent of initial construction costs
23	Pedestrian Bridge	0.5%	Percent of initial construction costs

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**US Army Corps
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Los Angeles River Ecosystem Restoration Feasibility Study

Cost Appendix

Attachment 7 Abbreviated Risk Analysis

August 2013

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Abbreviated Risk Analysis

Los Angeles River Feasibility (Alternatives)

Meeting Date: 6-Jun-13

PDT Members

Note: PDT involvement is commensurate with project size and involvement.

[illegible]

Abbreviated Risk Analysis

Project (less than \$40M): **Los Angeles River**
 Project Development Stage: **Feasibility (Alternatives)**
 Risk Category: **Moderate Risk: Typical Project or Possible Life Safety**

Total Construction Contract Cost = **\$ 9,000,000**

	<u>CWWBS</u>	<u>Feature of Work</u>	<u>Contract Cost</u>	<u>% Contingency</u>	<u>\$ Contingency</u>	<u>Total</u>
	01 LANDS AND DAMAGES	Real Estate	\$ 1,000,000	20.00%	\$ 200,000	\$ 1,200,000.00
1	09 01 CHANNELS	Mobilization - Demobilization	\$ 1,000,000	26.44%	\$ 264,381	\$ 1,264,381.41
2	09 01 CHANNELS	Earthwork	\$ 1,000,000	45.78%	\$ 457,767	\$ 1,457,767.09
3	09 01 CHANNELS	Vegetation & Topsoil	\$ 1,000,000	22.80%	\$ 228,012	\$ 1,228,011.58
4	09 01 CHANNELS	Demolition	\$ 1,000,000	24.56%	\$ 245,596	\$ 1,245,595.58
5	09 01 CHANNELS	Riprap & Grouted Riprap	\$ 1,000,000	38.88%	\$ 388,781	\$ 1,388,780.61
6	09 01 CHANNELS	Turf Reinforcement Mat	\$ 1,000,000	24.13%	\$ 241,337	\$ 1,241,336.55
7	09 01 CHANNELS	Concrete (Walls & Planters)	\$ 1,000,000	47.10%	\$ 471,045	\$ 1,471,045.08
8	09 01 CHANNELS	Asphalt Paving (Inc. Base Course, Fence)	\$ 1,000,000	13.44%	\$ 134,371	\$ 1,134,370.70
9			\$ -	0.00%	\$ -	\$ -
12		Remaining Construction Items	\$ 1,000,000	12.5%	\$ 328,649	\$ 1,328,648.56
13	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	\$ 1,000,000	24.40%	\$ 244,020	\$ 1,244,019.73
14	31 CONSTRUCTION MANAGEMENT	Construction Management	\$ 1,000,000	26.25%	\$ 262,529	\$ 1,262,529.13
Totals						
		Real Estate	\$ 1,000,000	20.00%	\$ 200,000	\$ 1,200,000.00
		Total Construction Estimate	\$ 9,000,000	30.67%	\$ 2,759,937	\$ 11,759,937
		Total Planning, Engineering & Design	\$ 1,000,000	24.40%	\$ 244,020	\$ 1,244,020
		Total Construction Management	\$ 1,000,000	26.25%	\$ 262,529	\$ 1,262,529
		Total	\$ 12,000,000		\$ 3,466,486	\$ 15,466,486

Los Angeles River
Feasibility (Alternatives)
Abbreviated Risk Analysis

Meeting Date: 6-Jun-13

Risk Level				
Very Likely	2	3	4	5
Likely	1	2	3	4
Possible	0	1	2	3
Unlikely	0	0	1	2
	Negligible	Marginal	Significant	Critical
				Crisis

