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BIOMASS POWER FOR RURAL DEVELOPMENT

Quarterly Report for the Period
July 1, 1999 - September 30, 1999

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CHARITON VALLEY
RESOURCE CONSERVATION & DEVELOPMENT, INC.

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Project Progress Report for the Period 7/1/99 to 9/30/99

Cooperative Agreement: DE-FC36-96GO10148

Program/Project Title: Biomass Power for Rural Development/
Chariton Valley Biomass Project

Recipient: Chariton Valley Resource Conservation & Development, Inc.

Task 1.00 NEPA process

- Mention should be made that during previous reporting periods project staff has worked with DOE representatives to address and satisfy NEPA requirements associated with project activities in general and the planned co-fire test campaigns in particular.

Task 2.9.2 Develop switchgrass fuel supply procurement plan
Task 2.9.3 Harvest, load, transport, unload, and store switchgrass

- Prairie Lands Bio-Products, Inc., the switchgrass producers' organization, worked with project staff, researchers, contract operators, and cooperating landowners to plan activities for the upcoming harvest of switchgrass biomass. This work involved: (1) field visits to assess the conditions of stands available for harvest, (2) field work and visits to address issues related to field access, staging, and storage, (3) coordination meetings for research activities to be conducted in conjunction with the harvest; and (4) meetings and discussions to complete arrangements with contract operators and cooperating landowners for their participation in the harvest.

Task 2.9.4 Assign Alliant technical staff to the project
Task 2.9.5 Secure the services of engineer, purchase, and construct contractor(s)
Task 2.9.6 Equipment acquisition, site preparation, and facility modifications

- Alliant personnel and project staff continued their review of the preliminary design report prepared by R.W Beck for its use in preparing the Plan for Co-firing Switchgrass at the Ottumwa Generating Station (OGS). The initial and subsequent revisions of the Plan for Co-firing Switchgrass at OGS were developed by Alliant personnel and project staff with DOE assistance as part of the Statement of Work originally submitted to the DOE on June 30, 1999. The contents of the Plan for Co-firing Switchgrass at OGS provided the basis for Alliant personnel and project staff to develop a cooperative agreement between Alliant and the RC&D. The agreement outlines the terms and conditions of cooperation between the two parties for completing activities presented in the plan.

- In addition to Mr. Gary Walling, Alliant's principal contact for the project, Alliant personnel continue to be assigned and perform activities related to specific project related tasks and needs in the areas of plant operation, environmental regulations and permits, contractual agreements for fuel supply, research, and market development. Alliant continues to plan and make arrangements for the assignment of additional technical personnel, i.e., project engineer(s), to the biomass project. Related to these tasks, Alliant personnel, Prairie Lands representatives, and project staff are conducting activities to address the need for on-site storage of switchgrass at OGS for the planned co-fire test campaigns.

- Alliant personnel have maintained contact and continued technical exchange with representatives of the Danish organizations Elsam and Midtkraft as follow-up to previous meetings and discussions. The nature and content of these conversations provided input into development of the Plan for Co-firing Switchgrass at OGS and addressed the potential role of Elsam and Midtkraft in project activities related to the final engineering design, modifications at OGS, and co-fire test campaigns.

Task 3.90 Design, develop, and test gas clean up systems

Activities during the reporting period consisted primarily of continued development of a moving granular bed filter (MGBF), setup of gas analysis equipment, and reconstruction of the fluidized bed gasifier at a new location.

- Development of the MGBF was initiated using a cold flow model, as reported in last quarter's report. The cold-flow model development work has resulted in the design of a hot-flow model to be built and implemented with our 5 ton/day fluidized bed gasifier. The design of this filter was completed during this quarter. The design was sent out for bid to several metal fabrication shops.

- The hot-flow model will be installed at the Biomass Energy Conversion Facility (BECON) located near Nevada, IA. The 5 ton/day fluidized bed gasifier formerly located on the ISU campus has been relocated to BECON. As part of the relocation, a new reactor has been designed and fabricated. Approximately half of the system has been installed. Procurement of the remaining parts to the system is in process.

- Several new pieces of analytical equipment have been acquired. The equipment includes an atomic adsorption spectrometer, an ion chromatograph, and several on-line analyzers. This equipment is currently being installed and calibrated.

Task 5.20 Assess the genetic variability for biofuel traits
Task 5.30 Determine the effect of timing of harvest on burning qualities
Task 5.3.1 Fuel quality analysis

- Data on stands, height, and disease were scored for the switchgrass variety trials. Growth in plots during this season appears excellent. Arrangements have been made for the harvest of variety trial plots this fall.

- Reed canarygrass variety/management trials in Ames, IA and Arlington, WI have not shown much regrowth, unlike last year. Given this, researchers are considering the need for a split application of N. Overall, the variety/management plots look good.

- Reed canarygrass variety/management trial in Chariton, IA established well despite some smartweed pressure. All plots were clipped at about 8 inches in July for weed control. Overall the plots appear excellent.

- Reed canarygrass plant introduction trials in Ames, IA and Arlington, WI demonstrated exceptional regrowth following May/June harvest. As previously reported, all plots were fertilized (not split applied) with 100 lbs. of nitrogen per acre in April. Since this regrowth is similar to the first year results with the reed canarygrass variety/management trial at Ames, IA, the difference in regrowth when compared to this year's variety/management trials could be due to residual nitrogen in the soil which is mined out after the first year. Arrangements were made for all plots to be harvested this fall.

- Twenty-four accessions of reed canarygrass germplasm were collected from a diversity of habitats in Boone County, IA. Plans are to evaluate this germplasm, together with other collections from native stands in North America, in preparation for a possible germplasm collection trip. Financial support for these activities is being sought from the National Plant Germplasm System.

- The laboratory analysis and interpretation of results is still underway at both ISU and the Federal Energy Technology Center for switchgrass samples collected during the 1998/1999 harvest season. These include monthly samples of unharvested switchgrass from two biomass production fields and samples of harvested switchgrass, i.e., baled material, from six biomass production fields.

- An estimated 20 acres in two fields of reed canarygrass have been secured as sites for yield, fuel quality analysis, and fertility/management trials. Plans for the establishment of ten acres of reed canarygrass this fall were postponed due to drier than normal weather. An additional 20 acres of reed canarygrass will be established and/or secured as sites for the trials.

