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BIOMASS POWER FOR RURAL DEVELOPMENT

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RESOURCE CONSERVATION & DEVELOPMENT, INC.**

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EXECUTIVE SUMMARY

In this quarter a large amount of time was spent doing project planning and budget preparation for the fiscal years 1998 and 1999. Many issues of long-term strategic planning and budgeting depend on the availability of Federal support, including *financial*, *technical* and *political*. It has become increasingly obvious that several significant barriers must be overcome in order to reach the final project goal of commercial replication of the technology.

Financial barriers include short and long-term considerations. In the short term, having the ability to conduct the environmental analysis necessary to provide reliable, replicable information to policy makers and environmental activists on the likely impacts to wildlife, soil erosion, water quality and carbon sequestration. Without this information the political cover will not be available to allow for the tax policy changes required to obtain the long-term financial goals of the project. The long-term project financial requirements must be met if the project is to be successful. All along the biomass pathway, partners must understand how they will benefit from their role in the new industry. This includes providing a long-term market for the switchgrass which will allow for farmers to be able to make the long-term land and machinery commitment required to establish the acres of switchgrass. And it requires the monetary incentives to be in place, which will provide the farmers with a market price, allowing them to remain in business. The utility partner must understand how this additional effort will benefit either their bottom line, their public image, their boiler performance, or some combination of all of the above. But the final electricity consumer may be the driver for the entire industry. If the retail electricity consumer perceives benefit from the purchase of "green" electricity, that market niche may be able to drive the entire economic process. Early indicators of green electricity marketing nation wide are showing some positive signs.

Technical barriers include the designing of a cost effective harvest, storage, transport, process and conversion system. While farmers in this region have many decades of experience in harvest, storage and transport of grass, switchgrass presents new challenges due to our harvest requirements and the switchgrass yield potential. We have identified two locations in the United States that have similar material handling situations, one site in Minnesota the other in Oregon. We have visited the Minnesota site in order to learn from their experience and we may visit the Oregon site in the future. The processing technology remains in a stage of development. As we grow closer to the time for a test co-fire we are

beginning to include additional test objectives which individually seem minor, but when taken together provide drivers which impact overall machinery requirement decisions. The next quarter will provide additional levels of detail.

Policy barriers have become a major component of the Project. If short-term financial and technical barriers are successfully addressed and the economics of the process are still negative the project will end at the end of Phase I. In order to provide a positive economic scenario for the Project, some policy changes may need to be implemented. We are presently in the process of identifying the changes that need to occur. We are forming coalitions with policy makers from other states with like interests. The next quarter should further define specific issues we will be pursuing.

The weather has continued to be a major problem. The spring weather in this section of Iowa has been very wet. Farmers are behind in their planting and spring tillage work. The winter was the first winter in memory in which the ground did not freeze solid. While we have not yet seen empirical evidence, it was clearly a very unusual winter in southern Iowa. The lack of frozen soil, coupled with a large amount of precipitation, prevented the farmers from harvesting switchgrass during the winter and spring months. Even though we know this is a very unusual winter/spring, it should provide the Project with important information to use in the design of future operating parameters.

While the barriers remain substantial, the project management remains optimistic that they will be addressed and surmounted. Short-term budget talks remain positive with the Department of Energy (the critical first step). A plan is under development to address the many technical/logistic goals of the co-fire test. And talks are underway with industry partners and elected representatives which will likely lead to necessary policy changes. Local and state interest continues to grow in the Project and Project partners remain committed. In addition, the rural commodity prices for corn and cattle are at low levels, adding additional regional need and motivation for the development of alternative agricultural crops. The stage continues to be set for the new biomass industry.

SWITCHGRASS CONVERSION DEVELOPMENT

Iowa State University Gasification Activities

The third quarter has been occupied with continued development of a material-handling system for switchgrass. A system has been identified which enables continuous feeding of switchgrass in an acceptable manner. Two tests were performed. A summary of each of these activities is described below.

The conundrum of feeding switchgrass into a fluidized bed reactor has plagued this project for many months. The reactor operates with forced draft air supply which results in a slight positive pressure in the reactor. At the point where fuel is injected, the pressure is typically 40-50 inches of water column. Although the pressure is relatively small compared to pressurized systems, it is large enough that it still presents a challenge to prevent hot producer gas from flowing back through the feed system.

Several methods of handling and injection were tried. Variations of these systems include injection augers operating at different speeds, different airlocks, and the use of a plug maker for switchgrass injection with compaction. Each of these methods has its own advantages and disadvantages. Additionally, feedstock preparation is an essential variable to a feed system. Originally we were trying to do as little preparation as possible. Basically, this involved shredding the switchgrass bales in a tub grinder. The result was varying lengths of switchgrass from $< 0.25''$ up to $8''$. Ultimately this resulted in difficult to feed material that hung up in the system and bunched easily. A better approach involved processing the switchgrass with a hammer mill. The hammer mill that is immediately available to us is mounted in a farm-scale portable mixer-grinder. A one-inch screen resulted in 95% of the switchgrass having a length less than one inch. The resulting bulk density of the product was 6-8 lb/ft³.

