

*U.S. FOREST SERVICE – NATURAL RESOURCE CONSERVATION SERVICE*  
*LARGE WOOD WORKSHOP*  
*(September 2023 Craig, Alaska.)*

**Contracting for Large Wood Projects**



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- D.J. Bandowski – US Bureau of Reclamation
- Jeanne Williams – USFS Region 6 Contracting
- Brian Bair – USFS TEAMS Enterprise Unit

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## Topics



- **Types of Contracts**
- **Contract Parts**
- **Specifications**
- **Cost Estimates**

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## Contract Preparation: What do you need to develop your contract?

Contract development checklist.

- Checklist of Items from Project Planning and Design
- Construction Drawings (Plans)
- Construction Specifications (Specs)
- Independent Government Cost Estimate (IGCE)
- Design Documentation (Report)
- Quantity Calculations
- Implementation Schedule (Timeline)
- Bid Schedule/Line Items (BID)
- Agreements/Landowner Consent
- Right of Entry (ROE)/Right-of-Way (ROW)
- Government Furnished Materials/Information (GFM or GFI)



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## Acquisition Methods

1. **Sealed Bids** – FAR Part 14
  - A. Invitation for bid (IFB)
  - B. Based on price related factors only
  - C. *“Low Bid” No Choice only lowest responsive bidder*
2. **Negotiation** – FAR Part 15
  - A. Request for Proposal - RFP
  - B. Based on Price and non price factors
  - C. Allows for selection of “Best Value”
  - D. *Typically best technical proposal, experience, & references. Can include a price component. All questions developed and weighted before contract solicitation*



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## Contract Type

### ***Firm Fixed Price***

Fixed-Price family contracts are the most common type of contract that is used for construction work due to their low risk application and increased efficiencies to the federal government. Work must be well described and involves a end product

### ***Time and Materials***

Time-and-Materials (T&M) or Labor-Hour (LH) contract methods may be used only when it is not possible at the time of placing the contract to estimate accurately the extent or duration of the work or to anticipate costs with any reasonable degree of confidence. (FAR 16.601(c)).

Hybrid Contract 

**Contract can be mostly fixed price but has equipment rental for functions like log jam construction or instream rock structures that can be difficult to describe the proper placement.**

**(THIS IS THE BEST OPTION IF THE CONTRACTING OFFICER WILL LET YOU!)**


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## Work Types

**Construction** – FAR 2.10: (Produces a product)  
 “Construction” is defined as construction, alteration, or repair (including dredging, excavating, painting) of buildings, structures, or other real property.”

**Service Contracts** – FAR 37.101: Provides a service)  
 “Service Contract” is defined as a contract that directly engages the time and effort of a contractor whose primary purpose is to perform identifiable task rather than to furnish an end item of supply. “

*Note: Davis Bacon act applies to construction contracts and not necessarily Service Contracts. Hence higher costs for the construction contract.*



Used for items that can describe the work easily

if the task can be defined specifically rather than the end product

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## “Contract”

### “The Parts”

Large wood restoration contracts are similar to other contracts as far as required contract documents needed for the project. Contracts are made up of:

RED highlights show what you need to provide contracting for advertisement

Section	Title
Part I – The Schedule	
A	Solicitation/Contract Form
B	Supplies or Services and Prices (Bid Schedule)
C	Description/Specifications/Statement of Work (SOW)/Performance Work Statement (PWS)
D	Packaging and Marking
E	Inspection and Acceptance
F	Deliveries or Performance
G	Contract Administration Data
H	Special Contract Requirements
Part II – Contract Clauses	
I	Contract Clauses
Part III – List of Documents, Exhibits, and Other Attachments	
J	List of Documents, Exhibits, and Other Attachments
Part IV – Representations and Instructions	
K	Representation, certifications, and other statements of bidders
L	Instructions, conditions, and notices to bidders
M	Evaluation factors for award

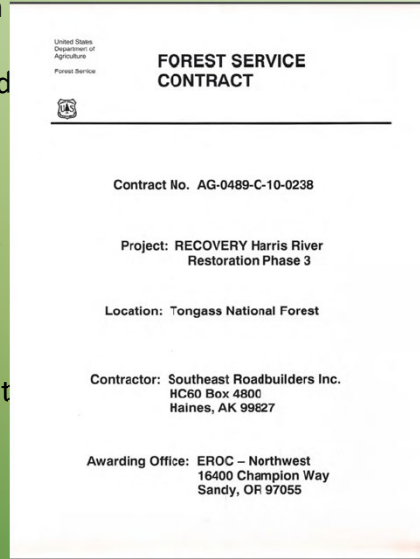
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## “The Schedule”

*Section B* – Has the bid schedule which consists of pay items, estimated quantities, method of measurement and payment

*Section C* - Includes the Scope and statement of work, Description of work, and general and specific construction and materials specifications

*Section H* – Special contract clauses that principally pertain to this job or are requirements that need emphasis.



