

ADVERTISEMENT FOR BIDS

Lyon Swamp Drainage and Levee District Board of Commissioners

c/o Dale Norris

24276 NC Hwy 210 E

Kelly, NC 28448

Sealed bids for the completion of the Lyon Swamp Drainage and Levee District Hurricane Matthew storm debris removal project by the Lyon Swamp Drainage and Levee District Board of Commissioners will be received until 12:00 PM on January 5, 2018. The bids will then be publicly opened and read aloud at a special meeting of these Commissioners beginning at 2:01 pm on January 5, 2018 at the Kelly Fire Department (Main Station) 18628 NC Hwy 53 E Kelly, NC 28448.

Project bid packets and specifications may be obtained and returned to the Pender Soil and Water Conservation District office located at 801 S Walker Street in Burgaw, NC 28425. (910-259-9123 #3). There will be **no formal** bid conference or site showing.

This board shall reserve the right to reject any or all proposals.

INFORMATION FOR BIDDERS

Bids will be received by the Lyon Swamp Drainage and Levee District Board of Commissioners (herein called the "Owner"), at the Pender Soil and Water Conservation District office located at 801 S Walker St in Burgaw, NC 28425 until 12 PM on January 5, 2018. Bids may be mailed to Pender Soil and Water Conservation District PO Box 248 Burgaw, NC 28425. If mailed, it shall be the responsibility of the bidder to insure delivery by mail prior to 12 PM on January 5, 2018. Bid will be publicly opened during a special meeting of the commissioners on that same day, beginning at 2:01 PM and read aloud. This meeting will be held at the Kelly Fire Department (Main Station) 18628 NC Hwy 53 W Kelly, NC 28448.

Each bid must be submitted in a sealed envelope, addressed to the Lyon Swamp Drainage District Commissioners. Each sealed envelope containing a bid must be plainly marked on the outside as **BID for Lyon Swamp Drainage Levee District Project**. The envelope must also bear on the outside the **BIDDER'S** name and address. If forward by mail, the sealed envelope containing the bid must be enclosed in another envelope addressed to Pender Soil and Water Conservation District PO Box 248 Burgaw, NC 28425.

All bids must be made on the required bid form. All blank spaces for bid prices must be filled in, ink or typewritten, and the bid form must be fully completed and executed when submitted. The bid schedule for this project is subdivided into individual items but all items must be bid to be eligible for contract award. Only one copy of the bid form is required.

The **Owner** may waive any informalities or minor defects or reject any or all bids. Price alone shall not be the single determining factor in awarding bids. Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered. **No Bidder** may withdraw a bid within **10 days** after the actual date of the opening thereof. Should there be reasons why the contract cannot be awarded within the specified period, the time may be extended by mutual agreement the **Owner** and the **Bidder**.

Bidders must satisfy themselves for the accuracy of the estimated quantities in the bid schedule by examination of the site and a review of the drawings and or specifications including special provisions. After bids have been submitted, the **Bidder** shall not assert that there was a misunderstanding concerning the quantities of Work or of the nature of the Work to be done.

The contract documents contain the provisions required for the completion of the project. Information obtained from an officer, agent, or employee of the **Owner** or any other person shall not affect the risks or obligations assumed by the **Contractor** or relieve the **contractor** from fulfilling any of the conditions of the contract.

A performance bond and a payment bond in the amount of **100 percent** of the contract price will be required for the faithful performance of the contract.

Attorneys-in-fact who sign performance bond must file a certified and effective dated copy of their power of attorney.

The party to whom the contract is awarded will be required to execute the Contract and obtain the performance bond within five calendar days from the date when the Notice of Award is delivered to the bidder. The notice of award shall be accompanied by the necessary contract and bond forms. If the bidder fails to execute the contract, the owner may consider the bidder in default and the bid bond accompanying the bid shall become the property of the owner.