The switchgrass available to us was baled in the late summer of 1996. At that time the moisture content was approximately 24%. The high moisture has meant the bales do not store well. In many cases the bales had a wet inner core with some of the grass slightly fermented. Mold was very evident in the bales as they were being processed. Even though the bales were covered, the outdoor storage resulted in an average moisture content of 30-35%. The high moisture content forced us to utilize the processed switchgrass within the next 48 hours to prevent overheating and potential ignition of the material.

The material-handling system utilized for the two tests consisted of a metering bin, rotary airlock, injection screw, and an exhaust fan. The metering bin has been described in past reports but basically consists of two nine inch counter rotating screws. The hopper works reasonably well but requires almost constant supervision to ensure a uniform feed. The airlock does not make up the entire pressure differential. It is constructed of steel vanes with rubber wiping strips. The injection auger is stainless steel and currently rotates at 30 rpm. This is the same auger used in the attempt to feed with a plug system. We have not yet obtained a new high-speed drive system. The exhaust fan serves to collect the smoke and other exhaust gases which leak back through the system. In the past, our goal has been to try to totally eliminate these gases. However, to move this project forward we have abandoned that constraint by using the exhaust fan. A large quantity of make-up air is injected below the airlock to minimize the amount of producer gas flowing back through the system.

Two successful tests were performed this quarter. The first test lasted only one hour as we had prepared approximately 440 pounds of switchgrass. The second test lasted approximately two and one half hours. Producer gas samples were taken and analyzed. Tar and moisture content data are not available from this test.

Approximately 1,200 pounds of switchgrass were prepared for this test. The reactor was operated with an air injection rate of approximately 110 scfm. Approximately 450 lb/hr of fuel was injected to achieve an equivalence ratio of 0.28. The high moisture content of the fuel resulted in non-uniform feeding of the switchgrass into the reactor. Therefore, slugs of material would be injected in a short time period, resulting in a large gas production. This uneven gasification resulted in varying gas composition and high char carryover from the bed.

The following table shows the gas composition from five samples taken over the course of the experiment. The gas concentrations were determined using a gas chromatograph (GC) and a Fourier transform infrared spectrometer (FTIR). The GC is calibrated for nitrogen, hydrogen, carbon monoxide, methane, and carbon dioxide while the FTIR is calibrated for carbon monoxide, methane, carbon dioxide, and ethylene. The FTIR is able to detect acetylene and ethane but it has not yet been calibrated for these gases. It is unable to detect nitrogen, hydrogen, and oxygen because these gases are optically inactive. The gas is reported on a dry, tar-free basis.

Gas Composition And Heating Value For Switchgrass Gasification Test.

Sample #	N ₂	H ₂	CO	CH ₄	CO ₂	C ₂ H ₂ *	C ₂ H ₄	C ₂ H ₆	Total	HHV (Btu/scf)
1	56.18	3.68	12.55	3.53	15.33	0.20	1.60	0.00	93.07	117
2	60.18	5.61	17.06	5.16	19.71	0.20	2.13	0.00	110.05	163
3	61.40	4.75	14.83	4.37	20.30	0.20	1.96	0.00	107.81	142
4	54.68	3.93	16.49	4.85	17.36	0.20	1.92	0.00	99.43	149
5	53.88	3.25	16.47	4.94	17.52	0.20	1.99	0.00	98.25	149
Ave.	57.26	4.24	15.48	4.57	18.04	0.20	1.92	0.00	101.72	144

* - estimated value (detected but not quantified)

The higher heating value of the producer gas varied between 117-163 Btu/scf with an average value of 144 Btu/scf. This is respectable considering the uneven feed of fuel and the high carryover of char. The carbon conversion for this test is estimated at 72%. This is determined by doing a rough mass balance on the system. We fed approximately 1,200 pounds of switchgrass, which on a dry basis is about 840 pounds (assuming 30% moisture). Switchgrass is approximately 47% carbon (by ultimate analysis) equating to a carbon input to the system of approximately 400 pounds. We collected approximately 150 pounds of particulates with our cyclones. Assuming most of this is carbon (75%), this gives an approximate carbon conversion of 72%. As mentioned previously, the high char carryover from the bed is probably due to the uneven feeding and gas production. In fact, small fibrous particles were visible in the cyclone catch, which is clear evidence of inadequate particle residence time. Several measures may be taken to increase char conversion including a uniform fuel feed, decreasing the superficial velocity via airflow rate, and reinjection of elutriated solids.

