

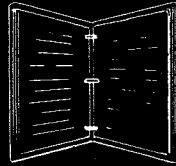
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**ENGINEERING
TECHNICAL
INFORMATION
SYSTEM**

FIELD NOTES • TECHNICAL REPORTS
DATA RETRIEVAL • MANAGEMENT
PROFESSIONAL DEVELOPMENT

VOLUME 8 NUMBER 1

Field



Notes

Computerized Cost Estimating Guide

Washington Office News



FOREST SERVICE

JANUARY 1976

U.S. DEPARTMENT OF AGRICULTURE



ENGINEERING FIELD NOTES

**Volume 8 Number 1
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This monthly newsletter is published for distribution to employees of the U.S. Department of Agriculture—Forest Service and its retirees only. The Department of Agriculture assumes no responsibility for the interpretation or use of this information by other than its own employees.

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The text in the publication represents the personal opinions of the respective author and must not be construed as recommended or approved procedures, mandatory instructions, or policy, except by FSM references. Because of the type of material in the publication, all engineers and engineering technicians should read each issue; however, this publication is not intended exclusively for engineers.

**FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE
Washington, D.C. 20250**

COMPUTERIZED COST ESTIMATING GUIDE

Ted Zeally
Sierra National Forest
Region 5

INTRODUCTION

The "Definitive Cost Estimating" procedure is one of several methods of costing estimating used in the Forest Service. In this method, units of work are identified, followed by an analysis of labor and equipment required and the production rates expected under varying conditions. This method has the distinct advantage of being responsive to changes in labor, equipment, and material costs. The major disadvantage has been the time required to prepare a cost estimate using this procedure. The Sierra National Forest has overcome this hurdle by computerizing its Construction Cost Estimating Guide.

THE COST ESTIMATING GUIDE

The Construction Cost Estimating Guide used on the Sierra National Forest was developed over a period of time by Sierra personnel. The major work tasks consisted of identifying labor, equipment, and production rates for major items of work and placing this information in the computer for easy retrieval and updating. This effort was expanded by the Forest's construction and preconstruction personnel using available literature, studies, publications, and a local contractor's input to include:

Clearing and grubbing*	Structural plate culverts*
Roadway excavation*	Underdrain*
Development of pits and quarries	Downdrain*
Watering	Berm drain*
Berms*	Aggregate base and surface courses
Reshaping and finishing existing roadways*	Dust oils*
Riprap	

The guide was developed with the intent that updating would be computerized, so considerable effort was made to cover more variables than had been considered in the past.

For example, previous culvert installation costs had included only one variable — installation in an existing drainage in common material. This portion of the guide alone has been expanded to include installations in natural drains and in aftergrade situations, each estimated for installation in common, two types of common and boulder combinations, and in solid rock.

*Now updated by computer.

COMPUTER PROGRAMMING AND PRINTOUT

All equipment and labor is coded and the program is developed so that only the hourly wage or equipment rental rates have to be "punched" into the computer when updating the cost is necessary. The following is a partial sample of the output. This output is generated for each timber sale or project and becomes a permanent record of the cost estimating procedures. It is kept for use in the event that cost adjustments or modifications are required later in the contract.

DEVELOPMENT COSTS AND COMPUTER SAVINGS

The development of the entire guide (the base document from which the computer program was developed) required an investment of almost \$2,000. Programming costs were approximately \$700. The real savings has been made since computerizing the updates. Prior to computerizing, updates would cost approximately \$100 to \$250. Costs now run less than \$10 per update including salary to enter wage and equipment rates and computer time.

For additional information contact Ted Zeally, Assistant Forest Engineer. Sierra National Forest, Region 5, Area Code 209-487-5161.