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### SECTION B SCHEDULE OF ITEMS

ITEM NO.	DESCRIPTION	PAY UNIT	METHOD OF MEASUREMENT	ESTIMATED QTY	UNIT PRICE	TOTAL PRICE
15101	Mobilization	Lump Sum	LS	1	\$ _____	\$ _____
15722	Dewatering Pumps and appurtenances (6" min hose dia)	Lump Sum	LS	1	\$ _____	\$ _____
15723	Dewatering Materials	Lump Sum	LS	1	\$ _____	\$ _____
15724	Soil Erosion & Pollution Control Materials Only	Lump Sum	LS	1	\$ _____	\$ _____
20404	Unclassified Borrow, Compaction Method C, Finishing Method C	CY	CQ	906	\$ _____	\$ _____

Pay Items for standard work that is well described

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SECTION B SCHEDULE OF ITEMS						
ITEM NO.	DESCRIPTION	PAY UNIT	METHOD OF MEASUREMENT	ESTIMATED QTY	UNIT PRICE	TOTAL PRICE
62201	Hydraulic Excavator #1 (300 Hitachi backhoe or equivalent)	Hour	AQ	183	\$ _____ _____	\$ _____ -
62201	Hydraulic Excavators #4 (120 Hitachi backhoe or equivalent)	Hour	AQ	89	\$ _____ _____	\$ _____ -
62201	Dump Truck #1 (12 – 25cy)	Hour	AQ	16	\$ _____ _____	\$ _____ -
62201	Log Truck #1 (U54 highway loads with high bunks)	Hour	AQ	45	\$ _____ _____	\$ _____ -

Pay Items for work that are "NOT WELL" described use equipment rental

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### "The Schedule – Section C"

**Section C** - is the "Description/Specification/work statement" and contains:

- **Scope of work** – What work is required to complete the project. e.g. Excavation, Dewatering, Clearing, Hauling, Construction of log and rock in-stream structures, placement of stream bed materials, etc.
- **Location of work** – A descriptive location of the general project area, location of approximate construction, and a description of local community and its services (full service or limited)
- **Description of work** – A brief but thorough description of what will be done and how much. e.g. reconstruct 1000ft of channel, construct 5 log jams, furnish and install a temporary 30ft modular bridge, etc.

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## “The Schedule – Section C” Cont’d

**Section C** - is the “Description/Specification/work statement” and contains:

- **Price Range** – Approximate price range between low and high anticipated costs. e.g. \$500,000 to \$1,000,000
- **Work Commencement and Yearly Work** - if multiple year contract
- **General Conditions** - a more in-depth description of work and specific information that applies to different phases/tasks as required
- **Specifications** – references for base spec’s and a list of modified spec’s and all applicable spec for construction and materials



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## The Schedule – Section C” Cont’d

**Section H** – contains all special clause requirements that are not covered by the project specs or require special emphasis such as:

- **Archeological / historic sites requirements**
- **Order of Precedence** - for the contract documents . **Very important for construction contracts!**
- **Landscape Preservation**
- **Instream Work Windows**
- **Road Maintenance Requirements**
- **Material Source locations**
- **Maintenance of Traffic**
- **Equipment requirements**

### SECTION H – SPECIAL CONTRACT REQUIREMENTS

#### AGAR 452.236-73 ARCHAEOLOGICAL OR HISTORIC SITES (FEB. 1988)

If a previously unidentified archaeological or historic site(s) is encountered, the contractor shall discontinue work in the general area of the site(s) and notify the Contracting Officer immediately.

#### H.1 ORDER OF PRECEDENCE - REQUIREMENTS, SPECIFICATIONS, DRAWINGS

Resolve any inconsistencies in the Specifications of this solicitation and any resultant contract by giving precedence in the following order:

- (a) Section H - Special Contract Requirements
- (b) Special Project Specifications (Latest date highest precedence)
  1. Tongass National Forest (TNF) special Project Specifications
  2. Region 10 Special Project Specifications
  3. National Special Project Specifications
- (c) Standard Specifications
- (d) Drawings
  1. Drawings, figured dimensions over scaled dimensions
  2. Drawings, large scale contract drawings over small scale contract drawings
  3. Schedules on contract drawings over any conflicting notations on contract drawings.
  4. Shop Drawings - (The term "Shop Drawings", includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the Contractor to explain in detail specific portions of the work required by the contract.)