Risk Element	Feature of Work	Concerns Pull Down Tab (ENABLE MACROS THRU TRUST CENTER) (Choose ALL that apply)	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Likelihood	Impact	Risk Level
Project Scope Growth							
						Max Potential Cost Growth	75%
PS-1	Mobilization - Demobilization	• Design confidence?	• Potential for scope growth, added features and quantities? • Design confidence?	Due to low level of design, many aspects in regards to staging areas and site constraints have not been fully developed. These assumptions utilized currently could differ significantly as design progresses and staging/constraints are analyzed in detail.	Likely	Significant	3
PS-2	Earthwork	• Water care and diversion fully understood, planned?	• Potential for scope growth, added features and quantities? • Project accomplish intent? • Investigations sufficient to support design assumptions? • Design confidence? • Water care and diversion fully understood, planned?	Primary concerns are that this project is at a low level of design, investigations remain to be completed to finalize design, encountering HTRWs, and no fully developed water control plan has been developed. Based on all these risks, it is likely that at least a few of them could impact the costs, and these risks would significantly impact costs.	Likely	Significant	3
PS-3	Vegetation & Topsoil	• Water care and diversion fully understood, planned?	• Design confidence? • Potential for scope growth, added features and quantities? • Water care and diversion fully understood, planned?	Low level of design is an inherent risk, and there is some chance for the scope to increase. However, the likelihood and impacts are both small as current assumptions are conservative and not likely to incur significant growth.	Possible	Marginal	1
PS-4	Demolition	• Water care and diversion fully understood, planned?	• Investigations sufficient to support design assumptions? • Design confidence? • Water care and diversion fully understood, planned?	Design level is low, and some investigations remain to determine the extent of demolition required. Also, the diversion and care of water has not been analyzed in detail. The likelihood of the demo work being affected by scope growth is small, but any increases could add significant costs.	Likely	Marginal	2
PS-5	Riprap & Grouted Riprap	• Water care and diversion fully understood, planned?	• Design confidence? • Potential for scope growth, added features and quantities? • Investigations sufficient to support design assumptions? • Water care and diversion fully understood, planned?	Primary concerns are the low level of design, and the need for additional hydraulic modeling to be completed to finalize design. The modeling could change the current riprap assumptions significantly.	Likely	Significant	3
PS-6	Turf Reinforcement Mat	• Water care and diversion fully understood, planned?	• Design confidence? • Potential for scope growth, added features and quantities? • Project accomplish intent? • Investigations sufficient to support design assumptions? • Water care and diversion fully understood, planned?	Further investigation into capabilities and reasonableness of utilizing the Turf Reinforcement Mats need to be completed. There is a risk that the mat is only for low velocity and small area surface run-off, and that it may be unsuitable for use in this project. Different material could be required, by overall impact to cost of this item is estimated to be marginal.	Likely	Marginal	2
PS-7	Concrete (Walls & Planters)	• Water care and diversion fully understood, planned?	• Potential for scope growth, added features and quantities? • Project accomplish intent? • Investigations sufficient to support design assumptions? • Design confidence? • Water care and diversion fully understood, planned?	The concrete structures require further investigations, require further easement and ROW analysis, and are based on conceptual designs. These risks are likely to cause some changes as the project progresses, and impacts to costs could be significant.	Likely	Significant	3
PS-8	Asphalt Paving (Inc. Base Course, Fence)	• Design confidence?	• Potential for scope growth, added features and quantities? • Project accomplish intent? • Investigations sufficient to support design assumptions? • Design confidence?	The level of design is low, but the risks to these items is anticipated to be minor. Scope is not anticipated to grow to an extent that would significantly impact these items.	Possible	Marginal	1
PS-9	0	• Potential for scope growth, added features and quantities?			Unlikely	Negligible	0
PS-10	0	• Investigations sufficient to support design assumptions?			Unlikely	Negligible	0
PS-11	0	• Potential for scope growth, added features and quantities?			Unlikely	Negligible	0
PS-12	Remaining Construction Items	• Design confidence?	• Design confidence?	No design currently for the storm drains or the new railroad trestles. Scope for these not anticipated to grow, but if it did costs would increase significantly.	Unlikely	Significant	1
PS-13	Planning, Engineering, & Design	• Water care and diversion fully understood, planned?	• Potential for scope growth, added features and quantities? • Project accomplish intent? • Investigations sufficient to support design assumptions? • Design confidence? • Water care and diversion fully understood, planned?	Many investigations remain to be completed in order to finalize the design. If the scope grows in extent then the cost to complete the PED phase would grow as well. However, current assumptions on cost of PED have generated large PED costs, thus impacts of future unaccounted for investigations would be marginal.	Very LIKELY	Marginal	3
PS-14	Construction Management	• Water care and diversion fully understood, planned?	• Potential for scope growth, added features and quantities? • Project accomplish intent? • Investigations sufficient to support design assumptions? • Design confidence? • Water care and diversion fully understood, planned?	The primary concern for construction management, is the possible encountering of a large area of HTRW. This would create a significant impact on the management costs.	Possible	Significant	2

