

**INVITATION FOR INFORMAL BIDS FOR A SERVICE CONTRACT FROM PENDER SOIL AND WATER CONSERVATION DISTRICT FOR HURRICANE FLORENCE DISASTER RECOVERY DEBRIS REMOVAL**

NOTICE IS HEREBY GIVEN THAT THE PENDER SOIL AND WATER CONSERVATION DISTRICT IS SOLICITING CONTRACTORS AND PROFESSIONAL FIRMS TO PERFORM THE REMOVAL OF STREAM DEBRIS IN SEVERAL LOCATIONS IN PENDER COUNTY. THIS BID PACKET IS CONSIDERED PENDER SOIL AND WATER CONSERVATION DISTRICT. THIS PLANNED WORK AREAS ARE REFERENCED ON THE ATTACHED PROJECT MAPS. THERE WILL BE NO GROUP SITE SHOWING FOR THESE PROJECTS. THE CONTRACTORS BIDDING ARE REQUIRED TO MAKE A MANDATORY SITE VISIT TO THE AREAS TO DETERMINE THEIR BID PRICE AND WILL BE REQUIRED TO SIGN A STATEMENT.

PLEASE REFERENCE THE FOLLOWING IMPORTANT DOCUMENTS:

\*PROJECT MAP

\*SCOPE OF WORK

\*WOODY DEBRIS REMOVAL GUIDELINES TITLED "INCREMENTAL EFFECTS OF LARGE WOODY DEBRIS REMOVAL ON PHYSICAL AQUATIC HABITAT"

\*STREAMFLOW REHABILITATION ASSISTANCE PROGRAM (STRAP) – DEBRIS REMOVAL & PROCESSING RECOMMENDATIONS (GS 139-65) AND STRAP RECOMMENDATIONS ON PERMITS FOR STRAP PROJECTS

\*PROJECT BID SHEET

THE SCOPE OF WORK DESCRIBES THE NORTH CAROLINA REQUIREMENTS FOR RECEIVING PAYMENT FOR COMPLETED WORK. THE PENDER SOIL AND WATER CONSERVATION DISTRICT WILL BE THE CONTRACTING AGENCY FOR THIS PROJECT; HOWEVER YOU SHOULD REFERENCE THE CONTRACT IN ORDER TO UNDERSTAND HOW THE PAYMENT PROCESS WORKS AND NOTE OTHER ITEMS THAT WILL BE REQUIRED SHOULD YOU BE AWARDED THE CONTRACT.

WORK MUST BE COMPLETED ACCORDING TO THE WOODY DEBRIS REMOVAL GUIDELINES TITLED "INCREMENTAL EFFECTS OF LARGE WOODY DEBRIS REMOVAL OF PHYSICAL AQUATIC HABITAT" AND THE STREAMFLOW REHABILITATION ASSISTANCE PROGRAM – DEBRIS REMOVAL & PROCESSING RECOMMENDATIONS (GS 139-65) AND THE) AND STRAP RECOMMENDATIONS ON PERMITS FOR STRAP PROJECTS. PENDER SOIL AND WATER DISTRICT WILL REQUIRE THAT THE DEBRIS REMOVAL BE PLACED OUTSIDE OF STREAM ALONG STREAM BANK AND ON THE SAME SIDE THAT IT ORIGINATED.

BIDS MUST CLEARLY STATE THE TOTAL PRICE FOR COMPLETING THE CONTRACT, NOT A PRICE PER FOOT. LENGTHS REFERENCED IN THIS NOTICE AND ON THE PROJECT MAP ARE APPROXIMATE AND WILL NOT BE USED TO DETERMINE PAYMENT OR PROJECT COMPLETION.

PROJECT BID SHEETS MUST BE RECEIVED NO LATER THAN **THURSDAY, DECEMBER 1, 2022**. SEND PROJECT BID SHEETS IN A SEALED ENVELOPE MARKED PENDER SOIL AND WATER CONSERVATION DISTRICT STORM DEBRIS PROJECT TO PENDER SOIL AND WATER CONSERVATION DISTRICT OFFICE, 801 S WALKER STREET, BURGAW, NC 28425. PLEASE INCLUDE COPIES OF REFERENCE LETTERS OR OTHER DOCUMENTATION OF PRIOR WORK EXPERIENCE. QUESTIONS REGARDING WOODY DEBRIS REMOVAL BID PACKET SHOULD BE DIRECTED TO PENDER SOIL AND WATER CONSERVATION DISTRICT OFFICE STAFF (910)259-9123X3

BIDS WILL BE PUBLICLY OPENED AND READ ALOUD ON **FRIDAY DECEMBER 2, 2022 AT 9:00 AM** AT PENDER SOIL AND WATER CONSERVATION DISTRICT 801 SOUTH WALKER STREET BURGAW NC 28425.