Task 5.40 Evaluate harvest and handling equipment

Task 5.4.1 Biomass procurement system design

- Representatives of John Deere, Prairie Lands, and project staff completed arrangements for the use and evaluation of prototypes of the company's forage equipment during the upcoming harvest. These arrangements included field visits to identify switchgrass stands that would be harvested as part of this task and meetings with John Deere personnel and contracted operators to give an orientation to the biomass project, plan harvest activities, select equipment based on project and company requirements, and provide instruction in the use of equipment.

- Technical Consultants, Inc. (TCI) continued to conduct meetings, discussions, and field visits with cooperating switchgrass producers and partner organizations to collect information needed to evaluate biomass procurement system alternatives. In addition, TCI has worked with GIS personnel assisting the project to obtain additional region-wide information and apply this technology to the development of biomass procurement system alternatives.

Task 5.50 Economic analysis of energy crop production

- Additional time during this reporting period has been dedicated to refining and interpreting estimated budgets for the establishment and management of switchgrass biomass. Accompanying this report is a series of tables that present cost summaries for seven establishment and management scenarios together with examples of detailed estimates used to generate these cost summaries. These scenarios represent practices and assumptions consistent with the production of switchgrass for biomass in the Chariton Valley area.

- At the request of producers cooperating with the biomass project, the production cost analysis has been extended to include a comparison between returns for land in corn production with those for switchgrass production. At the present time, this analysis has focused on determining the price that producers would need to receive for switchgrass biomass in order to obtain a comparable return should the same land be used to produce corn. Accompanying this report is an outline of the assumptions and results of a portion of this analysis.

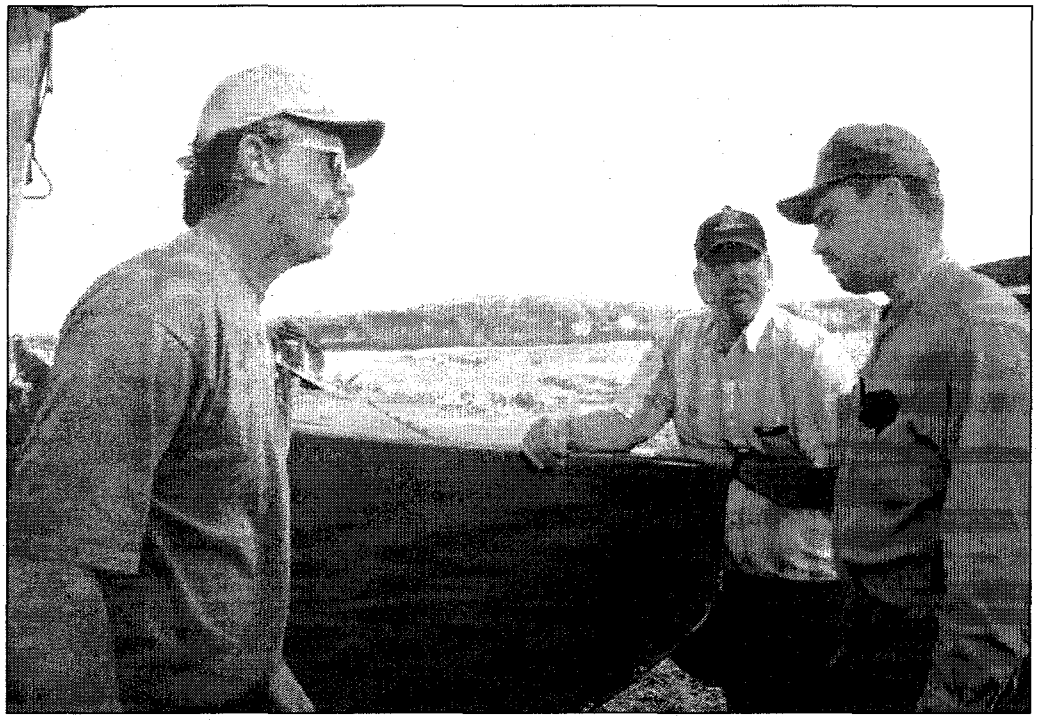
- Completion of the estimated budgets for the establishment and management of switchgrass biomass has allowed work to proceed with the quantification of on-farm energy requirements for switchgrass biomass production.

Task 5.60 Obtain commitments on 4,000 acres

Task 5.6.1 Field coordination and stand maintenance

- Currently seventy producers have agreed to cooperate with the biomass project to establish, manage, and harvest switchgrass and/or conduct research on their land. The seventy cooperating producers own and manage close to 5,500 acres of land in 245 fields in the project area. The average field size is approximately 22 acres and the range in field size is from one acre to 164 acres.

- Field coordination and stand maintenance activities have consisted primarily of providing technical assistance to cooperating producers to improve the management of 2,500 acres of established switchgrass and to complete the establishment and initial management of switchgrass on an additional 3,000 acres. This assistance has involved conducting field visits with producers to assess the condition of switchgrass stands, selecting management alternatives, coordinating the application of stand maintenance activities, and evaluating the effectiveness of these activities. Stand maintenance activities conducted during the reporting period consisted of completing post-harvest fertilizer application and weed control on older, established stands and fertilizer application and weed control on younger, recently established stands.



Prairie Lands member Doug Goben discusses switchgrass management with cooperating producers.

- At the request of Prairie Lands and cooperating producers, the project has initiated a preliminary study of switchgrass diseases that might impact the production of biomass. The study will consist of a comprehensive survey and identification of switchgrass diseases in the project area, an assessment of the potential impact of those diseases, and recommendations for their management. Dr. Gary Munkvold with ISU has agreed to conduct this study. Study activities have been conducted during this reporting period.

- Field coordination continues to consist of providing assistance and support to field related activities that are conducted as part of Tasks 2.10 to 2.9.6, 5.1.0 to 5.50, 5.70, 6.10, 8.10 to 8.50, and 9.0.

Task 5.70 Biomass cropping systems

- Research-scale demonstration plots of biomass cropping systems that have been established continue to be managed, e.g., application of treatments such as alternative hay harvest and grazing periods. Preparations are being made for the harvest of research plots. Data collection continues that will be used to evaluate the performance of these plots. Parameters to be evaluated include biomass fuel quality, biomass yield, forage quality, and forage yield as well as specific management implications, e.g., impact on nitrogen requirements for biomass production. Results of the research plots that combined legumes with switchgrass are encouraging. Plans are to increase the number of these types of research plots for the project's next year of evaluation.