Acquisition Strategy							Max Potential Cost Growth	30%
AS-1	Mobilization - Demobilization	• Bid schedule developed to reduce quantity risks?	• Contracting plan firmly established? • 8a or small business likely? • Requirement for subcontracting? • Accelerated schedule or harsh weather schedule? • High-risk acquisition limits competition, design/build? • Bid schedule developed to reduce quantity risks?	At this stage of the project no contracting plan has been established. Unit costs take into account use of some sub-contracting for certain aspects of construction. There may be some requirements of 8a/small business, but they probably would not be the prime. Some in channel work may need to be accelerated to avoid rainy seasons, but not a huge risk as many contractors would be capable of working through winter. There is no bid schedule, but detailed quantity take-offs have been developed for current design. So, PDT has concluded that these are all risks, but they are not likely to all occur and impact the costs. The overall impact on costs would be small as well due to the estimate already containing unit costs that account for subs.	Possible	Marginal	1	
AS-2	Earthwork	• Contracting plan firmly established?	• Contracting plan firmly established? • 8a or small business likely? • Requirement for subcontracting? • Accelerated schedule or harsh weather schedule? • High-risk acquisition limits competition, design/build? • Bid schedule developed to reduce quantity risks?	See discussion in first box above.	Possible	Marginal	1	
AS-3	Vegetation & Topsoil	• Contracting plan firmly established?	• Contracting plan firmly established? • 8a or small business likely? • Requirement for subcontracting? • Accelerated schedule or harsh weather schedule? • High-risk acquisition limits competition, design/build? • Bid schedule developed to reduce quantity risks?	See discussion in first box above.	Possible	Marginal	1	
AS-4	Demolition	• Contracting plan firmly established?	• Contracting plan firmly established? • 8a or small business likely? • Requirement for subcontracting? • Accelerated schedule or harsh weather schedule? • High-risk acquisition limits competition, design/build? • Bid schedule developed to reduce quantity risks?	See discussion in first box above.	Possible	Marginal	1	
AS-5	Riprap & Grouted Riprap	• Contracting plan firmly established?	• Contracting plan firmly established? • 8a or small business likely? • Requirement for subcontracting? • Accelerated schedule or harsh weather schedule? • High-risk acquisition limits competition, design/build? • Bid schedule developed to reduce quantity risks?	See discussion in first box above.	Possible	Marginal	1	
AS-6	Turf Reinforcement Mat	• Contracting plan firmly established?	• Contracting plan firmly established? • 8a or small business likely? • Requirement for subcontracting? • Accelerated schedule or harsh weather schedule? • High-risk acquisition limits competition, design/build? • Bid schedule developed to reduce quantity risks?	See discussion in first box above.	Possible	Marginal	1	
AS-7	Concrete (Walls & Planters)	• Contracting plan firmly established?	• Contracting plan firmly established? • 8a or small business likely? • Requirement for subcontracting? • Accelerated schedule or harsh weather schedule? • High-risk acquisition limits competition, design/build? • Bid schedule developed to reduce quantity risks?	See discussion in first box above.	Possible	Marginal	1	
AS-8	Asphalt Paving (Inc. Base Course, Fence)	• Contracting plan firmly established?	• Contracting plan firmly established? • 8a or small business likely? • Requirement for subcontracting? • Accelerated schedule or harsh weather schedule? • High-risk acquisition limits competition, design/build? • Bid schedule developed to reduce quantity risks?	See discussion in first box above.	Possible	Marginal	1	
AS-9	0	• Contracting plan firmly established?			Unlikely	Negligible	0	
AS-10	0	• Contracting plan firmly established?			Unlikely	Negligible	0	
AS-11	0	• Contracting plan firmly established?			Unlikely	Negligible	0	
AS-12	Remaining Construction Items	• Contracting plan firmly established?	• Contracting plan firmly established? • 8a or small business likely? • Requirement for subcontracting? • Accelerated schedule or harsh weather schedule? • High-risk acquisition limits competition, design/build? • Bid schedule developed to reduce quantity risks?	See discussion in first box above.	Possible	Marginal	1	
AS-13	Planning, Engineering, & Design	• Contracting plan firmly established?	• Contracting plan firmly established? • 8a or small business likely? • Requirement for subcontracting? • Accelerated schedule or harsh weather schedule? • High-risk acquisition limits competition, design/build? • Bid schedule developed to reduce quantity risks?	See discussion in first box above.	Possible	Marginal	1	
AS-14	Construction Management	• Contracting plan firmly established?	• Contracting plan firmly established? • 8a or small business likely? • Requirement for subcontracting? • Accelerated schedule or harsh weather schedule? • High-risk acquisition limits competition, design/build? • Bid schedule developed to reduce quantity risks?	See discussion in first box above.	Possible	Marginal	1	