DATA INPUT

EQUIPMENT RATES FOR ESTIMATING GUIDE

COST DATE : JULY 1975

EQPT. ID. NO.	DESCRIPTION	HOOR RATE	R/W FACTOR	DAILY R/W COST
1	D-8 CAT(46A SERIAL)W/BLADE AND WINCH	37.25	.45	134.10
2	LOADER(CAT 980,42H SERIAL)	26.00	.45	93.60
3	TRUCK,OFF HIGHWAY(22-27T)	17.00	.50	68.00
4	CHIPPER(12-16IN. CUTTERHEAD)	4.50	.55	19.80
5	CHAINSAW,5HP+	.80	.25	1.60
6	GRADER,CAT. 12F(99F SERIAL)	12.00	.45	43.20
7	D-8 CAT. W/RIPPER AND BLADE	38.50	.45	138.60
8	COMPRESSOR,600-900CFM	17.50	.50	70.00
9	JACKHAMMER	1.30	.25	2.60
10	RUBBER TIRE D ROLLER(SELF-PROPELLED,8-12 TON)	9.00	.45	32.40
11	WATER TRUCK,4000GAL W/PUMP	13.00	.50	52.00
12	SHEEPSFOOT OR GRID ROLLER, TOWED, DOUBLED RUM	4.50	.65	23.40
13	COMPRESSOR(900-1200CFM)	24.00	.50	96.00
14	AIRTRACK(0-4IN.)	10.50	.50	42.00
15	TRUCK TRACTOR,(60,000GVW)	20.00	.50	80.00
16	TRAILER,LOW-BED(40-50TON)	4.25	.50	17.00
17	DW-20 OR 270 RUBBER TIRE D SCRAPER(18 CU YD.)	27.00	.50	108.00
18	TRUCK(UNDER 12,000GVW)	3.00	.50	12.00
19	BACKHOE(50+HP.)	8.50	.45	30.60
20	WACKER(GROSS WT. 0-250LBS.)	1.70	.50	6.80
21	DUMP TRUCK(HIGHWAY,2 AXLES)	6.50	.50	26.00

RATES ARE FROM EQUIPMENT RENTAL RATES AND GENERAL PREVAILING WAGE RATES(FOR AREA 2) DATED JULY 1975

DATA INPUT

LABOR RATES FOR ESTIMATING GUIDE JULY 1975

LABOR ID. NO.	DESCRIPTION	BASE RATE,	COST/HOUR RATE*
1	LOADER OPERATOR, 4-12CU.YDS.	15.140	16.340
2	TRACTOR OPERATOR	14.500	15.700
3	TRUCK DRIVER, 18-24CU.YD.	12.320	13.520
4	CHAINSaw OPERATOR	10.985	12.185
5	CHOKESetter	10.835	12.035
6	CONSTRUCTION LABORER	10.735	11.935
7	GRADER OPERATOR (POWER BLADE)	14.980	16.180
8	AIR TOOL OPERATOR	10.985	12.185
9	DUMP TRUCK DRIVER (4-6YDS.)	11.735	12.935
10	ROLLER OPERATOR	14.000	15.200
11	WATER TRUCK DRIVER, 2500-4000GAL.	11.850	13.050
12	BLASTER AND POWDERMAN	11.210	12.410
13	HEAVY DUTY TRANSPORT TRUCK DRIVER	12.185	13.385
14	RUBBER-TIRED EARTHMOVING EGPT. OPER. (TO 45YD.)	14.500	15.700
15	BACKHDE OPERATOR	14.980	16.180

*INCLUDES PER DIEM AT \$1.50 PER HOUR ADJUSTED 0.8 BECAUSE PROFIT AND OVERHEAD AT 25% IS ALSO APPLIED TO PERDIEM IN COST CALCULATIONS.

RATES ARE FROM EQUIPMENT RENTAL RATES AND GENERAL PREVAILING WAGE RATES (FOR AREA 2) DATED JULY 1975

EXCAVATION PRINTOUT

EXCAVATION COSTS PER CUBIC YARD FOR SIDECASTING AND LAYER PLACEMENT JULY 1975

PUSH DIST.	DOZERS						SCRAPER + DOZER					
	EXCELLENT SLOPES 0-25%			AVERAGE SLOPES 25-40%			UNFAVORABLE SLOPES OVER 40%			EXCEL.	AVE.	UNFAV.
	150'	250'	350'	150'	250'	350'	150'	250'	350'	AVE. HAUL DISTANCE 700'		
COMMON	.25	.38	.46	.30	.42	.53	.37	.55	.67	1.34	1.98	3.09
RIPPING	.52	.78	.93	.61	.87	1.08	.76	1.14	1.38	1.80	2.49	3.68
BLAST	2.81	4.16	5.00	3.28	4.68	5.79	4.10	6.15	7.38	4.04	5.21	7.23