#### H.2 LANDSCAPE PRESERVATION

- (a) Confine operations to within the clearing limits or other areas designated in contract documents, and prevent the depositing of rocks, excavated materials, stumps, or other debris outside of these limits. Unless otherwise agreed to by the CO, retrieve material which falls outside of these limits and either incorporate the material in the work or dispose of the material as directed by the CO.

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## Contract Clauses – Applicable F.A.R.’s

This section contains the applicable Federal Acquisition Regulations.

This is the “Boiler Plate” part of the contract that the Contracting Officer or Lawyers for private or NGO organizations add.

Cover legal requirements such as:

- Payrolls
- Wages
- Sub Contracts
- Contract Termination
- Disputes Accident Prevention
- Schedules
- Warranty of Construction

PART II-CONTRACT CLAUSES  
SECTION I-CONTRACT CLAUSES

**1.1 FAR 52.252-2 Clauses Incorporated by Reference (FEB 1998)**

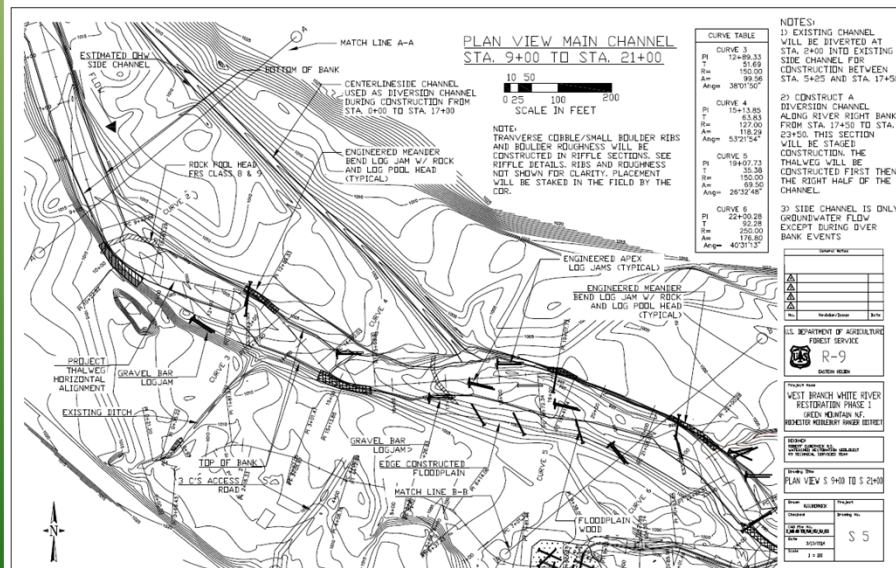
This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this address(es):  
[www.acquisition.gov/far](http://www.acquisition.gov/far)  
[www.usda.gov/procurement/policy/agar.html](http://www.usda.gov/procurement/policy/agar.html)

FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1) CLAUSES

52.202-1	Definitions (JUL 2004)
52.203-3	Gratuities (APR 1984)
52.203-5	Covenant Against Contingent Fees (APR 1984)
52.203-6	Restrictions on Subcontractor Sales to the Government (SEP 2006)
52.203-7	Anti-Kickback Procedures (JUL 1995)
52.203-8	Cancellation, Rescission, and Recovery of Funds for Illegal or Improper Activity (JAN 1997)
52.203-10	Price or Fee Adjustment for Illegal or Improper Activity (JAN 1997)
52.203-12	Limitation on Payments to Influence Certain Federal Transactions (SEP 2007)
52.204-4	Printed or Copied Double-Sided on Recycled Paper (AUG 2000)
52.209-6	Protecting the Government's Interest when Subcontracting with Contractors Debarred, Suspended, or Proposed for Debarment (SEP 2006)
52.211-18	Variation in Estimated Quantity (APR 1984)
52.219-3	Notice of Total HUBZone Set-Aside (JAN 1999)
52.219-8	Utilization of Small Business Concerns (MAY 2004)
52.219-14	Limitations on Subcontracting (DEC 1996)
52.222-3	Convict Labor (JUN 2003)
52.222-4	Contract Work Hours and Safety Standards Act -- Overtime Compensation (JUL 2005)
52.222-6	Davis-Bacon Act (JUL 2005)
52.222-7	Withholding of Funds (FEB 1988)
52.222-8	Payrolls and Basic Records (DEVIATION, JAN 2010)
52.222-9	Apprentices and Trainees (JUL 2005)
52.222-10	Compliance with Copeland Act Requirements (FEB 1988)
52.222-11	Subcontracts (Labor Standards) (JUL 2005)
52.222-12	Contract Termination - Debarment (FEB 1988)
52.222-13	Compliance with Davis-Bacon and Related Act Regulations (FEB 1988)
52.222-14	Disputes Concerning Labor Standards (FEB 1988)
52.222-15	Certification of Eligibility (FEB 1988)
52.222-21	Prohibition of Segregated Facilities (FEB 1999)
52.222-26	Equal Opportunity (MAR 2007)
52.222-27	Affirmative Action Compliance Requirements for Construction (FEB 1999)
52.222-35	Equal Opportunity for Special Disabled Veterans, Veterans of the Vietnam Era, and other Eligible Veterans (SEP 2006)
52.222-36	Affirmative Action for Workers with Disabilities (JUN 1998)