Construction Elements						Max Potential Cost Growth	25%
					Unlikely	Negligible	
CE-1	Mobilization - Demobilization	• Potential for construction modification and claims?	No significant risks anticipated.	No specialty equipment or contractors should be required for this project.			0
CE-2	Earthwork	• Potential for construction modification and claims?	<ul style="list-style-type: none"> • Accelerated schedule or harsh weather schedule? • High risk or complex construction elements, site access, in-water? • Water care and diversion plan? • Potential for construction modification and claims? 	The primary risks concerning the earthwork are the unanticipated groundwater occurrence, re-use of excavated material for structure foundations (must have good materials for re-use), lack of water care plan and encountering HTRW's. These risks are likely to occur at some point during the construction of this project, and the cost impact would be significant.	Likely	Significant	3
CE-3	Vegetation & Topsoil	• Water care and diversion plan?	<ul style="list-style-type: none"> • Accelerated schedule or harsh weather schedule? • Water care and diversion plan? 	These construction items are not risky themselves. The lack of a water care plan, or possible accelerated schedule could pose a small risk. Cost impacts would not be significant those as these are pretty typical items with accurate unit costs being used.	Possible	Marginal	1
CE-4	Demolition	• Potential for construction modification and claims?	<ul style="list-style-type: none"> • High risk or complex construction elements, site access, in-water? • Water care and diversion plan? • Potential for construction modification and claims? 	Site accessibility could be difficult as no detailed analysis has been done into this aspect. The same can be said about the water care and diversion. Also, unanticipated structures could be found during construction or in further design phases. These risks are possible to occur, but due to use of as-builts in quantity development, current costs/quantities, are not anticipated to be impacted greatly.	Possible	Marginal	1
CE-5	Riprap & Grouted Riprap	• Water care and diversion plan?	<ul style="list-style-type: none"> • High risk or complex construction elements, site access, in-water? • Water care and diversion plan? 	Site accessibility could be difficult as no detailed analysis has been completed. Also the water care and diversion plan has not been determined either. These risks would most likely impact other areas of construction prior to the start of the riprap placement. Thus it is unlikely that the risks would occur, and impacts would be negligible.	Unlikely	Negligible	0
CE-6	Turf Reinforcement Mat	• Potential for construction modification and claims?	<ul style="list-style-type: none"> • High risk or complex construction elements, site access, in-water? • Special equipment or subcontractors needed? • Potential for construction modification and claims? 	Turf reinforcement mat placement would probably be performed by company providing the material. Lack of expertise with material may lead to problems during design, which in turn could lead to mods. Risk is likely, and impact to cost should not be large, as material quote was provided by supplier for project.	Possible	Negligible	0
CE-7	Concrete (Walls & Planters)	• Potential for construction modification and claims?	<ul style="list-style-type: none"> • High risk or complex construction elements, site access, in-water? • Water care and diversion plan? • Potential for construction modification and claims? 	This work requires the large scale placement of large concrete retaining walls and concrete planter boxes. A project of this scale has not really been completed for these items. Thus any design errors could lead to construction mods. The placement could be risky as well, due to the size, and need for everything to line up properly. These risks are likely to occur at some point throughout the project, and costs for this would be significantly impacted.	Likely	Significant	3
CE-8	Asphalt Paving (Inc. Base Course, Fence)	• Accelerated schedule or harsh weather schedule?	No significant risks anticipated.	This work is all very straight forward and no risks are expected to occur or impact costs in a significant way.	Unlikely	Negligible	0
CE-9	0	• Accelerated schedule or harsh weather schedule?			Unlikely	Negligible	0
CE-10	0	• Accelerated schedule or harsh weather schedule?			Unlikely	Negligible	0
CE-11	0	• Accelerated schedule or harsh weather schedule?			Unlikely	Negligible	0
CE-12	Remaining Construction Items	• Special equipment or subcontractors needed?	<ul style="list-style-type: none"> • High risk or complex construction elements, site access, in-water? • Unique construction methods? • Special equipment or subcontractors needed? 	Construction of the railroad trestles is a more difficult construction task. The railroad companies would need to be heavily involved and special contractor would be likely. Cost estimate assumed a sub- for this work, and has conservative unit cost. Therefore impact would be marginal, but risk is still high of something not going as planned.	Likely	Marginal	2
CE-13	Planning, Engineering, & Design	• Potential for construction modification and claims?	<ul style="list-style-type: none"> • High risk or complex construction elements, site access, in-water? • Water care and diversion plan? • Potential for construction modification and claims? 	Designs will need to be very detailed in order for the large scale structures to be constructed properly. Extra time and oversight may be required, but current PED cost should be more than adequate to complete the design work. Thus no impacts to costs are assumed.	Unlikely	Negligible	0
CE-14	Construction Management	• Potential for construction modification and claims?	<ul style="list-style-type: none"> • High risk or complex construction elements, site access, in-water? • Water care and diversion plan? • Potential for construction modification and claims? 	Assumed CM costs could differ from actual if some of the risks noted above occur. Primarily if there are mods to the contract, there could be need for more management costs. However, the risk would not be significant to overall CM costs as current CM costs are quite high.	Possible	Marginal	1