EXCAVATION COSTS PER CUBIC YARD FOR CONTROLLED COMPACTION

PUSH DIST.	DOZERS						SCRAPER + DOZER					
	EXCELLENT SLOPES 0-25%			AVERAGE SLOPES 25-40%			UNFAVORABLE SLOPES OVER 40%			EXCEL.	AVE.	UNFAV.
	150'	250'	350'	150'	250'	350'	150'	250'	350'	AVE. HAUL DISTANCE 700'		
COMMON	.48	.72	.86	.56	.80	1.00	.70	1.05	1.26	1.82	2.69	4.19
RIPPING	.97	1.45	1.74	1.13	1.63	2.03	1.42	2.13	2.57	2.44	3.37	4.98
BLAST	3.36	4.97	5.98	3.92	5.60	6.91	4.90	7.34	8.81	5.32	6.86	9.51

COSTS FOR SCARIFYING AND REMOVING ROCK FROM THE ROADWAY SURFACE

MINOR ROCK ----- \$ 208.20 PER MILE

MODERATE ROCK ----- \$ 416.40 PER MILE

PREVALENT ROCK ----- \$ 832.80 PER MILE

FINISH GRADING IN COMMON MATERIAL COSTS \$ 529.32 PER MILE.

FINISH GRADING IN ROCKY MATERIAL COST \$2116.80 PER MILE.

CULVERT INSTALLATION CREW COSTS JULY 1975

OPERATION	MATERIAL	COST/HOUR
EXCAVATION(18-36 IN.DIA.)	COMMON	60.48
EXCAVATION(18-36 IN.DIA.)	BLASTING*	83.03
EXCAVATION(42 IN.AND LARGER)	COMMON	88.75
EXCAVATION(42 IN.AND LARGER)	BLASTING*	100.69
BACKFILL(18-36 IN.DIA.)	COMMON AND BLASTING	70.40
BACKFILL(42 IN.AND LARGER)	COMMON AND BLASTING	89.83

*INCLUDES BLASTING SUPPLIES AT \$ 1635.00 PER TON

CULVERT INSTALLATION COST PER LINEAR FT. FOR 18-36 IN. PIPES JULY 1975

AFTER GRADE INSTALLATIONS

PIPE SIZE	COMMON	75%COM/25%BOULDERS	50%COM/50%BOULDERS	HARD ROCK
18 IN.CMP.	9.37	10.43	17.48	41.35
24 IN.CMP.	10.73	12.62	24.03	49.97

BEFORE GRADE INSTALLATIONS

PIPE SIZE	COMMON	75%COM/25%BOULDERS	50%COM/50%BOULDERS	HARD ROCK
18 IN.CMP.	7.41	7.56	8.87	12.29
24 IN.CMP.	8.91	9.21	11.05	16.24
36 IN.CMP.	12.20	12.35	15.88	28.33

----CULVERT INSTALLATION COSTS INCLUDE PROFIT AND OVERHEAD ----

INSTALLATION COST FOR A DROP INLET IN COMMON MATERIAL IS \$ 92.65, INCLUDING PROFIT AND OVERHEAD
 INSTALLATION COST FOR A DROP INLET IN BLASTING MATERIAL IS \$189.09, INCLUDING PROFIT AND OVERHEAD

COSTS FOR RESHAPE AND FINISH EXISTING ROADWAY JULY 1975

TASK DESCRIPTION	CREW	DAILY RATE	PRODUCTION RATE
REMOVE SLIDES	M	1101.96	COMPUTE BASED ON VOL OF SLIDE AND HAUL DISTANCE.
CLEAN DITCHES AND CULVERTS	N	320.92	350 FT. OF DITCH/HR. (INCLUDES CLEANING CULVERTS)
RESHAPE AND SCARIFY ROADWAY	O	529.32	1 MILE PER DAY
IMPORT CUSHION	P	1112.20	COMPUTE BASED ON LOCATION OF BORROW AND VOLUME OF HAUL
REMOVE OR SHOOT ROCKS	Q	779.28	1 HR/SHOT (INCLUDES MOVE IN/OUT)
RESHAPE, SCARIFY ROADWAY (ROCKY)	R	1058.40	1/2 MILE PER DAY
COMPACTION	S	193.60	MUST COINCIDE WITH GRADING RATE OF RESHAPE ROADWAY

UNDERDRAIN COSTS

EXCAVATION CREW IS \$ 48.55 PER HOUR IN COMMON MATERIAL

EXCAVATION CREW IS \$ 83.28 PER HOUR FOR BLASTING MATERIAL

INSTALLATION (EXC., BACKFILL, ASSEMBLY) IN COMMON MATERIAL IS \$ 6.19 PER LIN. FT., INCLUDING PROFIT AND OVERHEAD.