INVITATION FOR INFORMAL BIDS FOR A SERVICE CONTRACT FROM

LYON SWAMP DRAINAGE DISTRICT FOR HURRICANE MATTHEW DISASTER RECOVERY DEBRIS REMOVAL

Notice is hereby given that the Lyon Swamp Drainage and Levee District is soliciting contractors and professional firms to perform the removal of stream debris in Lyon Canal Drainage System. This bid packet is considered Lyon Canal-Pender End and Lyon Diversion Ditch. This planned work areas are referenced on the attached project maps. There will be no group site showing for these projects, so the contractors bidding will need to visit the areas to determine their bid price.

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"

*Project Bid Sheet

The Scope of Work describes the State requirements for receiving payment for completed work. The Lyon Canal Drainage District will be the Contracting Officer 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". Lyon Canal Drainage District will require that the debris removal be placed outside of maintenance easement along canal 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 by 12:PM on Friday, January 5, 2018. Send project bid sheets in a sealed envelope marked Lyon Swamp Drainage Levee District Project to Pender Soil and Water Conservation District, 801 S Walker Street, Burgaw, NC 28425. Please include copies of reference letters or other documentation of prior work experience. Questions about bid packet should be directed to Lyon Swamp Drainage and Levee District Board members Dale Norris 910-874-0128, Robert Moore 910-604-0016, Dean Robinson 910-231-4390, Milton Green 910-876-3034

Bids will be publicly opened and read aloud on Friday, January 5, 2018 at 2:01 PM at a special called meeting of the Lyon Swamp Drainage and Levee District at the Kelly Fire Department (Main Station) located at 18628 NC HWY 53E Kelly, NC 28448. **All Bid awards will be final after all references have been checked and verified by the Lyon Swamp Drainage and Levee District Board.**

CONSTRUCTION SPECIFICATIONS

DISASTER RECOVERY 2016

HURRICANE MATTHEW STREAM DEBRIS REMOVAL

1. LOCATION:

THE SITES ARE LOCATED IN PENDER AND BLADEN COUNTIES (SEE MAPS INCLUDED IN PACKET). STREAMS TO BE CLEARED ARE HIGHLIGHTED ON THE ATTACHED MAPS. THE LYON CANAL (34,946') WILL BE CLEANED FROM THE PENDER /BLADEN COUNTY LINE (34. 429 LAT. AND 78.220 LONG) TO LYON LANDING (34.372 LAT. AND 78.106 LONG). THE LYON DIVERISION DITCH (17,899') WILL BE CLEANED FROM THE JAMES E PORTER ROAD (34.481145 LAT. AND 78.266477 LONG) TO COLLY CREEK. THE APPROXIMATE TOTAL FOOTAGE IS 52,845 LINEAR FEET.

2. SCOPE OF WORK:

THE CONTRACTOR MUST PROVIDE PROOF OF INSURANCE AND WORKMAN'S COMP 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 LYON CANAL DRAINAGE 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 ALL 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 MATTHEW, 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 MAINTENANCE EASEMENT, 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 45 DAYS OF THE AWARDED CONTRACT. ANY DEVIATION FROM THIS MUST BE APPROVED BY THE LYON CANAL DRAINAGE DISTRICT BOARD.

WORK MUST BE STARTED BY FEBRUARY 26, 2018, AND MUST BE SATISFACTORIALLY COMPLETED NO LATER THAN JUNE 15, 2018. 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 LYON CANAL DRAINAGE DISTRICT BOARD.

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 EASEMENTS, EVERY EFFORT WILL BE MADE BY LYON SWAMP DRAINAGE AND LEVEE 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 EASEMENT, WITH TREES AND LIMBS CUT TO A MAXIMUM LENGTH OF 16 FEET OR AS DETERMINED BY THE PROJECT INSPECTOR. DEBRIS FROM THESE LOCATIONS SHALL NOT BE "PILED UP". 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 DEBRIS SHALL BE PLACED IN SUCH A MANNER TO PREVENT POTENTIAL MOVEMENT OF THE MATERIAL BACK INTO THE FLOODWAY BY SUBSEQUENT HIGH WATER EVENTS.