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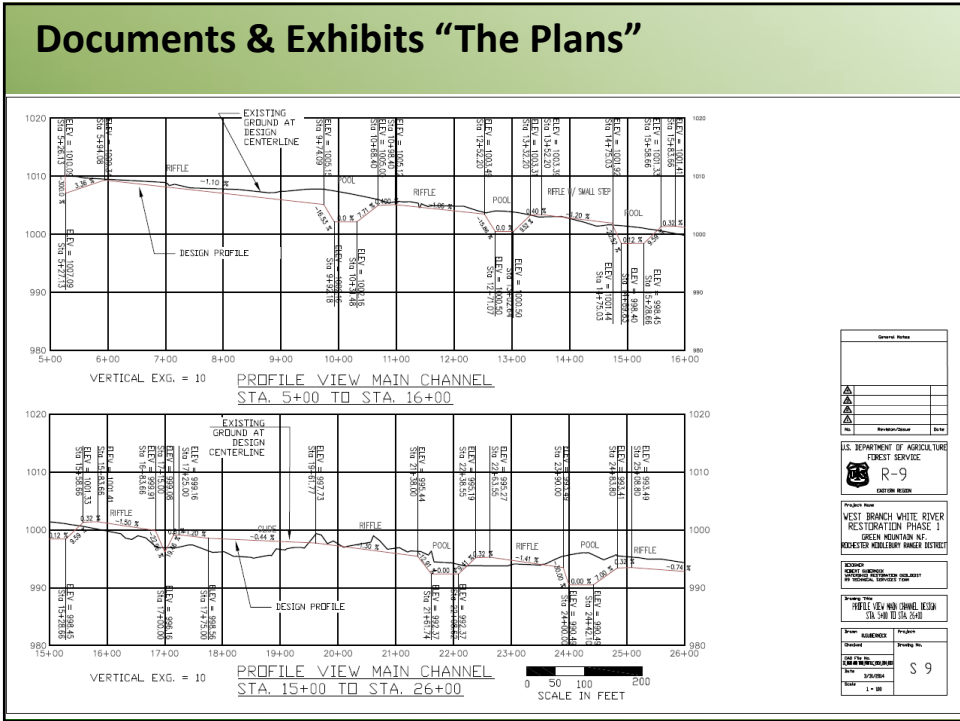
## Documents & Exhibits “The Plans”