**ALL BID AWARDS WILL BE FINAL AFTER ALL REFERENCES HAVE BEEN REVIEWED AND VERIFIED BY PENDER SOIL AND WATER CONSERVATION DISTRICT STAFF.**

**CONSTRUCTION SPECIFICATIONS**

**DISASTER RECOVERY 2018**

**HURRICANE FLORENCE STREAM DEBRIS REMOVAL**

**1. LOCATION:**

THE SITE IS LOCATED IN PENDER COUNTY, STATE OF NORTH CAROLINA (SEE MAP INCLUDED IN PACKET). STREAM TO BE CLEARED IS HIGHLIGHTED ON THE ATTACHED MAP. **RYLIES CREEK (34,950')** WILL BE CLEARED AT THE CONJUNCTION OF RYLIES CREEK AND LONG CREEK (-78.026, 34.424) TO THE CONJUNCTION OF KELLYS CREEK, MILL CREEK, AND RYLIES CREEK (-77.969, 34.470)

**2. SCOPE OF WORK:**

THE CONTRACTOR MUST PROVIDE PROOF OF INSURANCE AND WORKMAN'S COMP THROUGH CERTIFICATES OF INSURANCE THAT NAMES PENDER SOIL AND WATER CONSERVATION DISTRICT AS AN ADDITIONAL INSURED, BEFORE WORK CAN COMMENCE. THE CONTRACTOR AWARDED THIS PROJECT SHALL BE REQUIRED TO HAVE A ONE MILLION (\$1,000,000) LIABILITY INSURANCE POLICY IN EFFECT THROUGHOUT THE TERM OF THE CONTRACT.

THE CONTRACTOR AWARDED THIS PROJECT SHALL FURNISH A PERFORMANCE BOND PAYABLE TO THE PENDER SOIL AND WATER CONSERVATION DISTRICT AND CONDITIONED UPON THE CONTRACTOR FAITHFULLY PERFORMS THE CONDITIONS OF THE CONTRACT. SAID BOND SHALL BE IN THE AMOUNT OF THE TOTAL BID FOR THE CONTRACT. THE SURETY ON THE BOND SHALL BE A DULY AUTHORIZED CORPORATE SURETY COMPANY AUTHORIZED TO DO BUSINESS IN THE STATE OF NORTH CAROLINA.

THE CONTRACTOR WILL ENSURE THAT STATE, FEDERAL AND LOCAL REQUIRED PERMITS ARE SECURED FOR EACH SITE BEFORE ANY WORK PROCEEDS FOR THAT SITE.

**3. CLEARING AND DEBRIS REMOVAL:**

WORK WILL CONSIST OF REMOVAL OF ALL STREAM OBSTRUCTIONS (SURFACE & SUBSURFACE) RESULTING FROM HURRICANE FLORENCE, THIS INCLUDES TREE LIMBS, DISLODGED BRUSH, RUBBISH, AND ANY FOREIGN DEBRIS WITHIN OR ACROSS THE SECTION OF THE CHANNEL AND DESIGNATED ADJACENT AREAS, WHICH IMPEDES STREAM FLOW OR NAVIGATION AS DETERMINED BY THE PROJECT INSPECTOR. ALL TREES LEANING GREATER THAN 45 DEGREES OVER THE CHANNEL SHALL BE REMOVED. DEBRIS SHALL BE PLACED AWAY FROM THE STREAMBANK, SO IT DOES NOT INTERFERE WITH ACCESS ALONG THE DRAINAGE WAY AND IN A MANNER SO IT WILL NOT EASILY WASH BACK IN WATERWAY IN THE EVENT OF FLOODING. THE DROPPING OF TREES UNDER THE WATER SURFACE AND LEAVING THEM IS NOT ALLOWED AND WILL BE CONSIDERED A BREACH OF THE CONTRACT.

**4. START AND COMPLETION DATES:**

**THE CONTRACTOR SHALL COMMENCE WORK ON THE PROJECT WITHIN 30 DAYS OF THE AWARDED CONTRACT. ANY DEVIATION FROM THE AFORE-STATED DATE OF COMMENCEMENT MUST BE APPROVED BY THE PENDER SOIL AND WATER CONSERVATION DISTRICT.**

WORK MUST BE SATISFACTORIALLY COMPLETED NO LATER THAN SIX MONTHS AFTER START DATE. IF WORK IS NOT COMPLETED BY THIS DATE, LIQUIDATED DAMAGES WILL BE ASSESSED AT A RATE OF \$100 PER DAY. AN EXTENSION MAY BE GRANTED DUE TO WEATHER CONDITIONS BY THE PENDER SOIL AND WATER DISTRICT. THE CONTRACTOR WILL BE REQUIRED TO SUBMIT TO THE INSPECTOR A WEEKLY TIME LOG OF PROGRESS MADE EACH WEEK ON THE PROJECT SITE.

**5. METHOD:**

CONVENTIONAL LOGGING EQUIPMENT, FLOATING BARGE OR BOAT WITH MECHANICAL WINCHES; HYDRAULIC EXCAVATORS (MUST BE LGP IF USED IN WETLAND AREAS) AND DRAGLINES WITH GRAPPLE-TYPE ATTACHMENTS MAY BE USED. CONTRACTOR WILL USE EQUIPMENT AND JUDGEMENT TO MINIMIZE RUTTING OR SOIL DISTURBANCE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO NEGOTIATE WITH THE LANDOWNER FOR REMOVAL OF ANY STANDING MERCHANTABLE TREES THAT ARE CUT.