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. ANYTHING MENTIONED IN THE SPECIFICATIONS AND NOT SHOWN ON THE DRAWINGS, OR SHOWN ON THE DRAWINGS AND NOT MENTIONED IN BOTH. IN CASE OF DIFFERENCE BETWEEN DRAWINGS AND SPECIFICATIONS, THE SPECIFICATIONS SHALL GOVERN. IN CASE OF DISCREPANCY EITHER IN THE FIGURES, 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 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 LYON CANAL DRAINAGE 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 LYON CANAL DRAINAGE DISTRICT, LYON CANAL DRAINAGE DISTRICT RESERVES THE RIGHT TO AWARD THE CONTRACT TO THE NEXT LOWEST RESPONSIBLE BIDDER.

14. PAYMENT:

STAFF FROM THE 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 LYON SWAMP DRAINAGE AND LEVEE DISTRICT TO THE CONTRACTOR. THE DIVISION MUST SATISFACTORILY DETERMINE THAT ALL WORK HAS BEEN COMPLETED IN ACCORDANCE WITH THE WOODY DEBRIS REMOVAL GUIDELINES.

DISASTER RECOVERY 2016

HURRICANE MATTHEW STREAM DEBRIS REMOVAL

BID FORM

MUST BE RETURNED BY FRIDAY, JANUARY 5, 2018. NO EXEPTIONS.

ALL BIDS WILL BE CONFIDENTIAL

BID AREA

EST. FOOTAGE

LYON CANAL

34,946

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

*PLEASE INCLUDE REFERNECES OR ANY OTHER PERTINENT DOCUMENTATION.

*ALSO PLEASE INCLUDE PRIOR WORK EXPERIENCE.

COMPANY NAME _____

COMPANY PHONE# _____

BID \$ _____

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 LYON CANAL DEBRIS REMOVAL.

DISASTER RECOVERY 2016

HURRICANE MATTHEW STREAM DEBRIS REMOVAL

BID FORM

MUST BE RETURNED BY FRIDAY, JANUARY 5, 2018. NO EXCEPTIONS.

ALL BIDS WILL BE CONFIDENTIAL

BID AREA

EST. FOOTAGE

LYON DIVERSION DITCH

17,899

*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.

COMPANY NAME _____

COMPANY PHONE# _____

BID \$ _____

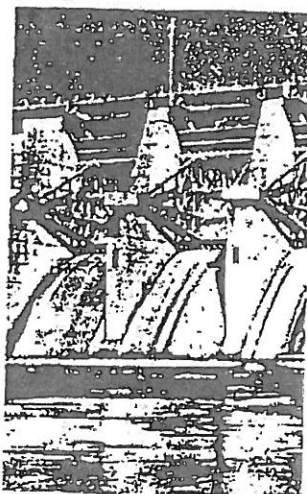
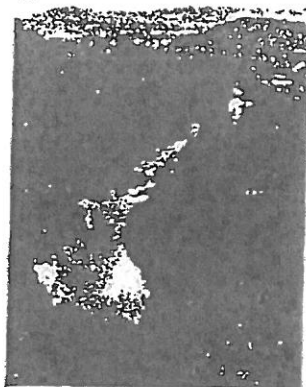
CONTRACTOR SIGNATURE _____

DATE: _____

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BIDS SHOULD BE IN A SEALED ENVELOPE MARKED LYON CANAL DEBRIS REMOVAL.



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

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Center for River Studies
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Memphis, Tennessee 38152

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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



November 1992

Final Report

Approved For Public Release; Distribution Is Unlimited

Prepared for DEPARTMENT OF THE ARMY
US Army Corps of Engineers
Washington, DC 20314-1000

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.