Biomass cropping system demonstration, corn and switchgrass, on Prairie Lands member Loren Eddy's farm.

- Field-scale demonstrations of biomass cropping systems continue to be managed, e.g., weed control, preparations for harvest. The project staff continued to assist cooperating producers to plan and implement management practices as well as evaluate system performance. Data collected for this evaluation includes tillage and planting system, weed control, seed types and rates, fertilizer types and rates, and harvest activities and yields as well as observations on specific benefits, problems, and suggestions. Preparations continue for the establishment of additional field-scale demonstrations of biomass cropping systems, e.g., corn or forage sorghum as companion crops, with interested producers.

Task 6.10 Sales contracts and biofuel market development

- Representatives of Alliant Energy, Prairie Lands, and other project partners continued meetings and discussions with the objective of developing one or more model contractual agreements for the generation and marketing of electricity from co-firing switchgrass biomass with coal.

- Representatives of project partners including the Iowa Department of Natural Resources (DNR) and Pheasants Forever continued to provide information which could assist with the development of a pilot program that will allow the marketing of biomass produced on land in the Conservation Reserve Program.

- Project partners including the Iowa Farm Bureau and Prairie Lands continued to provide information which may assist with the extension of the Renewable Resources Electricity Credit and its modification that will improve opportunities for facilities that co-fire closed-loop biomass with coal to be eligible for the credit.

Task 7.00 Construction and environmental permits

- Alliant personnel assisting the project with permits have continued discussions with the Iowa DNR and US Environmental Protection Agency (EPA) in an effort to address any requirements associated with the planned co-fire test campaigns. In addition, Alliant personnel have had discussions with ISG Resources, Inc. (Midwest Fly Ash) regarding the impacts of co-firing switchgrass biomass on ISG Resources' applications for the fly ash that will be generated during the test campaign.

Task 8.10 GIS Analysis

- The application of GIS and related technologies has been provided during this reporting period to assist with activities that are part of Tasks 5.2, 5.4.1, 5.5, 5.60, 5.6.1, 5.70, 8.20, 8.30, 8.40, 8.50, and 9.00. Assistance provided has continued to include the collection of field data, assembling, developing, and providing coverages and associated databases, creation and maintenance of project related databases, model application, data analysis, and the development of map products.

Task 8.20 Soil quality

- Sub-samples were collected from the fertility plots in July and August for quality and chemical analysis. All laboratory analyses on samples collected last year have been completed. Switchgrass growth during this season looks good on all plots. Arrangements were been made for the fall harvest of fertility plots.

- Preparations were finalized for the collection of switchgrass yield data from biomass production fields during the 1999/2000 harvest. In addition to final field selection, these preparations included development of data collection sheets, training of harvest crew members, and acquiring necessary equipment.

Task 8.30 Water quality

- The soil and water assessment tool (SWAT) has been selected by ISU researchers for use in evaluating the impacts on water quality in Rathbun Lake of producing switchgrass for biomass. As such, researchers and project staff dedicated considerable time and effort during the reporting period to becoming more familiar with the development and application of SWAT. Professionals with the USDA Agricultural Research Service at the Grassland, Soil, and Water Research Laboratory in Texas have provided technical assistance with SWAT.

- A methodology for the collection, processing, and analysis of data that will be used as input for the soil and water assessment tool continues to be developed. Local USDA NRCS field offices and Soil and Water Conservation Districts (SWCD) have cooperated to provide information regarding land use and management practices which, together with available GIS coverages such as soils, is being used to define and identify data collection procedures. A number of the GIS coverages that will be essential to the evaluation of the water quality impacts of switchgrass biomass production have been assembled, processed, and are operational. These coverages include soils, land use, water resources, and topography.

- Researchers at ISU have initiated the design of rainfall simulations that will be used to collect field data regarding the water quality impacts of growing switchgrass for biomass relative to alternative land uses such as row crop production. Candidate fields for the rainfall simulations continue to be identified and evaluated.

Task 8.40 Wildlife impacts

- ISU researchers and a team of technicians have completed the first year of field surveys. As previously reported, fieldwork has involved breeding bird surveys, nest searches, monitoring active nests, set-up and monitoring of artificial nests, and vegetation measurements. The analysis of data collected will be carried out during the fall and winter. Results of data analysis will be used to evaluate the impact on wildlife habitat of producing switchgrass for biomass.

- Plans have been finalized for the wildlife research treatments to be applied during the upcoming harvest. Plans are for the project to apply harvest treatments in at least 24 switchgrass fields being managed to produce biomass. This year's harvest will allow a season of winter field surveys to be completed to evaluate the impact of biomass production on fall and winter habitat.

- ISU researchers and biomass project representatives continue to develop the framework for a GIS based model to assess the potential impacts on wildlife habitat of changes in land use to switchgrass biomass production. One particularly attractive feature of the framework being developed will be its capability to assess impacts from alternative land use change scenarios, e.g., varying percentages of row crop conversion in a given area. Results from the analysis of data from the first year of field surveys will be used together with similar data from published research to develop this framework. A number of the GIS coverages required for this analysis have been developed and assembled.

Task 8.50 Carbon sequestration

- ISU researchers continued to conduct the carbon content analyses of 1.2 meter long soil cores collected from the fertility plots and adjacent fields under different land uses in Lucas (Derby) and Wayne (Millerton) Counties. In addition, researchers collected 83 soil cores from nine transects from fields having differing switchgrass stand age. These will be described and analyzed over the winter.

- University of Iowa researchers have continued to collect and analyze data to perform the life cycle analysis of greenhouse gas emissions for the co-firing of switchgrass biomass with coal at OGS. A preliminary report for this study is expected to be available during the next reporting period.

- Project partners including the Iowa Farm Bureau, Prairie Lands, Iowa DNR, ISU, and the Center for Global and Regional Environmental Research at the University of Iowa together with the firm Environmental Financial Products and University of Colorado continued efforts to develop and demonstrate market opportunities for carbon sequestration and avoidance associated with the production and use of biomass in Iowa.