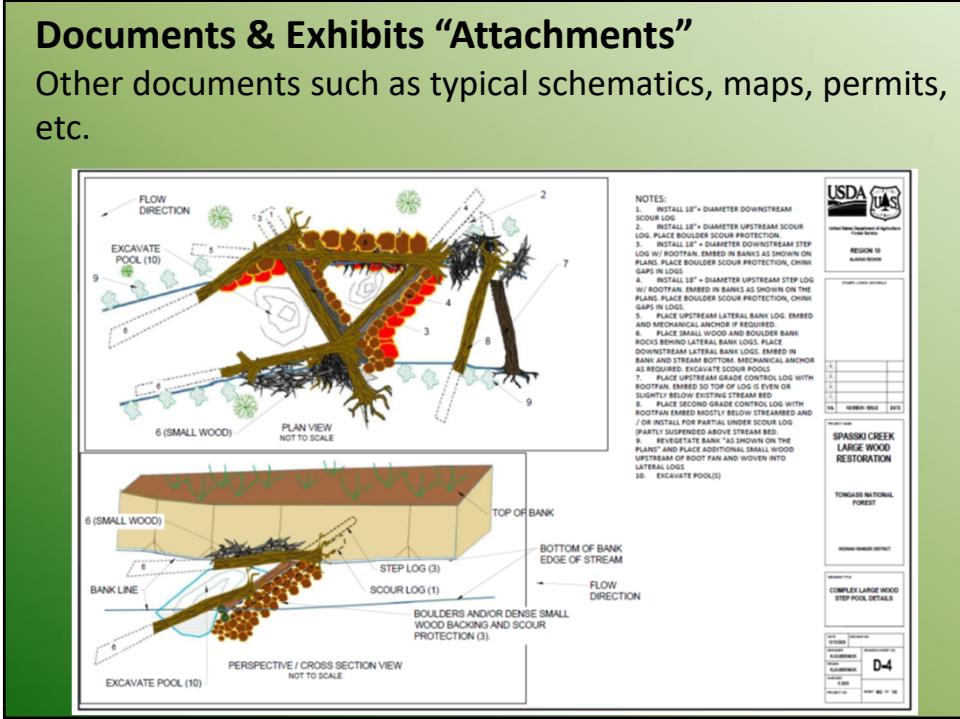
Make sure enough detail is added so Contractors know what work is expected to be built

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## Documents & Exhibits "Attachments"

Other documents such as typical schematics, maps, permits, etc.

**Profile View**

**NOTES:**

1) Excavate trench for scour log(s). Place scour log and backfill. Excavate Lateral Bar jam key log trenches (-1 to 4 required) parallel with bank and or gravel bar. Excavate trench(s) so the end of the stem is 6ft below the streambed grading up to the root fan. The root fan should set lower than the stream bed so the log at the root ball rests on the top of the bar and scour logs. Place key logs and backfill 2) Excavate trench for ballast log and embed a minimum of 1/3 its length or as designated in the field by the engineer 3) Place remaining excavated gravel and streambed materials over the embedded logs and compact. 4) Place weave / rack additional trees, logs at upstream face of log structure at the root fan. 5) Plant willows or other vegetation as required in the plans. Note: actual log lengths may vary if mechanical anchor system is used

USDA FOREST SERVICE  
 PROJECT NO: XXX-XXX-XXXX  
 STRUCTURE: LATERAL BAR LOG JAM  
 DATE: 8/1/2023  
 DESIGNED BY: BOB OLSBERG  
 DRAWN BY: J. SUBERSIDE

XXXXXXXX XXXXXXXX XXXXXXXXXXXXXXXX  
 DEPARTMENT OF ARMY PERMIT  
 LATERAL BAR LOG JAM PLAN VIEW  
 LAT XX' XX' XX' XX" W LONG XX' XX' XX' XX" NAD 83
APPLICANT: XXX XXXXXXXX  
 USDA FOREST SERVICE  
 DATE: XX-XX-XXXX  
 SHEET X

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## Cost Estimation

Costs are developed by :

- **Work cost estimates from previous contracts.**
  - Bids from previous work is good way to cost commonly used pay items such as excavation, Haul, borrow excavation, riprap or armor rock placement, etc. **For budgeting purposes, use the average cost not the low bid!**
- **Constructed Time and Motion costs**
  - Best for work items such as log jam construction and wood placement
  - Based on Equipment with operator hourly costs
  - Production capabilities of the equipment
  - Efficiency at the work site based on site conditions
    - Operating space
    - Operator experience
    - Terrain characteristics