**6. ACCESS:**

ACCESS SHALL BE DESIGNATED BY THE PROJECT INSPECTOR UNLESS ALTERNATE ROUTES ARE OBTAINED BY THE CONTRACTOR AND APPROVED BY THE PROJECT INSPECTOR. EVEN THOUGH MAINTENANCE TRAVELWAY ACCESS IS ASSURED BY LANDOWNER PERMISSION, EVERY EFFORT WILL BE MADE BY PENDER SOIL AND WATER CONSERVATION DISTRICT TO KEEP LANDOWNERS INFORMED OF ACTIVITIES AND ADDRESS LOCAL CONCERNS.

**7. LIMITS OF WORK:**

THE LIMITS OF WORK AREA SHALL NOT EXCEED THOSE SHOWN ON THE DRAWINGS OF THIS SPECIFICATION.

**8. DISPOSAL OF DEBRIS:**

NATURAL WOODY AND OTHER DEBRIS SHALL BE DISPOSED OF ALONG OFFSIDE OF THE STREAMBANK, WITH TREES AND LIMBS CUT TO A MAXIMUM LENGTH OF 16 FEET OR AS DETERMINED BY THE PROJECT INSPECTOR. DEBRIS FROM THESE LOCATIONS SHALL BE REMOVED AND DISPOSED IN ACCORDANCE TO THE STREAMFLOW REHABILITATION ASSISTANCE PROGRAM (STRAP) – DEBRIS REMOVAL & PROCESSING RECOMMENDATIONS (GS 139-65) AND STRAP RECOMMENDATIONS ON PERMITS FOR STRAP PROJECTS. ALTERNATIVE METHODS PROPOSED BY THE CONTRACTOR FOR DISPOSAL OF NATURAL WOODY AND OTHER DEBRIS MUST BE PRE-APPROVED BY THE PROJECT INSPECTOR. DEBRIS SHALL NOT BE PLACED IN TRIBUTARIES OR SIDE DITCHES. THE NATURAL WOODY DEBRIS SHALL BE PLACED IN SUCH A MANNER TO PREVENT POTENTIAL MOVEMENT OF THE MATERIAL BACK INTO THE FLOODWAY BY SUBSEQUENT HIGH WATER EVENTS IN ACCORDANCE TO THE STREAMFLOW REHABILITATION ASSISTANCE PROGRAM (STRAP) – DEBRIS REMOVAL & PROCESSING RECOMMENDATIONS (GS 139-65) AND STRAP RECOMMENDATIONS ON PERMITS FOR STRAP PROJECTS.

**9. ENVIRONMENTAL REQUIREMENTS:**

EQUIPMENT SHALL OPERATE ADJACENT TO THE STREAM AND NOT WITHIN THE STREAM UNLESS PRIOR APPROVAL IS GRANTED BY THE PROJECT INSPECTOR. CROSSING A STREAM TO GAIN ACCESS TO THE OPPOSITE BANK IS PERMISSIBLE.

EQUIPMENT SHALL BE MAINTAINED TO PREVENT FUEL, OIL, AND LUBRICANT SPILLS. REFUELING, REPAIR, AND LUBRICATION SHALL BE PERFORMED AT SAFE DISTANCES FROM THE STREAM. SHOULD FUEL LEAKS, OIL LEAKS OR HYDRAULIC PIPE RUPTURE OCCUR DURING CONSTRUCTION, THE

**CONTRACTOR'S OPERATORS SHALL IMMEDIATELY REMOVE THE EQUIPMENT TO A SAFE AREA AND TAKE PROMPT ACTION TO MINIMIZE DAMAGE AND SAFEGUARD THE SITE. THE CONTRACTOR OR HIS SUPERINTENDENT SHALL IMMEDIATELY REPORT THE DISCHARGE TO THE NC-DEQ (DEPARTMENT OF ENVIRONMENTAL QUALITY) AT 1-800-858-0368 AND PROVISIONS OF THE NORTH CAROLINA OIL POLLUTION AND HAZARDOUS SUBSTANCE CONTROL ACT SHALL BE FOLLOWED. THE CONTRACTOR SHALL ALSO REPORT THE DISCHARGE TO THE PROJECT INSPECTOR.**

**THE CONTRACTOR SHALL PROVIDE TANKS OR BARRELS TO BE USED FOR OFF-SITE DISPOSAL OF CHEMICAL POLLUTANTS SUCH AS DRAINED LUBRICATING OR TRANSMISSION OILS, GREASES, ETC. PRODUCED AS A BY-PRODUCT OF THIS WORK. WASHING, FUELING, OR SERVICING EQUIPMENT SHALL BE AVOIDED WHERE SPILLAGE OR WASH WATER CAN ENTER THE WATERCOURSE.**

**10. SPECIFICATIONS AND DRAWINGS:**

**THE CONTRACTOR SHALL KEEP A COPY OF THE DRAWINGS AND SPECIFICATIONS. IN CASE OF DIFFERENCES BETWEEN DRAWINGS AND SPECIFICATIONS, THE SPECIFICATIONS SHALL GOVERN. IN CASE OF DISCREPANCY EITHER, IN THE DRAWINGS, OR IN THE SPECIFICATIONS, THE MATTER SHALL BE PROMPTLY SUBMITTED TO THE PROJECT INSPECTOR, WHO SHALL PROMPTLY MAKE A DETERMINATION IN WRITING. ANY ADJUSTMENT BY THE CONTRACTOR WITHOUT SUCH A DETERMINATION SHALL BE AT HIS OWN RISK AND EXPENSE.**