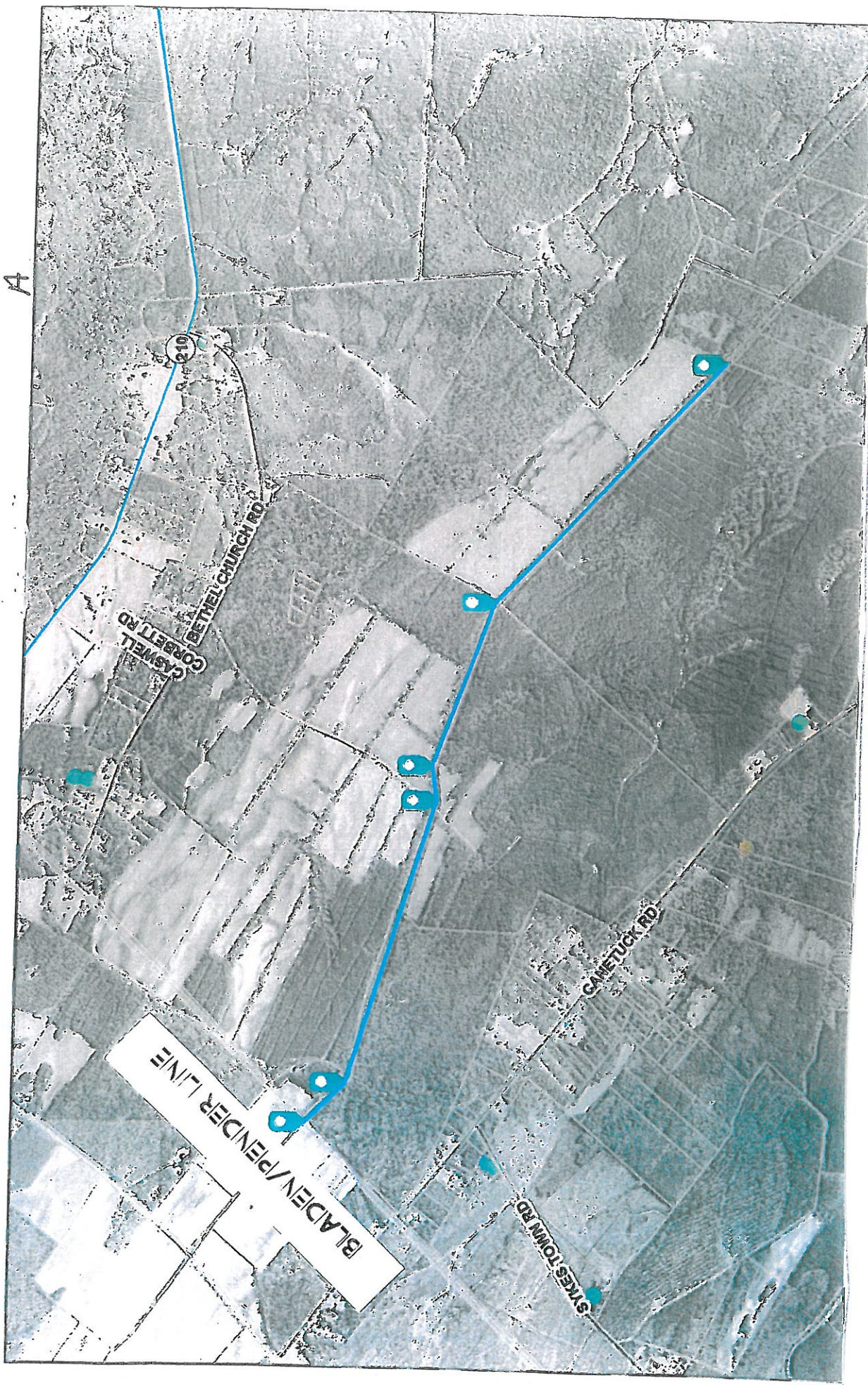
- (1) Logjam removal. Only those log accumulations that are obstructing flows to a degree that results in flooding or significant ponding or sediment deposition should be removed.
- (2) Removal of other logs.
 - Affixed logs. Isolated or single logs should not be disturbed if they are embedded, jammed, 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.