Quantities for Current Scope							Max Potential Cost Growth	20%
					Unlikely	Negligible		
Q-1	Mobilization - Demobilization	• Quality control check applied?	No significant risks anticipated.	Mob/Demob costs are not based on any quantity calculations, and therefore have no likelihood of risks and no impacts to costs.				0
Q-2	Earthwork	• Sufficient investigations to develop quantities?	• Level of confidence based on design and assumptions? • Sufficient investigations to develop quantities?	Earthwork quantities were calculated based on using one typical cross section per reach. This allows for plenty of room for changes as design progresses and more details are available. Also, investigations remain that could alter the quantity development as well. Changes to these quantities are likely to occur, and any growth in quantities would cause significant changes to costs.	Likely	Significant		3
Q-3	Vegetation & Topsoil	• Sufficient investigations to develop quantities?	• Level of confidence based on design and assumptions? • Sufficient investigations to develop quantities?	Vegetation areas were calculated based on using one typical cross section per reach. The areas are likely to change as design is refined. However, the areas are not anticipated to increase much and thus impact is assumed to be marginal.	Likely	Marginal		2
Q-4	Demolition	• Sufficient investigations to develop quantities?	• Level of confidence based on design and assumptions? • Sufficient investigations to develop quantities?	Demo quantities were calculated based on typical cross sections found in the as-built drawings. These cross sections were compared with aerials to determine lengths for quantity development. As design progresses quantities are not anticipated to increase greatly since current quantities were conservatively calculated. Thus impacts would be marginal.	Possible	Marginal		1
Q-5	Riprap & Grouted Riprap	• Sufficient investigations to develop quantities?	• Level of confidence based on design and assumptions? • Sufficient investigations to develop quantities?	The hydraulic modeling has not been finalized for this project, and thus the quantity of riprap currently assumed could change once the modeling is completed. There is a chance that more rock could be needed, and increases in this quantity would cause significant increases in costs.	Likely	Significant		3
Q-6	Turf Reinforcement Mat	• Level of confidence based on design and assumptions?	• Level of confidence based on design and assumptions?	Due to the low level of design, a single cross section per reach was used to calculate quantities for this. Increases to the amount of mats required is not anticipated to occur as conservative assumptions were already used. Any increases in quantity would impact the overall cost of this item significantly though.	Unlikely	Significant		1
Q-7	Concrete (Walls & Planters)	• Sufficient investigations to develop quantities?	• Level of confidence based on design and assumptions? • Sufficient investigations to develop quantities?	The current quantity calculations were based off one cross section per reach. Once further detailed designs are completed, and hydraulic modeling finished, the quantities would likely change. However, quantities are anticipated to change as the project progresses. Impacts to costs would be significant if the quantities increased.	Likely	Significant		3
Q-8	Asphalt Paving (Inc. Base Course, Fence)	• Sufficient investigations to develop quantities?	• Level of confidence based on design and assumptions?	Changes to the quantities for these items are not anticipated to change significantly. If they did change, costs would only be affected marginally.	Unlikely	Marginal		0
Q-9	0	• Level of confidence based on design and assumptions?			Unlikely	Negligible		0
Q-10	0	• Level of confidence based on design and assumptions?			Unlikely	Negligible		0
Q-11	0	• Level of confidence based on design and assumptions?			Unlikely	Negligible		0
Q-12	Remaining Construction Items	• Appropriate methods applied to calculate quantities?	• Level of confidence based on design and assumptions? • Appropriate methods applied to calculate quantities?	Detailed quantity take-offs have not been developed for the storm drains or the railroad trestles as no design exists currently. General assumptions were used and are likely to change, which could have a significant impact on costs.	Likely	Significant		3
Q-13	Planning, Engineering, & Design	• Sufficient investigations to develop quantities?	• Appropriate methods applied to calculate quantities? • Level of confidence based on design and assumptions? • Sufficient investigations to develop quantities?	Design level is very low at this time. Many investigations still remain to be order to accurately calculate quantities. However, current PED value should have adequate funds to account for any issues that arise for quantity development. Thus no impact to costs is assumed to occur either.	Unlikely	Negligible		0
Q-14	Construction Management	• Level of confidence based on design and assumptions?	No significant risks anticipated.	CM is not anticipated to be affected by risks to the quantities of the project.	Unlikely	Negligible		0

Specialty Fabrication or Equipment							Max Potential Cost Growth	75%
FE-1	Mobilization - Demobilization	• Risk of specialty equipment functioning first time? Test?	No significant risks anticipated.	This construction feature does not require specialty fabrication or equipment and thus no risks are anticipated.	Unlikely	Negligible	0	
FE-2	Earthwork	• Unusual parts, material or equipment manufactured or installed?	No significant risks anticipated.	This construction feature does not require specialty fabrication or equipment and thus no risks are anticipated.	Unlikely	Negligible	0	
FE-3	Vegetation & Topsoil	• Unusual parts, material or equipment manufactured or installed?	No significant risks anticipated.	This construction feature does not require specialty fabrication or equipment and thus no risks are anticipated.	Unlikely	Negligible	0	
FE-4	Demolition	• Unusual parts, material or equipment manufactured or installed?	No significant risks anticipated.	This construction feature does not require specialty fabrication or equipment and thus no risks are anticipated.	Unlikely	Negligible	0	
FE-5	Riprap & Grouted Riprap	• Unusual parts, material or equipment manufactured or installed?	No significant risks anticipated.	This construction feature does not require specialty fabrication or equipment and thus no risks are anticipated.	Unlikely	Negligible	0	
FE-6	Turf Reinforcement Mat	• Risk of specialty equipment functioning first time? Test?	• Unusual parts, material or equipment manufactured or installed? • Confidence in suppliers' ability? • Risk of specialty equipment functioning first time? Test?	There is a risk of the turf reinforcement not being sufficient to withstand the flows that may occur in the channel. Also, the supplier would most likely be a sub to the prime for installation of the material, which may be a risk in terms of methodologies. The supplier has been involved throughout this project so far, and has assured that the material is adequate for this project, so currently not likely to occur. But significant cost impacts could be accrued if it is shown that the material is not adequate.	Possible	Significant	2	
FE-7	Concrete (Walls & Planters)	• Ability to reasonably transport?	• Unusual parts, material or equipment manufactured or installed? • Confidence in suppliers' ability? • Ability to reasonably transport?	Precast planters may have some risks. These structures will be very large and may have difficulty in being manufactured and transported to project site. Also, each piece would need to be approved for placement. The region should have a supplier capable, but risk remains possible, and impact would be significant if no supplier is found and/or transportation becomes a problem.	Possible	Significant	2	
FE-8	Asphalt Paving (Inc. Base Course, Fence)	• Unusual parts, material or equipment manufactured or installed?	No significant risks anticipated.	This construction feature does not require specialty fabrication or equipment and thus no risks are anticipated.	Unlikely	Negligible	0	
FE-9	0	• Unusual parts, material or equipment manufactured or installed?			Unlikely	Negligible	0	
FE-10	0	• Unusual parts, material or equipment manufactured or installed?			Unlikely	Negligible	0	
FE-11	0	• Unusual parts, material or equipment manufactured or installed?			Unlikely	Negligible	0	
FE-12	Remaining Construction Items	• Ability to reasonably transport?	• Unusual parts, material or equipment manufactured or installed? • Confidence in contractor's ability to install? • Ability to reasonably transport?	Some prefabricated items may be required for the railroad trestle installation. The trestles are large structures and a risk could be the difficulty in making sure the materials arrive on site on schedule. Sub-contractor used should be capable of handling this and thus the risk is not likely but the impact could be large if things get delayed or fabrication can't be completed on time.	Possible	Significant	2	
FE-13	Planning, Engineering, & Design	• Unusual parts, material or equipment manufactured or installed?	• Unusual parts, material or equipment manufactured or installed?	New and different types of materials and construction elements, such as the Pyramat and planter boxes, can cause difficulty during the PED phase. There is a possible chance of these increasing PED costs, however that cost is assumed to be negligible due to the amount of the PED value being used.	Possible	Negligible	0	
FE-14	Construction Management	• Ability to reasonably transport?	• Unusual parts, material or equipment manufactured or installed? • Ability to reasonably transport?	Primary risk is the capability of the contractors to keep the transportation of the materials to the site on schedule (especially the planters). If materials are not provided on schedule significant impact to costs may be accrued.	Possible	Significant	2	