**11. NONCOMPLIANCE WITH CONTRACT REQUIREMENTS:**

**THE PROJECT INSPECTOR MAY ORDER SUSPENSION OF THE WORK IN WHOLE OR IN PART FOR SUCH TIME AS HE DEEMS NECESSARY BECAUSE OF THE FAILURE OF THE CONTRACTOR TO COMPLY WITH ANY OF THE REQUIREMENTS OF THIS CONTRACT, AND THE CONTRACT COMPLETION DATE SHALL NOT BE EXTENDED ON ACCOUNT OF ANY SUCH SUSPENSION OF THE WORK.**

**WHEN THE PROJECT INSPECTOR ORDERS ANY SUSPENSION OF THE WORK (SEE ABOVE), THE CONTRACTOR SHALL NOT BE ENTITLED TO ANY COST OR DAMAGES RESULTING FROM SUCH SUSPENSION.**

**12. PROTECTION OF WORK, PROPERTY, AND PERSONS:**

**THE CONTRACTOR WILL BE RESPONSIBLE FOR INITIATING, MAINTAINING, AND SUPERVISING ALL SAFETY PRECAUTIONS AND PROGRAMS IN CONNECTION WITH THE WORK. THE CONTRACTOR WILL TAKE ALL NECESSARY PRECAUTIONS OF THE SAFETY OF, WILL PROVIDE THE NECESSARY PROTECTION TO PREVENT DAMAGE, INJURY OR LOSS TO ALL EMPLOYEES ON THE WORK SITE AND OTHER PERSONS WHO MAY BE AFFECTED THEREBY, ALL THE WORK AND ALL MATERIALS OR EQUIPMENT TO BE INCORPORATED THEREIN, WHETHER IN STORAGE ON OR OFF THE SITE, AND OTHER PROPERTY AT THE SITE OR ADJACENT THERETO, INCLUDING TREES, SHRUBS, LAWNS, WALKS, PAVEMENT, ROADWAYS, STRUCTURES, AND UTILITIES NOT DESIGNATED FOR REMOVAL, RELOCATION, OR REPLACEMENT IN THE COURSE OF THE PROJECT COMPLETION.**

**THE CONTRACTOR WILL COMPLY WITH ALL APPLICABLE LAWS, ORDINANCES, RULES, REGULATIONS AND ORDERS OF ANY PUBLIC BODY HAVING JURISDICTION. THE CONTRACTOR WILL ERECT AND MAINTAIN, AS REQUIRED BY THE CONDITIONS AND PROGRESS OF THE WORK, ALL NECESSARY SAFEGUARDS FOR SAFETY AND PROTECTION. THE CONTRACTOR WILL NOTIFY OWNERS OF ADJACENT UTILITIES WHEN PROSECUTION OF THE WORK MAY AFFECT THEM. THE CONTRACTOR WILL REMEDY ALL DAMAGE, INJURY**

OR LOSS TO ANY PROPERTY CAUSED, DIRECTLY OR INDIRECTLY, IN WHOLE OR PART, BY THE CONTRACTOR, SUBCONTRACTOR OR ANYONE OF WHOSE ACTS ANY OF THEM MAY BE LIABLE, EXCEPT DAMAGE OR LOSS ATTRIBUTABLE TO THE FAULT OF THE CONTRACT DOCUMENTS OR TO THE ACTS OR OMISSIONS OF THE OWNER, THE PROJECTOR INSPECTOR OR ANYONE EMPLOYED BY THEM OR ANYONE FOR WHOSE ACTS EITHER OF THEM MAY BE LIABLE, AND NOT ATTRIBUTABLE, DIRECTLY OR INDIRECTLY, IN WHOLE OR IN PART, TO THE FAULT OR NEGLIGENCE OF THE CONTRACTOR.

**13. INSPECTION:**

WORK WILL BE PERFORMED UNDER THE SUPERVISION OF THE PROJECT INSPECTOR APPOINTED BY THE PENDER SOIL AND WATER CONSERVATION DISTRICT. COMPLETED WORK WILL BE INSPECTED BY PROJECT INSPECTOR, AS WELL AS STATE INSPECTOR WHILE THE CONTRACT IS ON GOING. INSPECTIONS WILL INCLUDE VISIBLE DEBRIS PILES IN APPROPRIATE LOCATIONS, DEBRIS LEFT BELOW SURFACE OF WATER, TREES LEANING GREATER THAN 45 DEGREES, ETC. PROJECT INSPECTOR HAS THE AUTHORITY TO ISSUE STOP AND PROCEED WORK ORDERS. IF A CONTRACT IS NOT EXECUTED WITHIN 15 DAYS OF AWARD BY THE PENDER SOIL AND WATER CONSERVATION DISTRICT, PENDER SOIL AND WATER CONSERVATION DISTRICT RESERVES THE RIGHT TO AWARD THE CONTRACT TO THE NEXT LOWEST RESPONSIBLE BIDDER.

**14. PAYMENT:**

STAFF FROM THE NC DIVISION OF SOIL AND WATER CONSERVATION OR ITS DESIGNATED AGENT WILL CONDUCT A SITE VISIT AND APPROVE THE WORK COMPLETED BEFORE PAYMENT IS MADE BY THE PENDER SOIL AND WATER CONSERVATION DISTRICT TO THE CONTRACTOR. THE DIVISION MUST SATISFACTORILY DETERMINE THE WORK HAS BEEN COMPLETED IN ACCORDANCE WITH THE WOODY DEBRIS REMOVAL GUIDELINES.