INSTALLATION (EXC., BACKFILL, ASSEMBLY) IN DIRT AND BOULDERS IS \$ 16.74 PER LIN. FT., INCLUDING PROFIT AND OVERHEAD.

INSTALLATION (EXC., BACKFILL, ASSEMBLY) IN BLASTING ROCK IS \$ 29.23 PER LIN. FT., INCLUDING PROFIT AND OVERHEAD.

-----THE ABOVE COSTS DO NOT INCLUDE RISERS OR FILTER MATERIAL COSTS -----

INSTALLATION COST OF A BERM DRAIN IS \$59.67, INCLUDING PROFIT AND OVERHEAD

WASHINGTON OFFICE NEWS

TECHNOLOGICAL IMPROVEMENTS

H. T. Taylor
Assistant Director

FEDERAL WATER POLLUTION CONTROL ACT PUBLIC LAW 92-500

The requirements of PL 92-500 are generating many diverse efforts within the Forest Service. Most of these efforts relate to Nonpoint Source (NPS) pollution. It is not our purpose to assess the impact of these activities on Forest Service programs (although it is obvious these requirements will have significant effect on our work); however, we want to show you the wide range of Forest involvement with NPS pollution.

The following list briefly describes a few of the more recent activities, some of which have been completed; others are still underway or are being coordinated with the Environmental Protection Agency (EPA) — the agency charged with administering PL 92-500.

The listed activities are by no means all inclusive or comprehensive. Only those activities having some Washington Office involvement are listed. Undoubtedly, there are many other activities underway in the Regions, Forests, and Experiment Stations that relate to Nonpoint Source Pollution and Public Law 92-500 that are not included in this list. It is evident that the requirements for the control of NPS pollution are in the evolving and developing stages. We plan on preparing subsequent articles in Field Notes informing you of the requirements and their significance and impact on FS engineering programs.

1. Nonpoint Water Quality Modeling in Wildland Management: A State-of-the-Art Assessment

Report prepared by FS under a contract with EPA.

2. Economic Evaluation of Alternative Control Strategies for Silvicultural Nonpoint Sources of Water Pollution

FS study proposal to EPA; currently under evaluation.

3. Strategy for the Control of Pollution from Silvicultural Activities

Position paper prepared by FS.

4. Silvicultural Pollution Control: Informational Guidance for Program Development to Control to Extent Feasible Such Sources

Information prepared by EPA and reviewed by FS.

5. Erosion Control During Highway Construction

Report coauthored by FS-Research for Transportation Research Board and reviewed by FS-NFS.

6. New Source National Pollutant Discharge Elimination System

Proposed amendment by EPA to code of Federal Regulations regarding preparation of environmental impact statements. Reviewed by FS at the request of the Department.

7. Interim Final Discharge Permit Regulations (Section 404 of PL 92-500)

Regulations could affect nonpoint sources of pollution. FS part of Department work group commenting on proposed Corps of Engineer regulations.

8. Cost and Effectiveness of Control of Pollution from Selected Nonpoint Sources

Report by Midwest Research Institute for the National Commission on Water Quality; report reviewed by FS.

9. Proposed Field Studies:

- A. Coweeta Watershed — Region 8
- B. Monongahela NF — Region 9
- C. Silver Creek — Region 4
- D. Horse Creek — Region 1

Proposed cooperative studies with Research for measuring and evaluating sediment yields from an array of different logging operations and, where roads are involved, an array of different sediment yields from an array of different logging operations, and where roads are involved, an array of different sediment minimizing measures. Study proposals have been reviewed and are being considered for funding and authority to proceed.

10. Cost Effectiveness of Techniques for Reducing Sediment from Logging Roads

Proposed NFS Study (Engineering) for FY 1977.