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BID ABSTRACT		Cost Estimation – “Bid Tabs”											
Issuing Office: EROC Northwest 16400 Champion Way Sandy, OR 97055		Unit Rates for various Pay Items											
Funds Available: \$500,000													
Number of Amendments: 2													
		Government Estimate		Contractor 1		Contractor 2		Contractor 3		Contractor 4		Total	
Item No.	Description	Qty	Unit	Unit Price	Total	Unit Price	Total	Unit Price	Total	Unit Price	Total	Unit Price	Total
171(03)	Staking Structures	3	EA	\$2,000.00	\$6,000.00	\$900.00	\$2,700.00	\$10,000.00	\$30,000.00	\$1,250.00	\$3,750.00	\$1,500.00	\$4,500.00
202(02)	Removal of Culverts	3	EA	\$1,400.00	\$4,200.00	\$1,250.00	\$3,750.00	\$2,500.00	\$7,500.00	\$400.00	\$1,200.00	\$750.00	\$2,250.00
203(08)	Borrow Excavation	1223	CY	\$18.00	\$22,014.00	\$9.50	\$11,618.50	\$15.00	\$18,345.00	\$15.00	\$18,345.00	\$8.00	\$9,784.00
203(21)	Haul	1470	CY	\$3.50	\$5,145.00	\$3.40	\$4,998.00	\$2.00	\$2,940.00	\$3.00	\$4,410.00	\$3.00	\$4,410.00
203(22)	End Haul	752	CY	\$15.00	\$11,280.00	\$8.00	\$6,016.00	\$9.00	\$6,768.00	\$4.50	\$3,384.00	\$10.00	\$7,520.00
220(02)	Controlled Blasting	30	CY	\$300.00	\$9,000.00	\$50.00	\$1,500.00	\$120.00	\$3,600.00	\$100.00	\$3,000.00	\$100.00	\$3,000.00
251(01)A	Placed Riprap, Class 4	119	CY	\$62.00	\$7,378.00	\$25.00	\$2,975.00	\$90.00	\$10,620.00	\$40.00	\$4,760.00	\$30.00	\$3,570.00
251(01)B	Placed Riprap, Class 5	43	CY	\$62.00	\$2,686.00	\$25.00	\$1,075.00	\$90.00	\$3,870.00	\$40.00	\$1,720.00	\$30.00	\$1,290.00
252(01)	Special Rock Embankment	12	CY	\$150.00	\$1,800.00	\$100.00	\$1,200.00	\$48.00	\$576.00	\$155.00	\$1,860.00	\$30.00	\$360.00
601(01)	Mobilization	1	LS	\$35,000.00	\$35,000.00	\$30,000.00	\$18,000.00	\$49,500.00	\$48,500.00	\$50,000.00	\$50,000.00	\$34,000.00	\$34,000.00
603(09A)	72-in Aluminum Pipe	40	FT	\$555.00	\$22,200.00	\$685.00	\$27,400.00	\$421.00	\$16,840.00	\$600.00	\$24,000.00	\$800.00	\$32,000.00
603(09)B	96-in Aluminum Pipe	58	FT	\$1,300.00	\$75,400.00	\$740.00	\$42,920.00	\$390.00	\$22,620.00	\$650.00	\$39,700.00	\$500.00	\$29,000.00
603(11)	117-in Span, 79-in Rise Aluminum Pipe	50	FT	\$1,300.00	\$65,000.00	\$865.00	\$43,250.00	\$700.00	\$35,000.00	\$750.00	\$37,500.00	\$1,000.00	\$50,000.00
603(21)	Steel Weirs	10	EA	\$900.00	\$9,000.00	\$230.00	\$2,300.00	\$2,000.00	\$20,000.00	\$250.00	\$2,500.00	\$0.00	\$0.00
638(03A)	Culvert Streambed Material, Class 9	76	CY	\$185.00	\$14,060.00	\$285.00	\$21,660.00	\$48.00	\$3,648.00	\$150.00	\$11,400.00	\$30.00	\$2,700.00
638(03)B	Culvert Streambed Material, Class 12	16	CY	\$185.00	\$2,960.00	\$285.00	\$4,560.00	\$48.00	\$768.00	\$150.00	\$2,400.00	\$30.00	\$480.00
638(05A)	Rock Weir Class 5	9	EA	\$555.00	\$5,000.00	\$1,550.00	\$13,950.00	\$1,100.00	\$9,900.00	\$300.00	\$2,700.00	\$450.00	\$4,050.00
638(05)B	Rock Weir Class 9	1	EA	\$555.00	\$555.00	\$1,550.00	\$1,550.00	\$1,100.00	\$1,100.00	\$300.00	\$300.00	\$450.00	\$450.00
638(05)A	Placed Streambed Rock, Class 9	12	CY	\$185.00	\$2,220.00	\$100.00	\$1,200.00	\$48.00	\$576.00	\$155.00	\$1,860.00	\$30.00	\$360.00
638(05)B	Placed Streambed Rock, Class 12	25	CY	\$185.00	\$4,625.00	\$100.00	\$2,500.00	\$48.00	\$1,200.00	\$155.00	\$3,875.00	\$30.00	\$750.00
<b>SUBTOTAL - BASE ITEMS</b>				<b>\$366,988.00</b>		<b>\$214,222.50</b>		<b>\$207,891.00</b>		<b>\$216,724.00</b>		<b>\$190,054.00</b>	