Task 9.0 Information and education

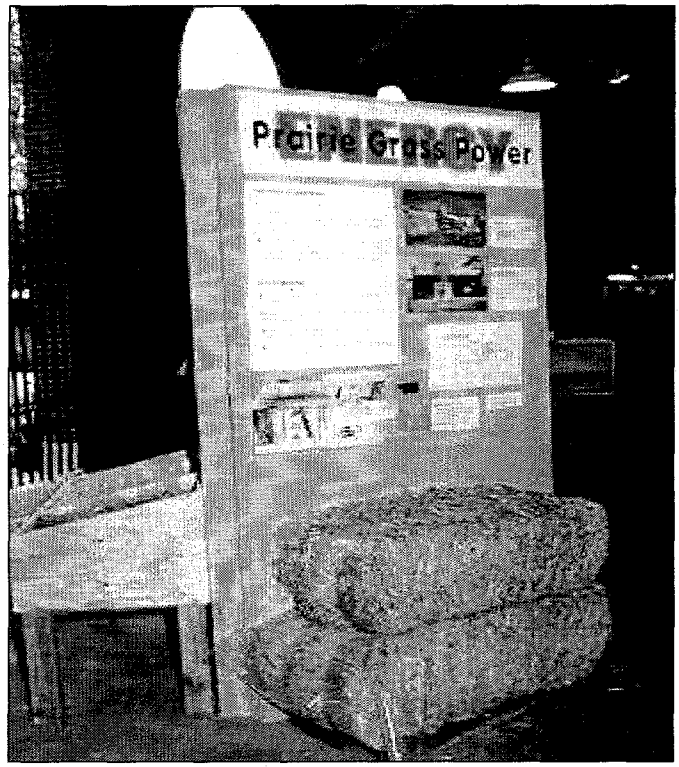
- Developed project displays and materials for the 1999 Iowa State Fair, county fairs in the project area, the 1999 Iowa All Energy Expo, and the Monroe County CRP demonstration field day. Fabricated and installed signs for project research and demonstration sites at the ISU McNay Research Farm and the Monroe County CRP Demonstration Area.

- Prepared and distributed the project newsletter to cooperating switchgrass producers and partner organizations.

- Developed a companion poster for the paper and presentation *Switchgrass for Energy in Southern Iowa: Developing and Maintaining Producer Involvement* at Fourth Biomass Conference of the Americas.

- Continued to develop materials for the project web site www.cvrcd.org

- Project partners are cooperating in preparations for the conference *Carbon: Exploring the Benefits to Farmers and Society* to be held in Des Moines in August, 2000. Conference sponsors include the USDA NRCS, Iowa Chapter of the Soil and Water Conservation Society, Chariton Valley RC&D, USDA Agricultural Research Service, Iowa DNR, Iowa Division of Soil Conservation, Iowa Farm Bureau, ISU, DOE, and US EPA.



Project display at the 1999 Iowa State Fair

Attachment for

Task 5.50 Economic analysis of energy crop production

Attachment A

Chariton Valley Biomass Project
Estimated Establishment and Management Costs for Switchgrass Biomass

Switchgrass Biomass Production Scenarios

1. Frost (February/March) seeding on cropland
2. Frost (February/March) seeding on grassland
3. Spring seeding on cropland with airflow
4. Spring seeding on cropland with a drill
5. Spring seeding on cropland with a no-till drill
6. Spring seeding on grassland with a drill
7. Spring seeding on grassland with a no-till drill

General Assumptions for All Scenarios

1. Establishment costs are prorated over 11 years at 8 percent
2. Re-seeding costs are prorated over 10 years at 8 percent, adjusted for probability of re-seeding
3. Land charges used for cropland are $50, $75, and $100 per acre
4. Land charges used for grassland are $25 and $50 per acre
5. All machinery operations are charged at custom rates
6. Switchgrass is harvested in large square bales with an average weight of 875 pounds per bale
7. Switchgrass yields used are 1.5, 3.0, 4.0, and 6.0 tons per acre

Accompanying Tables

Tables 1, 2, 3, and 4 present draft Cost Summaries for Switchgrass Biomass Production Scenarios

Draft establishment and production cost budgets for Scenarios 1 and 2

Table 1: Costs summaries for the different scenarios (Land charge equivalent $50-$75)

Scenario	Yield Ton/acre	Establishment costs (prorated) ($)	Reseeding costs (prorated) ($)	Production costs ($)	Total cost per acre ($)	Total cost per ton ($)
1 (Cropland)	1. 5	24.69	4.55	168.10	197.33	131.56
1	3.0	24.69	4.55	224.44	253.67	84.56
1	4.0	24.69	4.55	261.99	291.23	72.81
1	6.0	24.69	4.55	337.11	366.35	61.06
2 (Grassland)	1.5	23.96	3.61	143.10	170.68	113.78
2	3.0	23.96	3.61	199.44	227.02	75.67
2	4.0	23.96	3.61	237.95	264.57	66.14
2	6.0	23.96	3.61	312.11	339.69	56.61
3 (Cropland)	1.5	24.69	9.09	168.10	201.88	134.59
3	3.0	24.69	9.09	224.44	258.22	86.07
3	4.0	24.69	9.09	261.95	296.27	73.94
3	6.0	24.69	9.09	337.11	370.89	61.82
4 (Cropland)	1.5	25.19	9.09	168.10	202.38	134.92
4	3.0	25.19	9.09	224.44	258.72	86.24
4	4.0	25.19	9.09	261.95	296.27	74.07
4	6.0	25.19	9.09	337.11	371.39	61.90
5 (Cropland)	1.5	24.14	9.09	168.10	201.33	134.22
5	3.0	24.14	9.09	224.44	257.67	85.89
5	4.0	24.14	9.09	261.99	295.22	73.81
5	6.0	24.14	9.09	337.11	370.34	61.72
6 (Grassland)	1.5	24.47	7.23	143.10	174.80	116.53
6	3.0	24.47	7.23	199.44	231.14	77.05
6	4.0	24.47	7.23	236.99	268.69	67.17
6	6.0	24.47	7.23	312.11	343.81	57.30
7 (Grassland)	1.5	25.06	7.23	143.10	175.40	116.93
7	3.0	25.06	7.23	199.44	231.73	77.24
7	4.0	25.06	7.23	236.99	269.29	67.32
7	6.0	25.06	7.23	312.11	344.41	57.40

Table 2: Costs summaries for the different scenarios (Land charge equivalent $25-$100)