OPERATIONS

Harold L. Strickland
Assistant Director

ENGINEERING MANAGEMENT-PROGRAM WORKSHOP NOVEMBER 17-21, 1975

Regional Engineering Operations representatives met in Washington, D.C. the week of November 17 to get a better understanding of the Resource Planning Act's requirements and impacts on programming, budgeting, and engineering personnel. In addition, they had the opportunity to exchange information and express specific Regional concerns. The objectives of the meeting were accomplished through discussion sessions with Chief John McGuire, Associate Chief Rex Resler, Deputy Chiefs Tom Nelson and Max Peterson, and with various representatives from WO Staffs¹ and the Office of Management and Budget.

Six workshops were held to identify and define problems confronting Engineering in programming, budgeting, and manpower, and to formulate recommended action plans, in addition to the discussion sessions. We are listing the recommendations that were produced by the workshops. All recommendations are being analyzed by this office and those that are adopted will be sent to Regional Foresters through appropriate channels.

OTHER RECOMMENDATIONS

WORKSHOP RECOMMENDATIONS DISCUSSED WITH CHIEF MCGUIRE

1. Make an evaluation of the multi-Deputy organization concept to determine its impact on the technical input required for the day-to-day decisionmaking process of the Forest Supervisor. Emphasis should be placed on evaluating the filtering process this layer introduces and its effect on grade levels of technical specialists.
2. Evaluate our current recruitment levels and processes and, where warranted, take steps to increase the level of recruitment in each Region and to centralize recruiting authority (selection and placement) at the Regional or National level.
3. Develop a uniform Service-wide process for evaluating capital investment proposals.
4. Develop and approve the unit or resource plan before a capital investment project is undertaken.

¹ *Personnel Management, Administrative Management, Engineering, and Program Development and Budget.*

5. Timber Sale Augmentation:

- A. Make Regional allocations for contributions with the option of midyear adjustment if changes are necessary.
- B. Construct roads prior to timber sales via appropriated funds.
- C. Adjust contribution policy and consider alternatives of no supplementation.
- D. Use a 3-year average index for planning and funding requests. Changes will then be either funded or the sale made without contribution.

6. A task force made up of engineering representatives from each Region and the WO and a representative from Administrative Management should meet in Fort Collins the last 2 weeks in January 1976, to evaluate Regional responses to a proposed Forest Engineering complexity study and to develop a second generation format for testing by the Regions prior to full implementation.

PERSONNEL-ORGANIZATIONAL ISSUES

- 1. Each Region should establish criteria for determining the need for a District Engineering organization and, where such a need exists, criteria for determining how it will be structured.
- 2. Each Region should develop a functional (i.e., Engineering) review board process for screening and reviewing individual PRI data.
- 3. The Forest Service should strive to create a dual career ladder which will allow grade recognition for technical talent equal to that given for managerial responsibilities. In the interim, each Region should strive for full implementation of the concepts contained in the Chief's 6150 letter of August 21, 1975.
- 4. Each Region should review and analyze, by 2/1/76, a paper entitled, "A Human Resource Management Concept" (11/75 Engineering Operations Meeting) and determine:
 - A. The need for such a system.
 - B. The major elements and subelements of the system.
 - C. Regional priorities and methods for dealing with each element.
- 5. Each Region should review and analyze, by 2/1/76, a paper entitled, "Manpower Planning" (11/75 Engineering Operations Meeting) and determine:
 - A. How we can best meet the Resource Planning Act's requirement for a long-range Manpower Planning System.
 - B. Whether or not such a system should be tied into the Program-Budget process.

DATA

1. An automated data base that complements the Region's budget process and Resource Planning Act requirements should be developed for all resources.
2. The Program Development and Budget (PD&B) Staff should assert leadership in integrating and coordinating program accomplishment data systems for all functional and resource system areas. Duplication of "functional" efforts should be avoided.
3. Engineering should support PD&B by assisting in the development and utilization of data systems for the transportation system (TIS) and for other assigned activities.
4. Planning outputs should be identified and displayed in a manner that will be conducive to an effective evaluation and program outputs should be such that they can be used for accomplishment and accountability purposes under the Program Budget System and the Resource Planning Act.

The preceding recommendations represent an effective beginning for the systematic identification and resolution of the numerous issues associated with our Engineering efforts.