171(03)	Staking Structures	1	EA	\$2,000.00	\$2,000.00	\$900.00	\$900.00	\$10,000.00	\$10,000.00	\$1,250.00	\$1,250.00	\$1,500.00	\$1,500.00
202(02)	Removal of Culverts	1	EA	\$1,400.00	\$1,400.00	\$1,250.00	\$1,250.00	\$2,500.00	\$2,500.00	\$400.00	\$400.00	\$750.00	\$750.00
203(08)	Borrow Excavation, Placement	829	CY	\$18.00	\$14,922.00	\$9.50	\$7,874.50	\$15.00	\$12,435.00	\$15.00	\$12,435.00	\$8.00	\$6,632.00
203(21)	Haul	141	CY	\$3.50	\$493.50	\$3.40	\$479.40	\$2.00	\$282.00	\$3.00	\$423.00	\$3.00	\$423.00
203(22)	End Haul	301	CY	\$15.00	\$4,515.00	\$8.00	\$2,408.00	\$9.00	\$2,709.00	\$6.00	\$1,806.00	\$10.00	\$3,010.00
220(02)	Controlled Blasting	70	CY	\$300.00	\$21,000.00	\$50.00	\$3,500.00	\$120.00	\$8,400.00	\$100.00	\$7,000.00	\$100.00	\$7,000.00
251(01)A	Placed Riprap, Class 4	47	CY	\$62.00	\$2,914.00	\$25.00	\$1,175.00	\$90.00	\$3,820.00	\$45.00	\$2,115.00	\$30.00	\$1,410.00
252(01)	Special Rock Embankment	17	CY	\$150.00	\$2,550.00	\$100.00	\$1,700.00	\$60.00	\$1,020.00	\$150.00	\$2,550.00	\$30.00	\$510.00
601(01)	Mobilization	1	LS	\$10,000.00	\$10,000.00	\$8,500.00	\$8,500.00	\$15,000.00	\$15,000.00	\$2,400.00	\$2,400.00	\$0.00	\$0.00
608(11)	142-in Span 91-in rise, Aluminumized Steel Pipe	60	FT	\$2,100.00	\$126,000.00	\$1,180.00	\$70,800.00	\$800.00	\$48,000.00	\$900.00	\$54,000.00	\$1,000.00	\$60,000.00
638(03A)	Culvert Streambed Material	46	CY	\$185.00	\$8,510.00	\$285.00	\$13,110.00	\$48.00	\$2,208.00	\$150.00	\$6,900.00	\$30.00	\$1,380.00
<b>SUBTOTAL - OPTION 1</b>				<b>\$196,384.50</b>		<b>\$111,897.90</b>		<b>\$105,374.00</b>		<b>\$81,172.50</b>		<b>\$62,615.00</b>	
171(03)	Staking Structures	1	EA	\$2,000.00	\$2,000.00	\$900.00	\$900.00	\$10,000.00	\$10,000.00	\$1,250.00	\$1,250.00	\$1,500.00	\$1,500.00
202(02)	Removal of Culverts	1	EA	\$1,400.00	\$1,400.00	\$1,250.00	\$1,250.00	\$3,000.00	\$3,000.00	\$400.00	\$400.00	\$750.00	\$750.00
203(08)	Borrow Excavation	381	CY	\$18.00	\$6,858.00	\$9.50	\$3,619.50	\$15.00	\$5,715.00	\$15.00	\$5,715.00	\$8.00	\$3,048.00
203(21)	Haul	1538	CY	\$3.50	\$5,383.00	\$3.40	\$5,229.20	\$3.00	\$4,614.00	\$2.50	\$3,845.00	\$3.00	\$4,614.00
203(22)	End Haul	361	CY	\$15.00	\$5,415.00	\$8.00	\$2,888.00	\$9.00	\$3,249.00	\$6.00	\$2,166.00	\$10.00	\$3,610.00
251(01)B	Placed Riprap, Class 5	678	CY	\$62.00	\$42,036.00	\$25.00	\$16,950.00	\$98.00	\$66,564.00	\$27.50	\$18,645.00	\$30.00	\$20,340.00
251(13)	Ceotestite, Type I/LS	2538	SF	\$3.00	\$7,614.00	\$1.00	\$2,538.00	\$6.00	\$15,228.00	\$0.65	\$1,649.70	\$1.00	\$2,538.00
558(01)	Bridge Superstructure	1	EA	\$75,000.00	\$75,000.00	\$75,425.00	\$75,425.00	\$80,000.00	\$80,000.00	\$62,000.00	\$62,000.00	\$68,000.00	\$68,000.00
601(01)	Mobilization	1	LS	\$10,000.00	\$10,000.00	\$9,000.00	\$9,000.00	\$15,000.00	\$15,000.00	\$5,000.00	\$5,000.00	\$0.00	\$0.00
606(01)	Quarantal System Type 1	100	FT	\$120.00	\$12,000.00	\$75.50	\$7,550.00	\$100.00	\$10,000.00	\$200.00	\$20,000.00	\$100.00	\$10,000.00
638(05)B	Rock Weir FRS, Class 7	1	EA	\$555.00	\$555.00	\$1,550.00	\$1,550.00	\$1,500.00	\$1,500.00	\$500.00	\$500.00	\$450.00	\$450.00
638(05)B	Placed Streambed Rock, Class 9	64	CY	\$185.00	\$11,840.00	\$100.00	\$6,400.00	\$48.00	\$3,072.00	\$85.00	\$5,440.00	\$30.00	\$1,920.00
<b>SUBTOTAL - OPTION 2</b>				<b>\$180,131.00</b>		<b>\$133,898.70</b>		<b>\$198,922.00</b>		<b>\$156,769.70</b>		<b>\$116,770.00</b>	
<b>TOTAL ALL ITEMS</b>				<b>\$683,433.50</b>		<b>\$459,620.10</b>		<b>\$536,897.00</b>		<b>\$465,257.20</b>		<b>\$389,439.00</b>	