**DISASTER RECOVERY 2018**

**HURRICANE FLORENCE STREAM DEBRIS REMOVAL**

**BID FORM**

**MUST BE RETURNED BY THURSDAY, DECEMBER 1, 2022 . NO EXCEPTIONS.**

**ALL BIDS WILL BE CONFIDENTIAL**

**BID AREA**

**EST. FOOTAGE**

**RILEYS CREEK**

**34,950**

**\*ESTIMATED FOOTAGE IS GIVEN FOR REFERENCE ONLY AND WILL NOT BE USED TO ISSUE PAYMENT BY.**

**\*PLEASE INCLUDE REFERENCES OR ANY OTHER PERTINENT DOCUMENTATION.**

**\*ALSO PLEASE INCLUDE PRIOR WORK EXPERIENCE WITHIN THE LAST TWELVE MONTHS.**

**COMPANY NAME**

\_\_\_\_\_

**COMPANY PHONE#**

\_\_\_\_\_

**BID**

**\$** \_\_\_\_\_

**CONTRACTOR SIGNATURE**

\_\_\_\_\_

**DATE:**

\_\_\_\_\_

**I HAVE COMPLETED THE MANDATORY SITE VISIT.**

**CONTRACTOR SIGNATURE**

\_\_\_\_\_

**DATE:**

\_\_\_\_\_

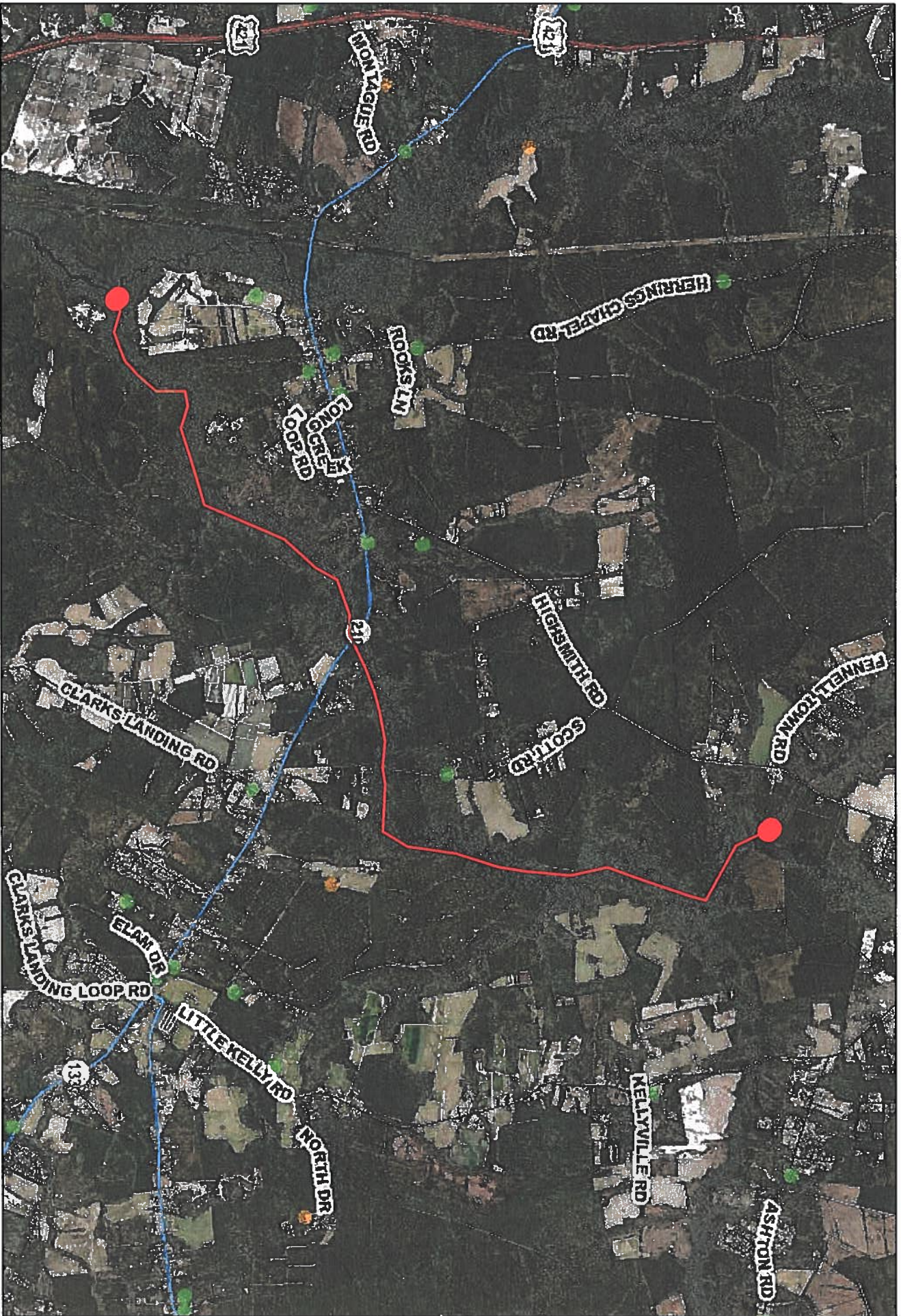
**NOTE: YOU ONLY NEED TO RETURN THIS SHEET WITH THE ABOVE INFORMATION TO SUBMIT YOUR BID. BIDS SHOULD BE IN A SEALED ENVELOPE MARKED PENDER SOIL AND WATER CONSERATION DISTRICT STORM DEBRIS PROJECT.**