Cost Estimate Assumptions							Max Potential Cost Growth	35%
CT-1	Mobilization - Demobilization	• Site accessibility, transport delays, congestion?	• Site accessibility, transport delays, congestion?	Site accessibility and staging areas have not been fully developed. However, current mob/demob assumption results in large mob/demob costs as it is a percentage of construction. Therefore mob/demob is not anticipated to have much of an impact even if further analysis results in accessibility problems.	Possible	Marginal		1
CT-2	Earthwork	• Site accessibility, transport delays, congestion?	• Reliability and number of key quotes? • Assumptions regarding crew, productivity, overtime? • Site accessibility, transport delays, congestion?	Large volumes of excavated material will be required to be disposed of off-site. The capability of the contractor to be able to find adequate disposal locations that would accept the large volumes could be difficult. Also, traffic could be a major risk to trucks transporting the material. These risks were factored in some for unit cost development, but at time of construction could vary significantly.	Likely	Significant		3
CT-3	Vegetation & Topsoil	• Lack confidence on critical cost items?	• Lack confidence on critical cost items?	No vegetation plan has been developed. Thus, the unit cost used was developed from analyzing other local projects' cost estimates. Actual cost for vegetation could be different depending on future design. Also, amounts of irrigation required could cause cost increases. However, conservative unit cost was used and assumptions are likely to change but impact would be marginal.	Likely	Marginal		2
CT-4	Demolition	• Reliability and number of key quotes?	• Assumptions regarding crew, productivity, overtime? • Site accessibility, transport delays, congestion? • Reliability and number of key quotes?	With no site access plan, demolition of existing structures could be more difficult to access than assumed. Tipping fees were obtained for materials being demolished, but these could be different at time of construction. These risks are not anticipated to be likely, but could have significant impacts.	Possible	Significant		2
CT-5	Riprap & Grouted Riprap	• Site accessibility, transport delays, congestion?	• Reliability and number of key quotes? • Assumptions regarding crew, productivity, overtime? • Site accessibility, transport delays, congestion?	Large volumes of stone would be required, and thus would heavily depend on the material and trucking costs. If these costs are different at time of construction, which is likely, then there would be significant impacts to costs.	Likely	Significant		3
CT-6	Turf Reinforcement Mat	• Reliability and number of key quotes?	• Reliability and number of key quotes?	Cost quote for material and placement of the material was obtained. Sub-contractor mark-ups were applied as well, due to the assumption that the material supplier would also install. Quote used was in line with other projects the material was used, and therefore is unlikely to change.	Unlikely	Marginal		0
CT-7	Concrete (Walls & Planters)	• Site accessibility, transport delays, congestion?	• Site accessibility, transport delays, congestion?	Transporting the concrete material, and planter boxes could be problematic due to traffic concerns. This shouldn't cause too many delays but could be significant if it does occur.	Possible	Significant		2
CT-8	Asphalt Paving (Inc. Base Course, Fence)	• Reliability and number of key quotes?	No significant risks anticipated.	This work is very typical in this area, and no significant risks are likely to occur. Unit costs are in line with this work in the area and not anticipated to change.	Unlikely	Negligible		0
CT-9	0	• Reliability and number of key quotes?			Unlikely	Negligible		0
CT-10	0	• Reliability and number of key quotes?			Unlikely	Negligible		0
CT-11	0	• Reliability and number of key quotes?			Unlikely	Negligible		0
CT-12	Remaining Construction Items	• Lack confidence on critical cost items?	• Lack confidence on critical cost items?	No design exists for the storm drain daylighting or the railroad trestles. Conservative unit costs were used for each of these items however. Costs are likely to be different, but due to the conservative unit costs used impacts would be marginal.	Likely	Marginal		2
CT-13	Planning, Engineering, & Design	• Lack confidence on critical cost items?	• Lack confidence on critical cost items?	Current percentage used for PED is probably conservative due to the overall project costs, which generate large PED costs. Thus the likelihood of it increasing is minimal, and the impact would be marginal if it did increase.	Unlikely	Marginal		0
CT-14	Construction Management	• Lack confidence on critical cost items?	• Lack confidence on critical cost items?	Current CM percentage used is conservative due to the overall project costs, which generates large CM costs. However, some of the risks outlined above may cause increases to CM. These risks are not likely to occur and could cause marginal increases here.	Possible	Marginal		1