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## Cost Estimation – “Time and Motion”

### Constructed costs based on Time and Equipment Rates

**Log Jam Construction** – Placement of logs and associated excavation from a stockpile close/adjacent to the site  
**Average 3.5 logs per hour – Range 2 to 5 logs / hour**

**Rootwad Tree Harvest** – Includes excavation, pushing down tree, and mobe to stockpile site  
**1 to 2 trees per hour depending on terrain, distance to stockpile, and proximity to other trees**

For more info equipment production rates see:  
[http://nees.ucsd.edu/facilities/docs/Performance\\_Handbook\\_41\\_6C.pdf](http://nees.ucsd.edu/facilities/docs/Performance_Handbook_41_6C.pdf)

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## Cost Estimation – “Time and Motion” Example Production Rates from Caterpillar Handbook

Cubic Yards per 60 Minute Hour\*

ESTIMATED CYCLE TIMES		ESTIMATED BUCKET PAYLOAD** — LOOSE CUBIC YARDS																				ESTIMATED CYCLE TIMES	
Cycle Time																						Cycles Per Min.	Cycles Per Hr.
Seconds	Min.	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.50	5.00	5.25			
10.0	0.17																					6.0	360
11.0	0.18																					5.5	330
12.0	0.20	75	150	225	300	375																5.0	300
13.3	0.22	87	135	202	270	337	404	472	540	607	675	742	810	877	945	1012	1080	1215	1350	1417	4.5	270	
15.0	0.25	80	120	180	240	300	360	420	480	540	600	660	720	780	840	900	960	1080	1200	1260	4.0	240	
17.1	0.29	52	105	157	210	262	315	367	420	472	525	577	630	682	735	787	840	945	1050	1102	3.5	210	
20.0	0.33	45	90	135	180	225	270	315	360	405	450	495	540	585	630	675	720	810	900	945	3.0	180	
24.0	0.40	37	75	112	150	187	225	262	300	337	375	412	450	487	525	562	600	675	750	787	2.5	150	
30.0	0.50	30	60	90	120	150	180	210	240	270	300	330	360	390	420	450	480	510	600	630	2.0	120	
35.0	0.58	38	51	77	102	128	154	180	205	231	256	282	308	333	360	385	410	462	513	535	1.7	102	
40.0	0.67					112	135	157	180	202	225	247	270	292	315	337	360	405	450	472	1.5	90	
45.0	0.75									180	200	220	240	260	280	300	320	360	400	408	1.3	78	
50.0	0.83																				1.2	72	

Job Efficiency Estimator	
Work Time/Hour	Efficiency
60 Min	100%
55	91%
50	83%
45	75%
40	67%

\*Actual hourly production = (60 min. hr. production) × (Job Efficiency Factor)  
 \*\*Estimated Bucket Payload = (Amount of Material in the Bucket) × (Bucket Fill Factor)  
 = (Heaped Bucket Capacity) × (Bucket Fill Factor)  
 Unshaded area indicates average production.

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???QUESTIONS???



YOU DON'T GET WHAT YOU EXPECT YOU GET WHAT YOU INSPECT!

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