Ryllies Creek

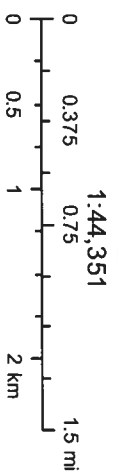
Pender County

Approx 34950'

STRAPP Project

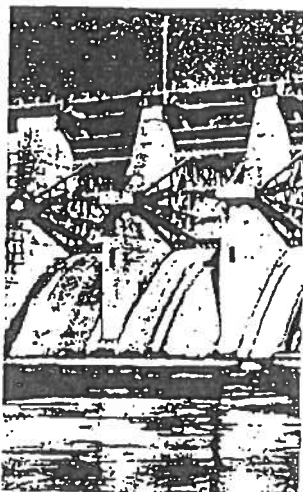
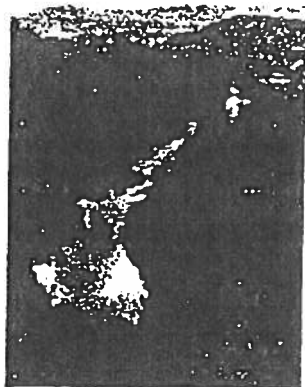


October 28, 2022





US Army Corps  
of Engineers



ENVIRONMENTAL IMPACT  
RESEARCH PROGRAM

TECHNICAL REPORT EL-92-35

INCREMENTAL EFFECTS OF LARGE WOODY DEBRIS  
REMOVAL ON PHYSICAL AQUATIC HABITAT

by

Roger H. Smith

Center for River Studies  
Memphis State University  
Memphis, Tennessee 38152

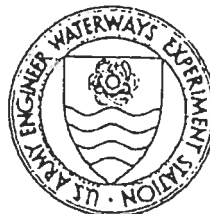
F. Douglas Shields, Jr.

USDA Agricultural Research Service  
National Sedimentation Laboratory  
Oxford, Mississippi 38655-1157

Elba A. Dardeau, Jr., Thomas E. Schaefer, Jr., Anthony C. Gibson

Environmental Laboratory

DEPARTMENT OF THE ARMY  
Waterways Experiment Station, Corps of Engineers  
3909 Halls Ferry Road, Vicksburg, Mississippi 39180-6199



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Under EIRP Work Unit 32555



## PART V: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

### Summary

LWD plays an important role as a component of aquatic habitat. Although LWD enters food webs as it decays, the major importance of debris lies in its structural characteristics and the way it influences channel flow patterns. Physical processes associated with debris in streams include the formation of pools and retention of fine sediment and organic matter.

Awareness of the adverse effects of complete LWD removal on channel stability and aquatic habitat has led to the development of guidelines for selective removal of LWD as a means of balancing habitat and conveyance objectives. These guidelines (Appendix A) involve the use of manual labor and small equipment to remove only the LWD that causes significant flow obstruction. Removal of bank vegetation and disturbance to stream habitats is minimized. Personnel within some Corps districts have already completed or are in the process of classifying the streams under their jurisdiction according to these guidelines. Use of these guidelines for project planning and design requires quantification of the hydraulic and environmental impacts of incremental LWD removal.

In this study, a simple method for quantifying LWD density and computing associated friction factors was developed and tested using data collected during an LWD removal project on the South Fork Obion River in western Tennessee. Physical conditions of both cleared and uncleared stream reaches were measured by collecting three types of data: LWD density, dye tracer tests (for computing reach mean hydraulic parameters), and physical habitat (depth, velocity, bed type, and cover) at selected transects. The LWD density was the important independent variable, while the dye tracer and physical habitat data were used to study macroscale and microscale effects of LWD, respectively. Macroinvertebrate samples were also collected at low flow conditions, and the results are presented in a companion report to this study (Payne and Miller in preparation).

### Conclusions

Removal of LWD from the study reach decreased near-bank-full friction factor by about one third. Impacts on physical aquatic habitat at base flow

were measurable and statistically significant, even though the Stream Obstruction Removal Guidelines (IAFWA 1983) were applied throughout project planning and implementation. Benefits of proposed LWD removal projects should be carefully analyzed in light of costs and environmental impacts. Findings of this study generally agreed with work by others in different types of streams. The simple procedure developed in this study for quantifying LWD density and its effect on channel resistance may be used for environmental impact assessment and hydraulic engineering analyses. Considerable refinement and site-specific adaptation may be in order, however. The method for prediction of channel roughness coefficients does not account for local losses because of bends or flow expansion and contraction at bridges, debris dams, or riffles.

#### Recommendations

To refine the methodology used in this study, additional data should be collected from two more stream LWD removal projects. Streams with higher LWD density and different types of bed sediment from that encountered in this study would be preferable. Physical data should be collected over a range of flows varying from normal low-flow to bank-full conditions. Concurrent biological data should be collected at base flow. Data should be collected to document preproject and postproject conditions. Investigation of additional methods of determining LWD density, such as using video recorders or low altitude aerial photography to count and measure the LWD formations, is recommended.