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

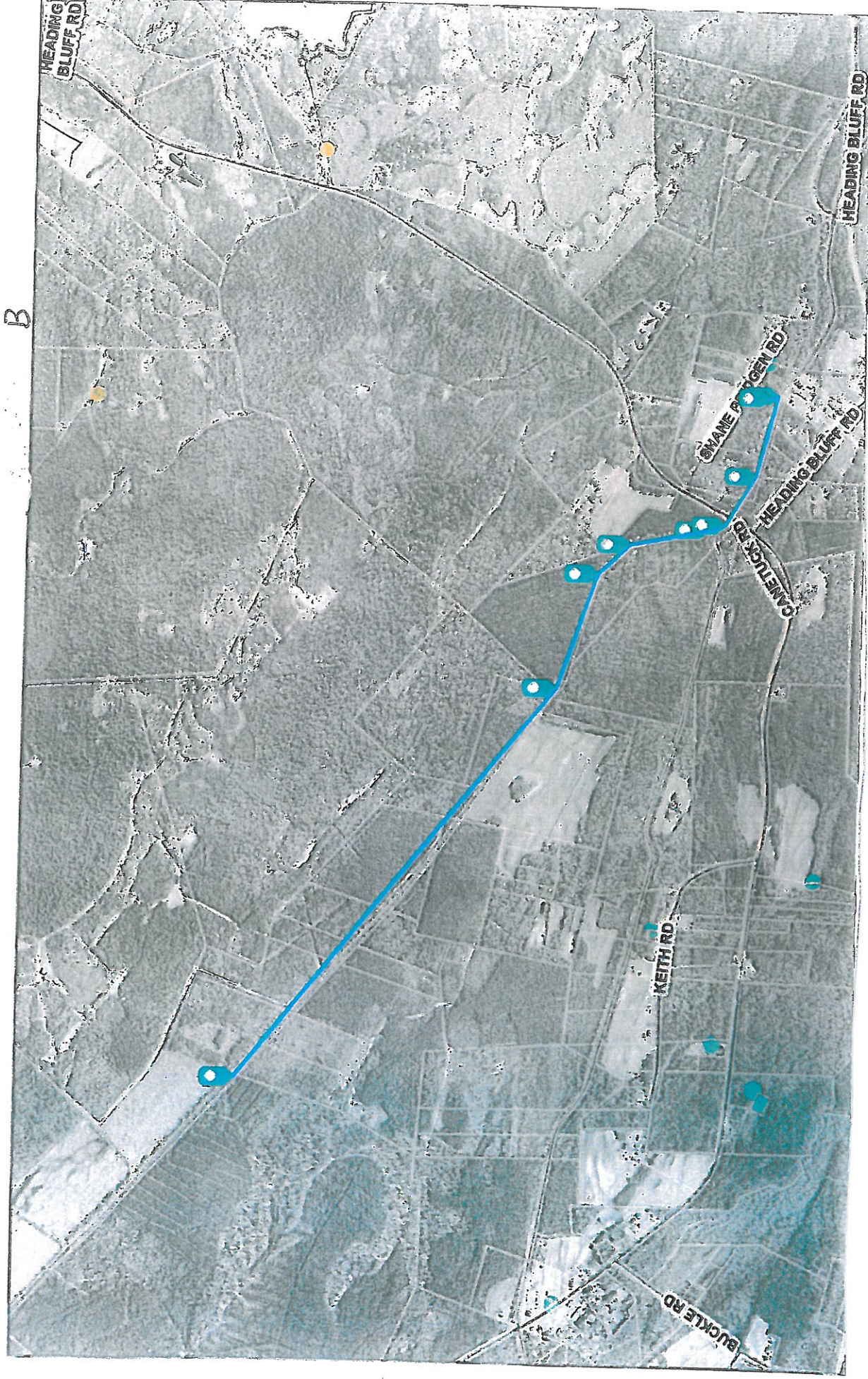
(3) Disposal of spoil material. Conventional excavating equipment may be required for sediment blockages. This equipment should be employed in a manner which will minimize environmental damages as follows:

- 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.