Although we have made much progress in the past, we can expect to make even more in the future through the full development and implementation of a comprehensive Transportation System Management program and a Human Resource Management System.

CONSULTATION & STANDARDS

C. R. Weller
Assistant Director

FEDERAL INTERAGENCY COMMITTEE FOR RECREATION WASTE MANAGEMENT RESEARCH

The Federal Interagency Committee for Recreation Waste Management Research was organized in 1973 as a working committee (not a policy committee) that would operate according to clearly defined objectives and functions. Its primary purpose was to prevent needless duplication of research, development, and test efforts by the numerous Federal agencies involved with Recreation Waste Management.

In November 1973, the Interagency Committee was accepted as a formal committee operating under the auspices of the Interagency Conference on the Coordination of Research Activity. The various Federal agencies represented on the Interagency Committee are: Environmental Protection Agency; Office of Chief Engineers (Corps of Engineers); Waterways Experiment Station (Department of Army); Bureau of Land Management; Bureau of Reclamation; Bureau of

Outdoor Recreation; Fish and Wildlife Service; Public Health Service; National Park Service; Federal Highway Administration (both the Office of Research and its operating arm); Forest Service; and Tennessee Valley Authority.

The Committee provides an exchange forum for technical research and development efforts regarding problems and solutions; participating agencies share in technical accomplishments or failures and, hopefully, duplication is eliminated. Mutual research needs are identified for collection, treatment, disposal, and/or reuse of wastes generated at recreation and highway rest area facilities. The Interagency Committee permits a comprehensive approach to the total problem of recreation waste management, and provides a logical and effective expenditure of research and development efforts.

Waterwaste treatment is the first priority in the various aspects of recreation waste management that the Interagency Committee has undertaken and is presently pursuing. Some interest has been pursued in solid waste and potable water systems, but these are secondary efforts.

The Committee meets twice a year using a formal agenda. The exchange of technical information on systems, facilities, and methods that are being investigated or have been tried by various agencies is always one of the items discussed.

An almost-completed study of recreation area wastewater flows and characterization is an example of coordinated work efforts between Federal agencies. The San Dimas Equipment Development Center, the Waterways Experiment Station, and the Federal Highway Administration have all been working on flow rates and characterization of various types of recreation area wastewaters over the past 18 to 24 months. The results of the three agencies' work were discussed at the December meeting. This information will be distributed to field units for use in design of waterwaste systems. It is this type of coordinated effort that has made the Federal Interagency Committee for Recreation Waste Management Research function very satisfactorily during the past three years of its existence.

The Forest Service has been an active member of this committee, formally represented by Bill Kolzow, WO Engineering Staff. Briar Cook, San Dimas Equipment Development Center, has also attended several of the meetings to present the work that San Dimas has undertaken in wastewater management the past few years.

Should you desire additional information on the Interagency Committee functions, or want to bring up what you believe is a new method or system for discussion and to find out if it has ever been used before by other Federal agencies, contact Bill Kolzow.

INVITATION TO READERS OF FIELD NOTES

Every reader is a potential author of an article for FIELD NOTES. If you have a news item or short article you would like to share with Service engineers, we invite you to submit it to FIELD NOTES for publication.

Material submitted to the Washington Office for publication should be reviewed by the respective Regional Office to see that the information is current, timely, technically accurate, informative, and of interest to engineers Service-wide (FSM 7113). The length of material submitted may vary from several short sentences to several typewritten pages; however, short articles or news items are preferred. All material submitted to the Washington Office should be typed double-spaced, and all illustrations should be original drawings or glossy black and white photos.

Each Region has an Information Coordinator to whom field personnel should submit both questions and material for publication. The Coordinators are:

R-1	Bill McCabe	R-4	Ted Wood	R-9	Norbert Smith
R-2	Allen Groven	R-5	Jim McCoy	R-10	Bill Vischer
R-3	Bill Strohschein	R-6	Kjell Bakke	WO	Al Colley
		R-8	Ernest Quinn		

Coordinators should direct questions concerning format, editing, publishing dates, and other problems to:

Forest Service, USDA
Engineering Staff, Washington Office, Editorial Services
Attn: Gordon L. Rome or Rita E. Wright
Washington, D.C. 20250

Telephone: Area Code 703-235-8198

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