APPENDIX B: BEST MANAGEMENT PRACTICES (BMPs) FOR  
SELECTIVE CLEARING AND SNAGGING\*

Trees and brush that shade streams and stabilize the banks should not be disturbed. In new channel construction, existing trees and brush should be left in place along the tops of banks. No stream work, including bank clearing and excavation or removal of materials, "snags," or other channel obstructions, should be allowed except at specific locations where significant blockages in streams occur. Channel excavation and snag removal should be accomplished with the minimum streambank clearing needed to provide access to the stream and should not be undertaken unless it is absolutely necessary. The following BMPs prescribe the manner in which snag removal and stream channel clearing should be undertaken:

a. Practices for snagging.

- (1) Logjam removal. Only those log accumulations that are obstructing flows to a degree that results in flooding or significant ponding or sediment deposition should be removed.
- (2) Removal of other logs.
  - Affixed logs. Isolated or single logs should not be disturbed if they are embedded, jammed, rooted, or waterlogged in the channel or the floodplain, if they are not subject to displacement by current, and if they are not presently blocking flows. Generally, embedded logs that are parallel to the channel are not considered to cause blockage problems and should not be removed. Affixed logs that are crossways to the flow of waters in the channel and are trapping debris to the extent that could result in significant flooding or sedimentation may be removed.
  - Free logs. All logs that are not rooted, embedded, jammed, or sufficiently waterlogged to resist movement by stream currents may be removed from the channel.
- (3) Protecting riparian vegetation. No rooted trees, whether alive or dead, should be cut unless:
  - They are leaning over the channel at an angle greater than 30 deg of vertical and they are dead or severely undercut, or damaged root systems are relying upon adjacent vegetation for support and it appears they will fall into the channel within 1 year and create blockage to flows; or
  - Their removal from the floodplain is required to secure access for equipment to a point where a significant blockage has been selected for removal.

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\* Source: State of New York (1986). The citation for this reference is included with those following the main text of this report.

- (3) Disposal of spoil material. Conventional excavating equipment may be required for sediment blockages. This equipment should be employed in a manner which will minimize environmental damages as follows:
- Access routes for equipment should be selected to minimize disturbance to existing floodplain vegetation, particularly in the riparian zone.
  - Material disposal and necessary tree removal should be limited to one side of the original channel at any given location.
  - To the maximum extent possible, excavating equipment should not be employed in the stream channel bed.
  - Where feasible, excavated materials should be removed from the floodplain. If floodplain disposal is the only feasible alternative, the spoil material should be placed on the highest practical elevation and no material should be placed in any tributary or distributary channels which provide for ingress and egress of waters to and from the floodplain.
  - No continuous spoil pile should be created. It is suggested that no pile exceed 50 ft in length or width and a gap of equal or greater length should be left between adjacent spoil piles.
  - Spoil piles should be constructed as high as sediment properties allow.
  - The placement of spoil material around the bases of mature trees should be avoided where possible.
  - All disturbed areas should be reseeded or replanted with plant species which will stabilize soils and benefit fish and wildlife. Revegetation should be in accordance with County Soil and Water Conservation District recommendations.
  - All disturbed areas should be reseeded or replanted with plant species which will stabilize soils and benefit fish and wildlife. Revegetation should be in accordance with County Soil and Water Conservation District recommendations.



## Streamflow Rehabilitation Assistance Program

### Debris Removal & Processing Recommendations

**§ 139-65. Streamflow Rehabilitation Assistance Program**, the authorizing legislation for StRAP, states that *“The Commission shall ensure that debris removed from streams with funds provided under this Article are either removed from the 100-year floodplain or processed in such a manner that the debris would not pose a risk of blockage or significant impairment of normal streamflow during a subsequent flood event.”*

The Soil & Water Conservation Commission has determined that processing of debris may include any of the following activities:

- Chipping
- Cabling or strapping in a secured manner outside the immediate stream area (minimum of 30 ft. from top of the stream bank)
- Burning (Must comply with all required State Forest Service permits and only under appropriate Air Quality conditions)
- Other processing options approved by the Commission

#### **Removal from the floodplain**

- Debris removed from the stream can be hauled away from the floodplain. Debris can be loaded directly into a truck for removal or debris can be floated to a location appropriate for its removal from the stream or floodplain.
- Debris can be removed to a landfill (grantees should confirm that the landfill accepts woody debris), another property, or to another location on the same property as long as it is outside of the floodplain and landowner has granted permission for the debris to be deposited on the site.
- Equipment used for hauling debris from the floodplain should be used in a manner that minimizes the impact to the banks of the stream. Boat mounted equipment may be an effective option for accessing stream debris. Tracked or wheeled equipment should be kept out of the stream channel and may be employed from the bank by using a manipulator arm or cables to drag debris out of the stream channel.<sup>1</sup>
- If garbage (such as wooden construction materials) is contributing to blockages in the stream, it can be removed from the stream and disposed outside of the floodplain.

#### **Chipping or Burning Debris**

Debris can be left in the floodplain if it has been chipped or burned so that it does not pose a risk of contributing to future blockages if it is washed back into the stream. Wood chips can be left on site or hauled away.