External Project Risks							Max Potential Cost Growth		40%
				There are several external risks that could delay the project and/or impact the overall costs. One risk is in regard to the interactions between all the agencies that would be involved in this project. Getting all the agencies on the same page could be a cause for concern moving forward. Also dealing with the overall scale of the project and all the multiple stakeholders is a risk as well. Weather is not anticipated to be a likely risk, but could impact the costs if something drastic occurred. Lastly, inflation in fuel and some materials would impact costs. Overall, these are not likely to occur, but most likely would be an impact to schedule and only marginal to costs.	Possible	Marginal			
EX-1	Mobilization - Demobilization	• Potential for market volatility impacting competition, pricing?	• Potential for severe adverse weather? • Political influences, lack of support, obstacles? • Unanticipated inflations in fuel, key materials? • Potential for market volatility impacting competition, pricing?				1		
EX-2	Earthwork	• Potential for severe adverse weather?	• Potential for severe adverse weather? • Political influences, lack of support, obstacles? • Unanticipated inflations in fuel, key materials? • Potential for market volatility impacting competition, pricing?	See discussion in first box above.	Possible	Marginal	1		
EX-3	Vegetation & Topsoil	• Potential for severe adverse weather?	• Potential for severe adverse weather? • Political influences, lack of support, obstacles? • Unanticipated inflations in fuel, key materials? • Potential for market volatility impacting competition, pricing?	See discussion in first box above.	Possible	Marginal	1		
EX-4	Demolition	• Potential for severe adverse weather?	• Potential for severe adverse weather? • Political influences, lack of support, obstacles? • Unanticipated inflations in fuel, key materials? • Potential for market volatility impacting competition, pricing?	See discussion in first box above.	Possible	Marginal	1		
EX-5	Riprap & Grouted Riprap	• Potential for severe adverse weather?	• Potential for severe adverse weather? • Political influences, lack of support, obstacles? • Unanticipated inflations in fuel, key materials? • Potential for market volatility impacting competition, pricing?	See discussion in first box above.	Possible	Marginal	1		
EX-6	Turf Reinforcement Mat	• Potential for severe adverse weather?	• Potential for severe adverse weather? • Political influences, lack of support, obstacles? • Unanticipated inflations in fuel, key materials? • Potential for market volatility impacting competition, pricing?	See discussion in first box above.	Possible	Marginal	1		
EX-7	Concrete (Walls & Planters)	• Potential for severe adverse weather?	• Potential for severe adverse weather? • Political influences, lack of support, obstacles? • Unanticipated inflations in fuel, key materials? • Potential for market volatility impacting competition, pricing?	See discussion in first box above.	Possible	Marginal	1		
EX-8	Asphalt Paving (Inc. Base Course, Fence)	• Potential for severe adverse weather?	• Potential for severe adverse weather? • Political influences, lack of support, obstacles? • Unanticipated inflations in fuel, key materials? • Potential for market volatility impacting competition, pricing?	See discussion in first box above.	Possible	Marginal	1		
EX-9	0	• Potential for severe adverse weather?			Unlikely	Negligible	0		
EX-10	0	• Potential for severe adverse weather?			Unlikely	Negligible	0		
EX-11	0	• Potential for severe adverse weather?			Unlikely	Negligible	0		
EX-12	Remaining Construction Items	• Potential for severe adverse weather?	• Potential for severe adverse weather? • Political influences, lack of support, obstacles? • Unanticipated inflations in fuel, key materials? • Potential for market volatility impacting competition, pricing?	See discussion in first box above.	Possible	Marginal	1		
EX-13	Planning, Engineering, & Design	• Potential for severe adverse weather?	• Potential for severe adverse weather? • Political influences, lack of support, obstacles? • Unanticipated inflations in fuel, key materials? • Potential for market volatility impacting competition, pricing?	See discussion in first box above.	Possible	Marginal	1		
EX-14	Construction Management	• Potential for severe adverse weather?	• Potential for severe adverse weather? • Political influences, lack of support, obstacles? • Unanticipated inflations in fuel, key materials? • Potential for market volatility impacting competition, pricing?	See discussion in first box above.	Possible	Marginal	1		