Scenario	Yield Ton/acre	Establishment costs (prorated) ($)	Reseeding costs (prorated) ($)	Production costs ($)	Total cost per acre ($)	Total cost per ton ($)
1 (Cropland)	1. 5	28.19	5.48	193.10	226.77	151.18
1	3.0	28.19	5.48	249.44	283.11	94.37
1	4.0	28.19	5.48	287.00	320.67	80.17
1	6.0	28.19	5.48	362.11	391.35	65.22
2 (Grassland)	1.5	20.46	2.68	118.10	141.25	94.17
2	3.0	20.46	2.68	174.44	197.59	65.86
2	4.0	20.46	2.68	212.01	235.15	58.79
2	6.0	20.46	2.68	287.11	310.26	51.71
3 (Cropland)	1.5	28.19	10.95	193.10	232.25	154.83
3	3.0	28.19	10.95	249.44	288.59	96.20
3	4.0	28.19	10.95	287.01	326.15	81.54
3	6.0	28.19	10.95	362.11	401.26	66.88
4 (Cropland)	1.5	28.69	10.95	193.10	232.75	155.16
4	3.0	28.69	10.95	249.44	289.09	96.36
4	4.0	28.69	10.95	287.01	326.65	81.66
4	6.0	28.69	10.95	362.11	401.76	66.96
5 (Cropland)	1.5	27.64	10.95	193.10	231.70	154.46
5	3.0	27.64	10.95	249.44	288.04	96.01
5	4.0	27.64	10.95	287.01	325.60	81.40
5	6.0	27.64	10.95	362.11	400.71	66.78
6 (Grassland)	1.5	20.97	5.36	118.10	144.44	96.26
6	3.0	20.97	5.36	174.44	200.78	66.93
6	4.0	20.97	5.36	212.01	238.33	59.58
6	6.0	20.97	5.36	287.11	313.44	52.24
7 (Grassland)	1.5	21.56	5.36	118.10	145.04	96.69
7	3.0	21.56	5.36	174.44	201.37	67.12
7	4.0	21.56	5.36	212.01	238.93	59.73
7	6.0	21.56	5.36	287.11	314.04	52.34

Table 3: Costs summaries for the different scenarios (Land charge equivalent $25-$50)

Scenario	Yield Ton/acre	Establishment costs (prorated) ($)	Reseeding costs (prorated) ($)	Production costs ($)	Total cost per acre ($)	Total cost per ton ($)
1 (Cropland)	1. 5	21.19	3.61	143.10	167.90	111.94
1	3.0	21.19	3.61	199.44	224.24	74.75
1	4.0	21.19	3.61	237.00	261.80	65.45
1	6.0	21.19	3.61	312.11	341.35	56.89
2 (Grassland)	1.5	20.46	2.68	118.10	141.25	94.17
2	3.0	20.46	2.68	174.44	197.59	65.86
2	4.0	20.46	2.68	212.01	235.15	58.79
2	6.0	20.46	2.68	287.11	310.26	51.71
3 (Cropland)	1.5	21.19	7.23	143.10	171.52	114.35
3	3.0	21.19	7.23	199.44	227.86	75.95
3	4.0	21.19	7.23	237.00	265.42	66.35
3	6.0	21.19	7.23	312.11	340.53	56.75
4 (Cropland)	1.5	21.69	7.23	143.10	172.02	114.68
4	3.0	21.69	7.23	199.44	228.36	76.12
4	4.0	21.69	7.23	237.00	265.92	66.48
4	6.0	21.69	7.23	312.11	341.03	56.84
5 (Cropland)	1.5	20.64	7.23	143.10	170.97	113.98
5	3.0	20.64	7.23	199.44	227.31	75.77
5	4.0	20.64	7.23	237.00	265.92	66.48
5	6.0	20.64	7.23	312.11	341.03	56.84
6 (Grassland)	1.5	20.97	5.36	118.10	144.44	96.26
6	3.0	20.97	5.36	174.44	200.78	66.93
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7	4.0	21.56	5.36	212.01	238.93	59.73
7	6.0	21.56	5.36	287.11	314.04	52.34

Scenario 1. Frost Seeding: Establishment Year

(Switchgrass following Crops)

Preharvest Machinery Operations	**Cost Per Acre***
Disc	$8.00
Harrow	3.75
Airflow spreader (seed and fertilizers)	5.00
Spraying chemicals	4.00
Total machinery cost	$20.75

Operating Expenses	**Unit**	**Price/Unit**	**Amount**	**Cost Per Acre**
Seed	lb of PLS	$4.00	6.00	$24.00
Fertilizer (0-30-40)	lb of N,K,P	0.143	100.00	14.30
Lime (including its application)	ton	11.50	3.00	34.50
Herbicide				
- Atrazine	qt.	3.37	1.50	5.06
- 2,4 D	pt.	1.76	1.50	2.64
Total operating cost	$/acre			$80.50

Land Charge (cash rent equivalent)	$/acre	$75.00
Total Establishment Costs		$176.25
Prorated Establishment Costs (11 yrs. @ 8%)		$24.69

* Source: 1999 Iowa Farm Custom Rate Survey, FM-1698, March 1999.

Scenario 2. Frost Seeding: Establishment Year

(Switchgrass Conversion from Grassland)

Preharvest Machinery Operations	Cost Per Acre*
Mow	$6.60
Airflow spreader (seed and fertilizers)	5.00
Spraying Roundup	4.00
Spraying Atrazine and 2,4 D	4.00
Total machinery cost	$19.60

Operating Expenses	Unit	Price/Unit	Amount	Cost Per Acre
Seed	lb of PLS	$4.00	6.00	$24.00
Fertilizer (0-30-40)	lb of N,K,P	0.143	100.00	14.30
Lime (including its application)	ton	11.50	3.00	34.50
Herbicide				
- Atrazine	qt.	3.37	1.50	5.06
- 2,4 D	pt.	1.76	1.50	2.64
- Roundup	qt.	10.49	2.00	20.98
Total operating cost	$/acre			$101.48

Land Charge (cash rent equivalent)	$/acre	$50.00
Total Establishment Costs		$171.08
Prorated Establishment Costs (11 yrs. @ 8%)		$23.96

* Source: 1999 Iowa Farm Custom Rate Survey, FM-1698, March 1999.