- Wood chips can be placed on the floodplain starting at the top of the bank. Wood chips should not be placed below the top of the bank or in channels that drain from the floodplain into the stream.<sup>2</sup>

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<sup>1</sup> [NRCS Clearing and Snagging Code 326 Practice Standards](#)

<sup>2</sup> [USACE Best Management Practices for Selective Clearing and Snagging](#)

- Wheeled chippers and other equipment should be used in a manner that reduces impact to soil and vegetation.
- Wood chips should be distributed across the site in as thin a layer as practical to avoid inhibiting plant growth. Wood chips can be left in a pile at the landowner's request.
- Debris can be burned on site. The grantee/contractor is responsible for obtaining and possessing a valid burn permit (if applicable) and for following any other necessary laws or statutes related to burning.

### **Cabling/Strapping**

Cabling or strapping refers to the practice of anchoring logs and other woody debris in place so that it will not be washed back into the stream in subsequent flood events.

- Cabled/strapped debris should be set back at least 30 feet from the top of the stream bank.
- Woody debris cabled/strapped within the floodplain should be anchored in such a way that it will not significantly affect the flow capacity of the floodplain. Securing logs parallel to the direction of the stream flow can help reduce flood flow impediment.
- Cabling debris to an anchor will ensure woody debris will not be moved back into the stream channel during future flood events. The anchor point should be selected based on site-specific factors, such as availability of natural anchors and cost. Examples of anchors include live trees or soil anchors.
- **Live Trees-** Logs and debris may be cabled to live trees or fresh stumps. Fatal damage to live trees should be avoided. Wedging logs against the live tree before the cable/strap is attached will help ensure the attached log is as immobile as possible.
  - If a strap/cable is looped around a tree, leaving a small amount of slack in the loop around the live tree, and between the live tree and the log, may help protect the tree from girdling and prevent the cable from snapping if the anchored log shifts.
  - If stumps are used, the cable/strap should be secured in a way so that it will not slip off the top of the stump in future flood events.
- **Soil Anchors-** Soil anchors may be useful on sites with few live trees to serve as anchors or in other situations when live trees are not desirable as anchors. For technical guidance on use soil anchors, contractors should refer to [\*NRCS Technical Supplement TS14E Soil Anchors\*](#).
- **Cable Material:** A variety of cable, rope, or strap options can be used for securing large woody debris to an anchor point.
  - If steel cable is used, a minimum cable diameter of 1/8-inch should be used to secure the debris. If rope or strapping is used, material with a breaking strength equivalent to 1/8-inch diameter steel cable should be used. Contractors should use thicker cables/ropes as necessary to sufficiently secure debris.
- Placing debris as close to the anchor as possible will reduce the amount of rope/cable needed and reduce the risk of landowners tripping over the cable.
- Logs can be anchored individually or in groups. If groups of logs & branches are anchored together, wrapping the cable or rope around the entire bundle of debris can secure the bundle to the anchor.



## Streamflow Rehabilitation Assistance Program

### Recommendations on Permits for StRAP Projects

The StRAP contract states, *"The Grantee shall be responsible for obtaining necessary landowner authorization for site access and all permits needed to complete the planned work."* This document is only a general reference guide to assist you and should not be treated as definitive instructions on which permits are required.

#### **When are permits (likely) necessary?**

- **Removing Vegetative Stream Debris:** permits may not be required if there is no impact to the streambed or banks.
  - Grantees should confirm if permits are required before beginning work.
- **Sediment Removal:** permits are required.
  - Contact US Army Corp of Engineers and Division of Water Resources.
- For more information, consult with the following organizations to learn what permits the project may need.

**Floodplain Manager-** The local floodplain manager can provide guidance on permits, rules, and local ordinances related to stream projects.

- The floodplain manager can advise if a [No-Rise Certification](#) hydraulic analysis will be necessary for the project.
  - Due to their minimal disturbance of streambed and bank, stream debris removal projects may be granted a [no-rise certification without needing an analysis](#). The floodplain manager can provide additional guidance.
- Contact the local [floodplain manager](#) for assistance.

**NC Division of Water Resources (DWR)-** DWR can provide resources on permitting related to stream projects. For general guidance, contact NC DWR or view their [FAQ document on permitting](#).

- DWR can provide guidance on if permits related to Section 401 or Section 404 of the Clean Water Act are required. A permit is generally not required for stream debris removal as long as the streambed and banks are not disturbed. NC DWR can provide further guidance.
- DWR may recommend additional communication with the [US Army Corps of Engineers](#) (USACE). Two [USACE Nationwide Permits](#) may apply to StRAP projects: Nationwide Permit 3 (stream clearing activities) and Nationwide Permit 13 (stream restoration activities undertaken with federal funds from the NRCS).
- DWR can provide guidance on the [State Riparian Buffer Rules](#).

**NC Wildlife Resources Commission (WRC)-** WRC can provide guidance on the presence of threatened and endangered species near the project site.

- WRC can also provide guidance on moratoriums associated with waterways designated as Anadromous Fish Spawning Areas (AFSA), Primary Nursery Areas (PNA), and Trout Waters.

**NC Division of Coastal Management-** Coastal counties may require a Coastal Area Management Act (CAMA) permit in situations where a Clean Water Act permit is required.

**Landowner Permissions-** Much of the work funded by StRAP will be done on privately owned land. Grantees should secure permission from all landowners before work begins.