A



Pender County

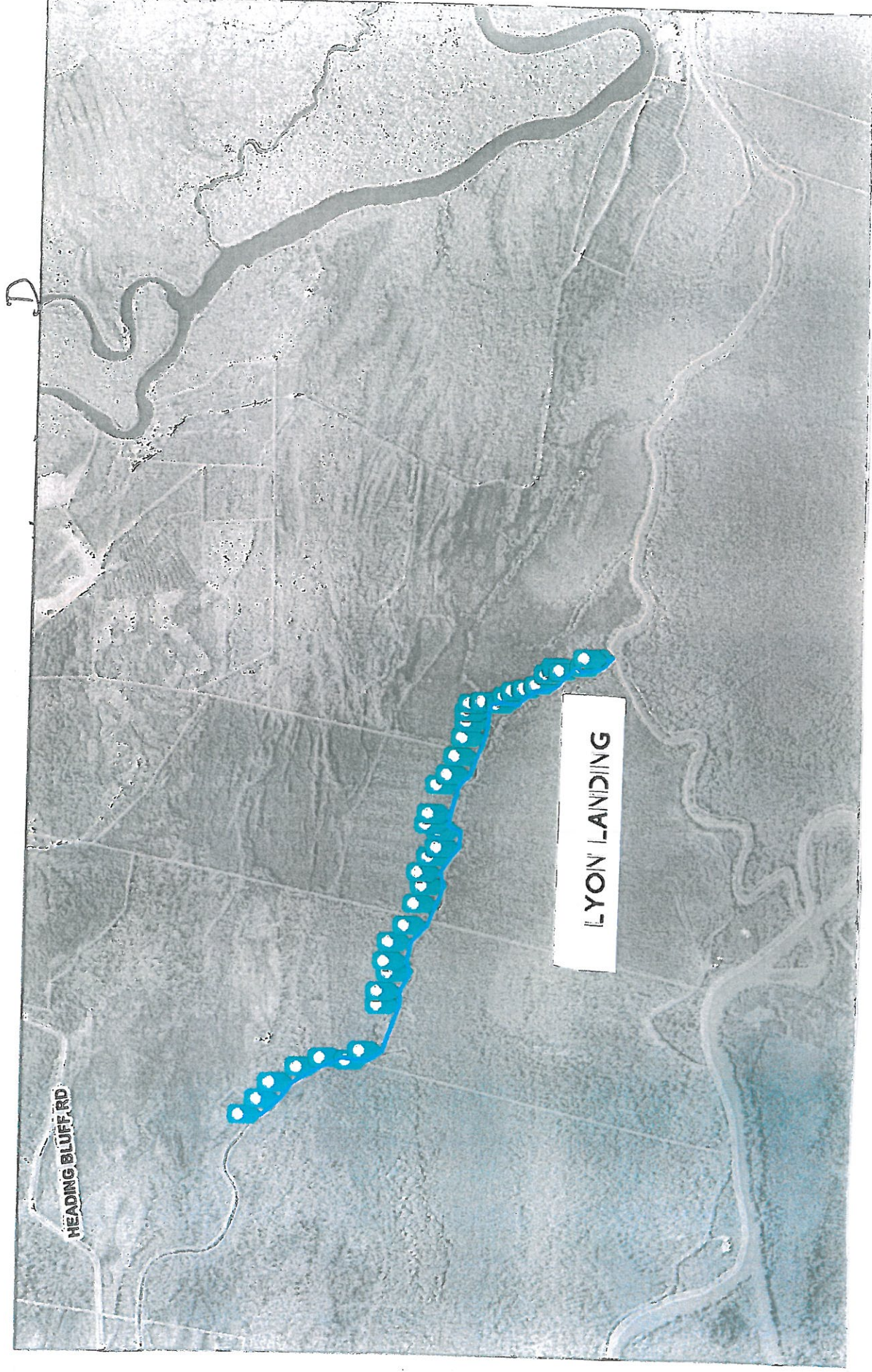


Pender County

C

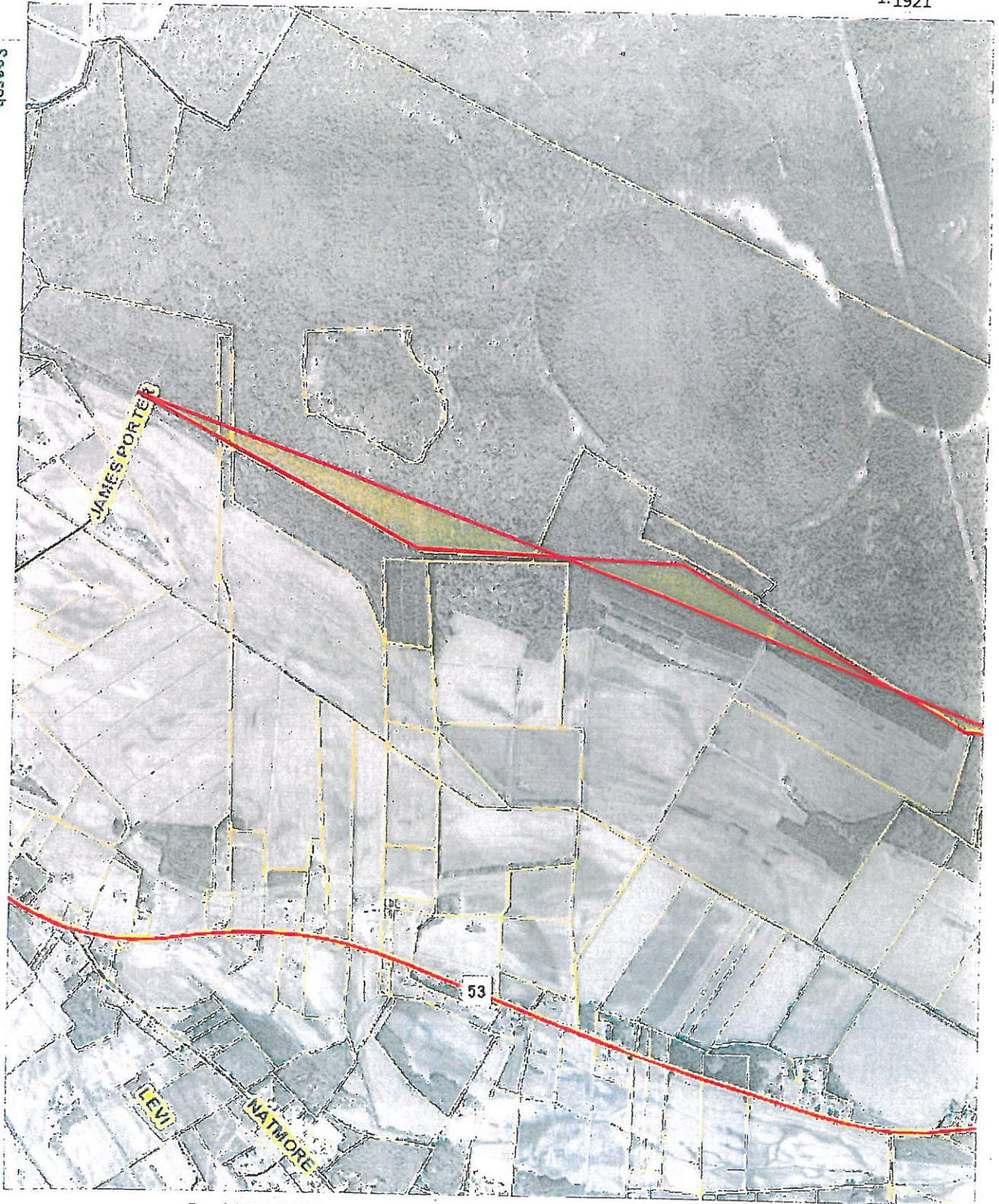