Scenario 1. Frost Seeding: Production Year
(Switchgrass Following Crops)

Expected Yield: 4 tons/acre
Approximately 9 large square bales: 875 lbs./bale

Preharvest Machinery Operations	**Cost Per Acre***
Spread liquid nitrogen	$4.00
Application P&K	4.00
Spraying chemicals	4.00
Total machinery cost	$12.00

Operating Expenses	**Unit**	**Price/Unit**	**Amount**	**Cost Per Acre**
Nitrogen	lb.	$.16	100.00	$16.00
P	lb.	.29	21.79	6.32
K	lb.	.14	91.20	12.77
Herbicide				
- Atrazine	qt.	3.37	1.50	5.06
- 2,4 D	pt.	1.76	1.50	2.64
Total operating cost	$/acre			$42.78
Interest on operating expenses (9%)	$/acre	.09	1.00	$1.93

Harvesting and Storing Expenses	**Cost/Ton**	**Cost Per Acre**
Mowing/conditioning	$6.00	$24.00
Raking	3.00	12.00
Baling (large square bales)	16.57	66.29
Staging and loading	7.00	28.00
Total harvesting cost	$32.57	$130.29

Land Charge (cash rent equivalent)	$75.00
Prorated Establishment Costs (11 yrs. @ 8%)	$24.69
Prorated Re-Seeding Costs (10 yrs. @ 8%)	$4.55
Total Production Costs Per Acre	$291.23
Total Costs Per Bale	$31.21
Total Costs Per Ton	$72.81

* Source: 1999 Iowa Farm Custom Rate Survey, FM-1698, March 1999.

Scenario 2. Frost Seeding: Production Year

(Switchgrass Conversion From Grasslands)

Expected Yield: 4 tons/acre
Approximately 9 large square bales: 875 lbs./bale

Preharvest Machinery Operations	**Cost Per Acre***
Spread liquid nitrogen	$4.00
Application P&K	4.00
Spraying chemicals	4.00
Total machinery cost	$12.00

Operating Expenses	**Unit**	**Price/Unit**	**Amount**	**Cost Per Acre**
Nitrogen	lb.	$.16	100.00	$16.00
P	lb.	.29	21.79	6.32
K	lb.	.14	91.20	12.77
Herbicide				
- Atrazine	qt.	3.37	1.50	5.06
- 2,4 D	pt.	1.76	1.50	2.64
Total operating cost	$/acre			$42.78
Interest on operating expenses (9%)	$/acre	.09	1.00	$1.93

Harvesting and Storing Expenses	**Cost/Ton**	**Cost Per Acre**
Mowing/conditioning	$6.00	$24.00
Raking	3.00	12.00
Baling (large square bales)	16.57	66.29
Staging and loading	7.00	28.00
Total harvesting cost	$32.57	$130.29

Land Charge (cash rent equivalent)	$50.00
Prorated Establishment Costs (11 yrs. @ 8%)	$23.96
Prorated Re-Seeding Costs (10 yrs. @ 8%)	$3.61
Total Production Costs Per Acre	$264.57
Total Costs Per Bale	$28.36
Total Costs Per Ton	$66.14

* Source: 1999 Iowa Farm Custom Rate Survey, FM-1698, March 1999.

Attachment B

Chariton Valley Biomass Project
Comparison of Returns for Land in Corn and Switchgrass Production

General Assumptions

1. Production cost estimates for corn are from ISU Extension Publication FM1712, with appropriate adjustments for changes in land charge and fertilizer rates depending on assumed yield.

   Estimated Production Costs for Corn:

Yield in Bushels	Cost per Acre
100	$287.50
90	$266.21
80	$250.93
70	$232.65

2. Production cost estimates for switchgrass are from the Chariton Valley Biomass Project.

   Estimated Production Costs for Switchgrass[a]:

Yield in Tons	Cost per Ton
4	$72.81

[a] Frost seeding on cropland, $75 per acre land charge

Comparable Return Analysis

A. Assume 100 bushel per acre corn yield:

Corn Price per Bushel	Switchgrass Price per Ton for Comparable Return
$1.80	$45.94
$2.00	$50.94
$2.20	$55.94
$2.50	$63.44
$3.00	$75.94

Attachment B

Chariton Valley Biomass Project
Comparison of Returns for Land in Corn and Switchgrass Production

Comparable Return Analysis contd.

B. Assume 90 bushel per acre corn yield:

Corn Price per Bushel	Switchgrass Price per Ton for Comparable Return
$1.80	$46.76
$2.00	$51.26
$2.20	$55.76
$2.50	$62.51
$3.00	$73.76

C. Assume 80 bushel per acre corn yield:

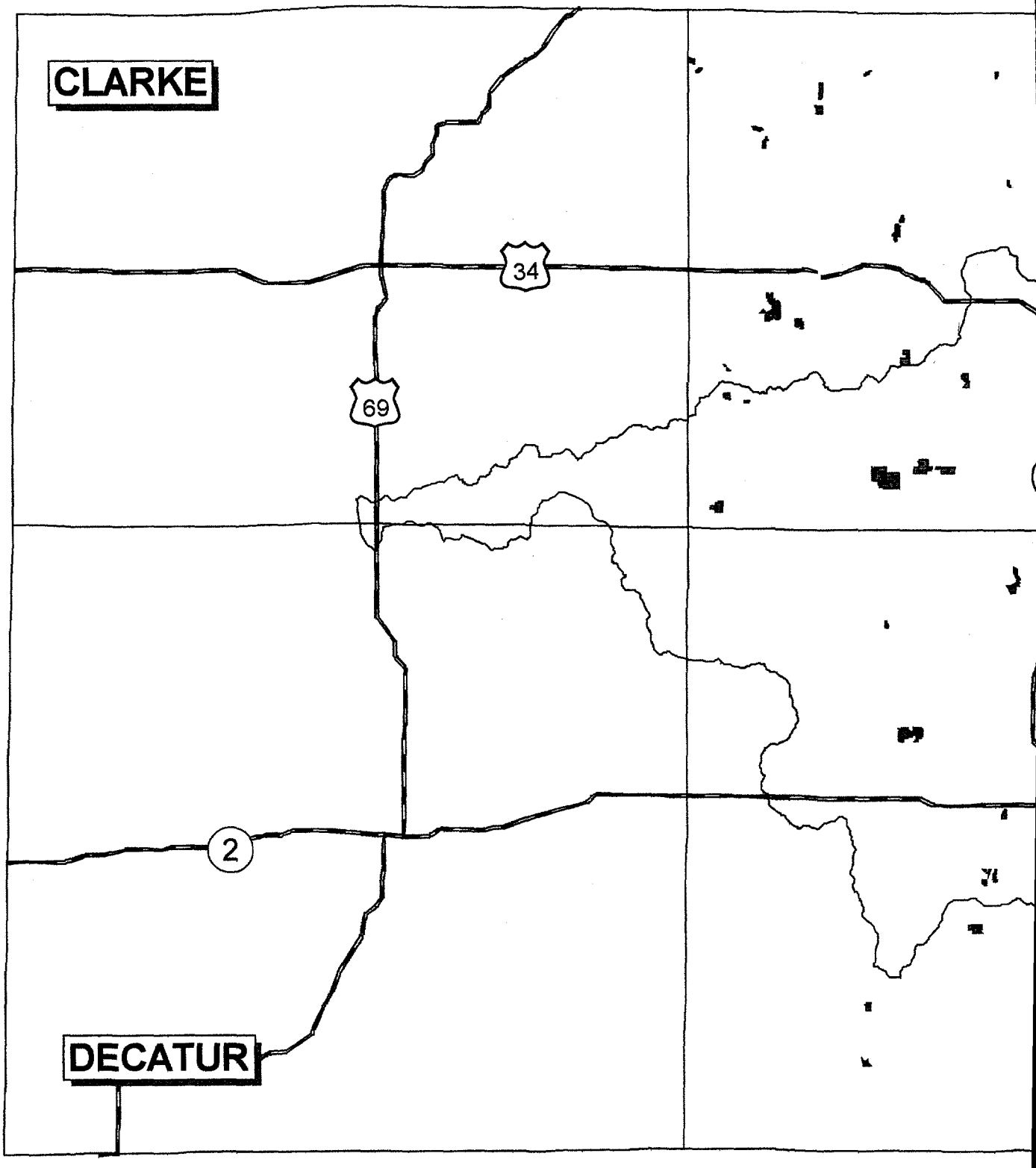
Corn Price per Bushel	Switchgrass Price per Ton for Comparable Return
$1.80	$46.08
$2.00	$50.08
$2.20	$54.08
$2.50	$60.08
$3.00	$70.08