Los Angeles River
Feasibility (Alternatives)
Abbreviated Risk Analysis

	Potential Risk Areas													
	<i>Mobilization - Demobilization</i>	<i>Earthwork</i>	<i>Vegetation & Topsoil</i>	<i>Demolition</i>	<i>Riprap & Grouted Riprap</i>	<i>Turf Reinforcement Mat</i>	<i>Concrete (Walls & Planters)</i>	<i>Asphalt Paving (Inc. Base Course, F&E)</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>Remaining Construction Items</i>	<i>Planning, Engineering, & Design</i>	<i>Construction Management</i>
Project Scope Growth	3	3	1	2	3	2	3	1	-	-	-	1	3	2
Acquisition Strategy	1	1	1	1	1	1	1	1	-	-	-	1	1	1
Construction Elements	-	3	1	1	-	-	3	-	-	-	-	2	-	1
Quantities for Current Scope	-	3	2	1	3	1	3	-	-	-	-	3	-	-
Specialty Fabrication or Equipment	-	-	-	-	-	2	2	-	-	-	-	2	-	2
Cost Estimate Assumptions	1	3	2	2	3	-	2	-	-	-	-	2	-	1
External Project Risks	1	1	1	1	1	1	1	1	-	-	-	1	1	1

Typical Risk Elements

Construction Contingencies by Alternative

ALT 10 - ARBOR Riparian Transitions (ART)

Features	Construction Cost	Contingency	Total Cost
Mobilization - Demobilization	\$ 2,787,026	26.44%	\$ 3,523,915
Earthwork	\$ 19,169,720	45.78%	\$ 27,945,617
Vegetation & Topsoil	\$ 3,624,550	22.80%	\$ 4,450,948
Demolition	\$ -	24.56%	\$ -
Riprap & Grouted Riprap	\$ 11,283,850	38.88%	\$ 15,671,010
Turf Reinforcement Mat	\$ -	24.13%	\$ -
Concrete (Walls & Planters)	\$ -	47.10%	\$ -
Asphalt Paving (Inc. Base Course, Fence)	\$ 1,182,222	13.44%	\$ 1,341,113
Remaining Construction Items	\$ 1,900,000	32.86%	\$ 2,524,340
Total Construction Costs	\$ 39,947,368	38.83%	\$ 55,456,944

ALT 13 - ARBOR Corridor Extension (ACE)

Features	Construction Cost	Contingency	Total Cost
Mobilization - Demobilization	\$ 6,171,589	26.44%	\$ 7,803,357
Earthwork	\$ 32,734,957	45.78%	\$ 47,721,020
Vegetation & Topsoil	\$ 3,953,828	22.80%	\$ 4,855,301
Demolition	\$ 8,360,013	24.56%	\$ 10,413,232
Riprap & Grouted Riprap	\$ 23,109,490	38.88%	\$ 32,094,459
Turf Reinforcement Mat	\$ 9,494,344	24.13%	\$ 11,785,329
Concrete (Walls & Planters)	\$ -	47.10%	\$ -
Asphalt Paving (Inc. Base Course, Fence)	\$ 2,669,458	13.44%	\$ 3,028,233
Remaining Construction Items	\$ 1,965,760	32.86%	\$ 2,611,709
Total Construction Costs	\$ 88,459,438	36.01%	\$ 120,312,641

ALT 16 - ARBOR Narrows to Downtown (AND)

Features	Construction Cost	Contingency	Total Cost
Mobilization - Demobilization	\$ 19,938,361	26.44%	\$ 25,210,063
Earthwork	\$ 81,865,448	45.78%	\$ 119,343,449
Vegetation & Topsoil	\$ 3,872,911	22.80%	\$ 4,755,935
Demolition	\$ 30,050,117	24.56%	\$ 37,430,426
Riprap & Grouted Riprap	\$ 60,223,646	38.88%	\$ 83,638,599
Turf Reinforcement Mat	\$ 9,494,344	24.13%	\$ 11,785,329
Concrete (Walls & Planters)	\$ 46,625,927	47.10%	\$ 68,586,739
Asphalt Paving (Inc. Base Course, Fence)	\$ 7,616,160	13.44%	\$ 8,639,772
Remaining Construction Items	\$ 26,096,257	32.86%	\$ 34,671,487
Total Construction Costs	\$ 285,783,170	37.89%	\$ 394,061,800

ALT 20 - ARBOR Riparian Integration Via Varied Ecol. Reintroduction (RIVER)

Features	Construction Cost	Contingency	Total Cost
Mobilization - Demobilization	\$ 27,391,085	26.44%	\$ 34,633,288
Earthwork	\$ 113,775,573	45.78%	\$ 165,862,031
Vegetation & Topsoil	\$ 5,603,018	22.80%	\$ 6,880,507
Demolition	\$ 25,234,156	24.56%	\$ 31,431,665
Riprap & Grouted Riprap	\$ 76,784,594	38.88%	\$ 106,638,445
Turf Reinforcement Mat	\$ 11,815,774	24.13%	\$ 14,666,920
Concrete (Walls & Planters)	\$ 93,075,780	47.10%	\$ 136,914,473
Asphalt Paving (Inc. Base Course, Fence)	\$ 7,925,902	13.44%	\$ 8,991,143
Remaining Construction Items	\$ 30,999,672	32.86%	\$ 41,186,164
Total Construction Costs	\$ 392,605,556	39.38%	\$ 547,204,636

PED Contingency: 24.40%

CM Contingency: 26.25%