Pender County



Pender County

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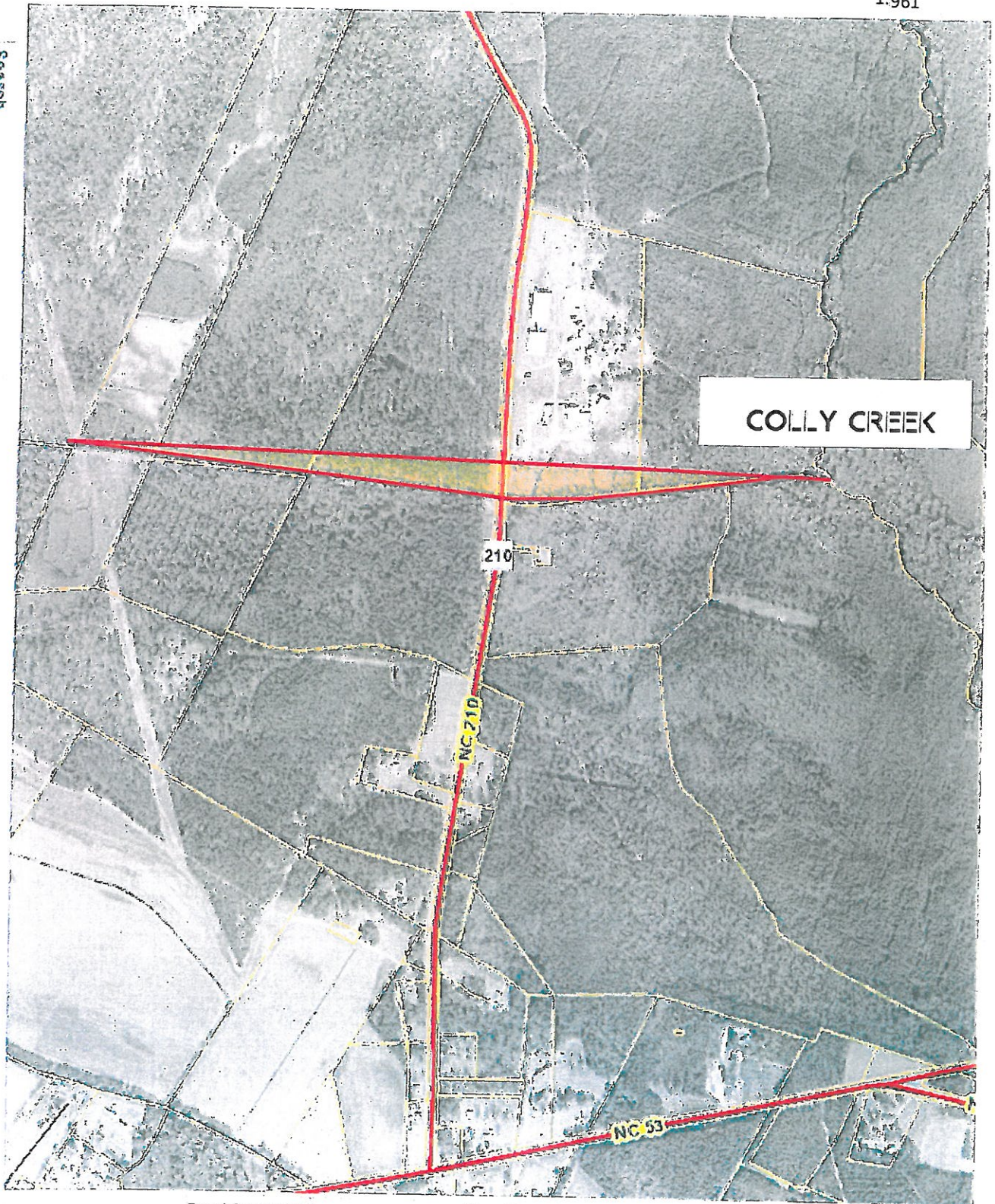


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Search



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