D. Assume 70 bushel per acre corn yield:

Corn Price per Bushel	Switchgrass Price per Ton for Comparable Return
$1.80	$46.15
$2.00	$49.65
$2.20	$53.15
$2.50	$58.40
$3.00	$67.15

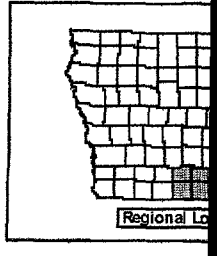
Attachment for
Task 5.60 Obtain commitments on 4,000 acres

Chariton Valley Biomass
South Cen



LEGEND

- County Boundaries
- Major Roads
- Biomass Cooperator Fields
- Rathbun Lake Watershed



Project -- Cooperators
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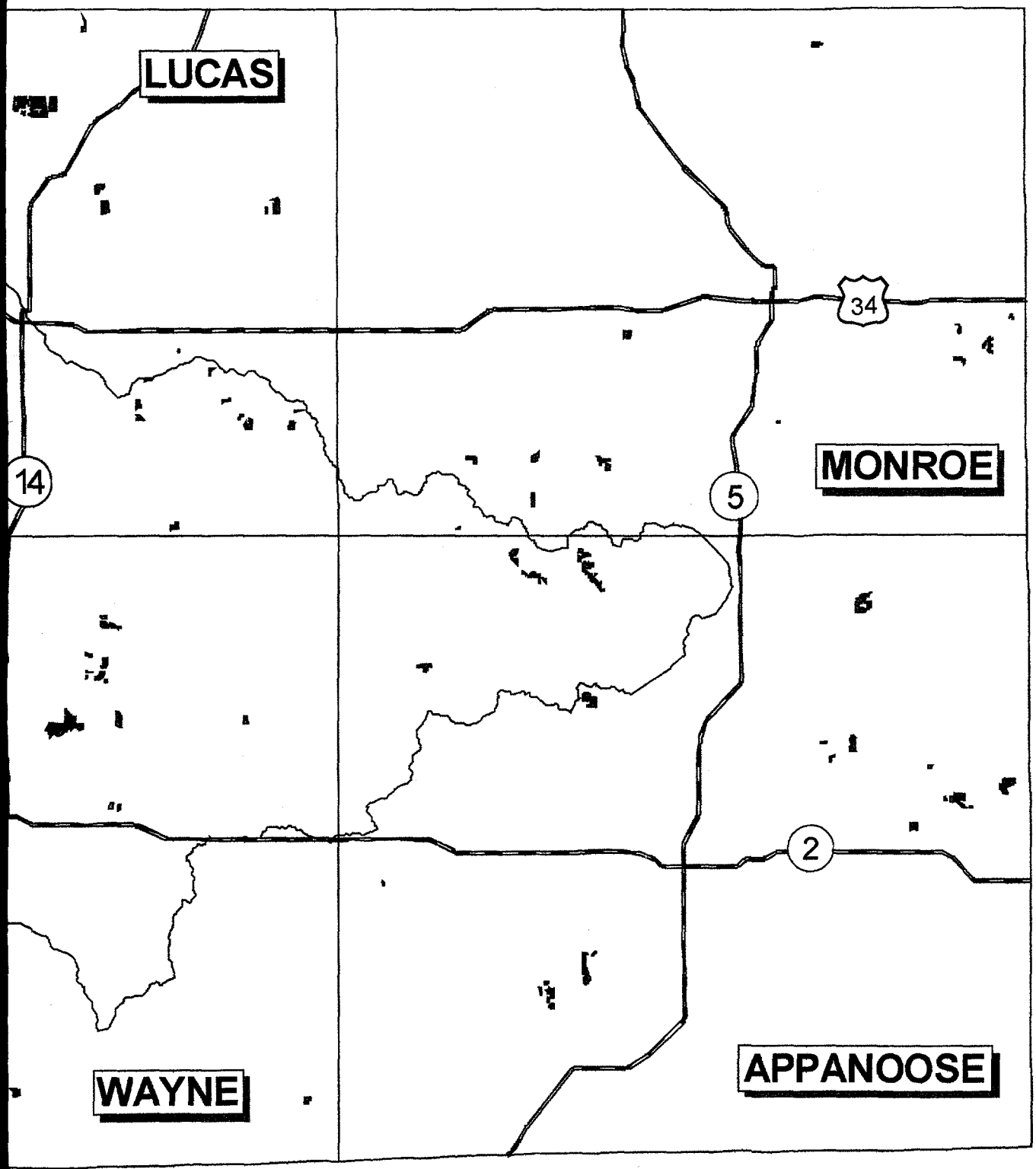

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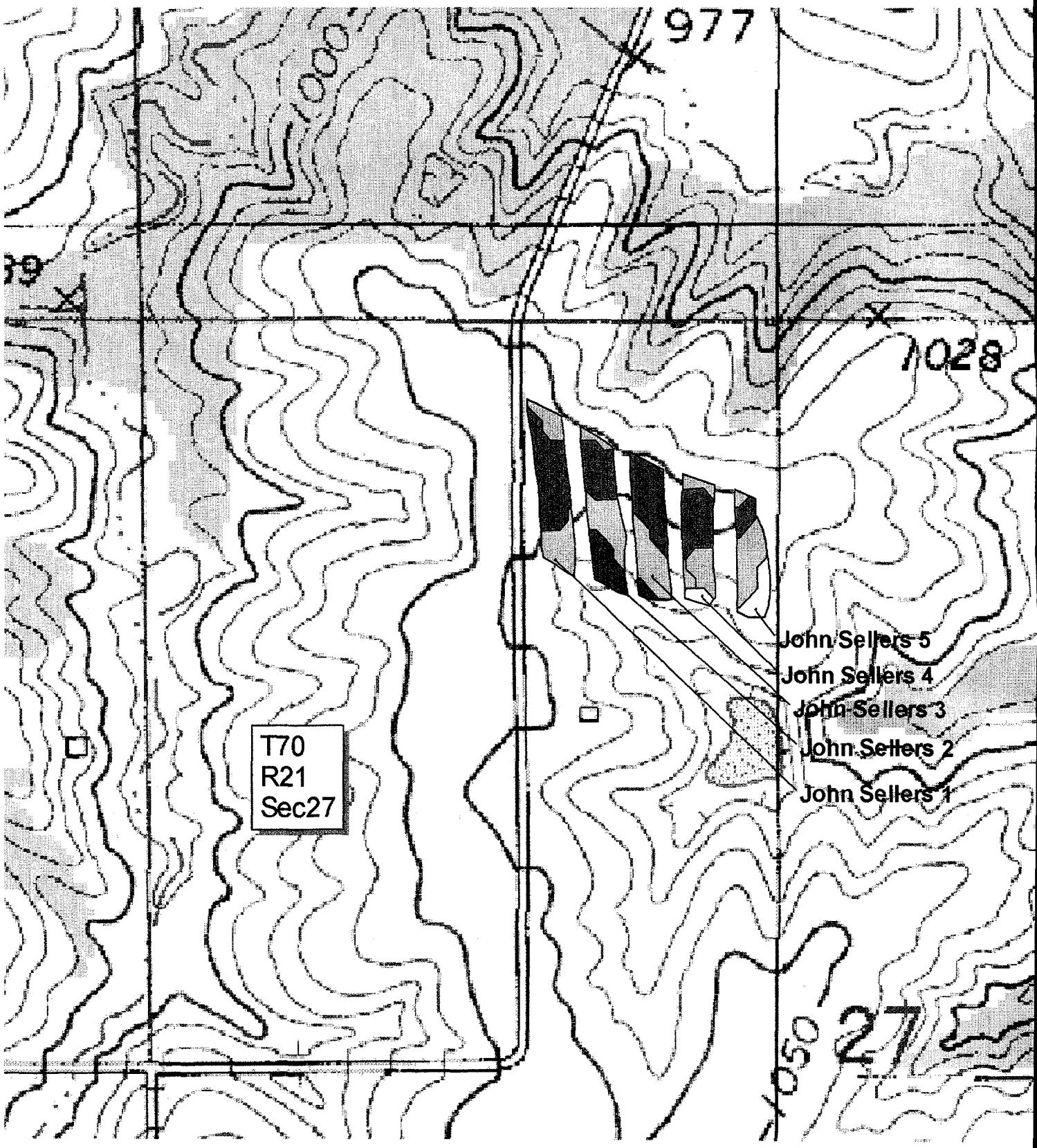
Source: Chariton Valley Resource Conservation & Development
Iowa Department of Natural Resources NRGIS

Biomass Harvest (Soils) -- John Sellers (Particip
T70 R21 Sec27 Wayne County, Iowa



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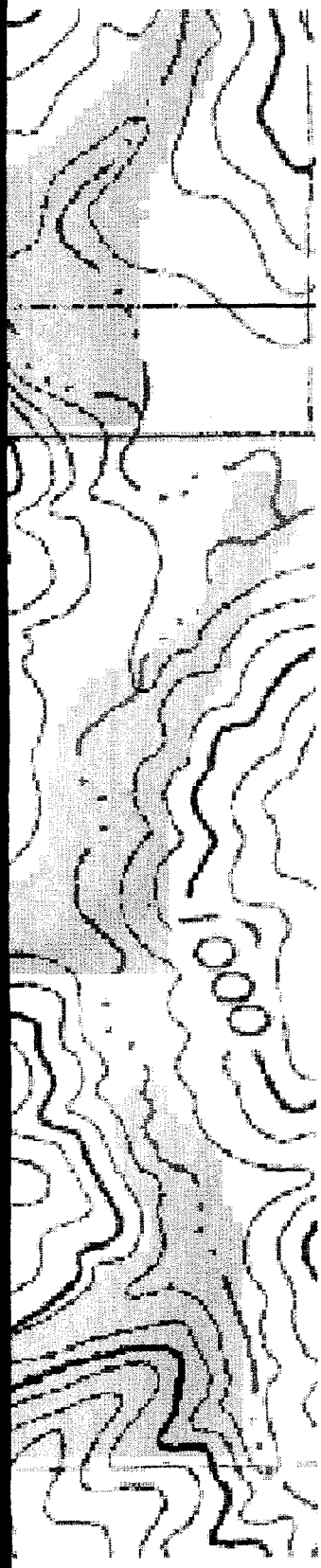

LEGEND

Biomass Harvest (Soils) -- Joe Cross (Participant)

- ClC
- ClC2
- KnC2
- SeB
- SfC2

N

500 0 500 Feet

Source: GPS Field Data Collection, Chariton Valley RC&D
USGS 7.5 Minute DRG Corydon, Iowa
Iowa Cooperative Soil Survey Digital Soils