Future work includes continued development of the material feeding and injection system for switchgrass. Although the present system works, it would be beneficial to reduce the amount of producer gas back flow through the system. Testing will continue with the goal of verifying gas composition, determining tar and moisture contents, and possibly identifying and quantifying fuel cell contaminants. It would be beneficial if dry switchgrass was utilized in these tests. An attempt to locate a supply of dry switchgrass will be made. Energy Research Corporation is currently working on computer simulation of an integrated gasification fuel cell power plant.

Status Assessment and Forecast: On schedule.

Engineering Status Report – R. W. Beck

Our process design changed dramatically during our meetings of June 11 and 12, especially for the co-firing test. We have been revising the co-firing test protocol to include these changes. More significantly, we are in the process of issuing Revision 3 of the preliminary process design that will include separate identical twin process trains exclusive of any queuing or flow splitting. We had previously included a flow dividing feature to maximize process efficiency and minimize equipment capital and O&M costs.

The modifications require re-sizing of each unit process and selection of additional bale conveyors and handling systems. From a process integration standpoint the changes essentially require a re-start of that effort. We also developed a re-estimate of the test's capital costs, based on the changes. We are also attempting to gain whatever additional information is available from the project's only significant reference facility, Studstrup in Denmark.

We have selected several qualified turnkey contractors, one of which will ultimately construct and install the facility and specified equipment. We are also working with personnel at ABB/CE to potentially observe and play a role in bench scale SWG co-firing tests currently being conducted at the Federal Energy Technology Center in Pittsburgh.

In addition to the above, and at the request of the team, we are conducting a "stack-out and re-claim" analysis to evaluate the capital and O&M costs of an automated system. The analysis includes sensitivities for storage size and variable bale sizes and configurations. Although we do not expect to complete this analysis by our next meeting, we will provide Revision 3 process flow diagrams, modified equipment capacities and arrangements, and more cost information on what will be the process end of the temporary and permanent system.

Finally, we are working with the contractors/vendors to develop a critical path schedule and potential completion dates for the test/permanent facility.

PRODUCTION ACTIVITIES

Accomplishments In The Field

A total of 43 land owners have entered into cooperative agreements with Chariton Valley RC&D to produce switchgrass and provide access to their land in support of project

activities. These cooperators own and manage approximately 4,000 acres of land that have been planted, or will be established, to switchgrass.

Fifteen landowners received financial and technical assistance to establish an estimated 1,000 acres of switchgrass during the most recent planting season. Wet weather throughout the season prevented the planned establishment of an additional 1,000 acres of switchgrass. Plans have been made for these acres to be planted in early 1999.

A technical assessment has been completed on more than 800 acres planted to switchgrass in preparation for the eventual harvest of this land for biomass to be used during the project's planned co-fire test.

Project partners, including Iowa State University and the Iowa Department of Natural Resources (DNR) Energy Bureau, cooperated in the development of a scope of work for the demonstration and evaluation of alternative biomass cropping systems. These cropping systems will be designed to increase the financial return through higher value products and reduced costs from land dedicated to biomass production. Systems may include hay production and livestock grazing in addition to late season biomass production. The Iowa DNR Energy Bureau has committed \$50,000 to the demonstration and evaluation of these biomass-cropping systems.

Fuel supply development activities over the next reporting period will include the continued identification and assessment of existing switchgrass plantings and preparations for the fall/winter harvest of switchgrass to supply the co-fire test.

ENVIRONMENTAL ANALYSIS PLANNING

Geographic information system (GIS) activities during the reporting period consisted of providing continued support to the fuel supply development, yield and variety research, and environmental analyses activities of the project. Specifically:

- Biomass cooperator fields and related information continue to be entered into the GIS as map coverage and associated databases.
- Assistance has been provided to investigators conducting yield and variety research.

- Map coverage and databases are being created and assembled to support project-related efforts in the areas of water quality, wildlife habitat, soil quality and carbon sequestration. Available coverage and databases are included in the table Biomass Project -- Current Available GIS Data Layers (Lucas, Wayne, Appanoose and Monroe Counties) (*See attachment 1*) for wildlife habitat developed by the USDA Natural Resources Conservation Service.

Wildlife

Activities related to the wildlife impacts task during the reporting period have focused primarily on the development of criteria that can be used to direct the establishment and management of switchgrass for biomass to enhance wildlife habitat quality in the project area. Specifically:

- Meetings and discussions with wildlife habitat management practitioners and researchers from the USDA, Iowa DSC, Iowa DNR, ISU, private conservation organizations, and local soil and water conservation districts continued to be held to obtain input and assistance regarding the project's wildlife habitat related activities;
- An initial set of wildlife habitat quality related criteria has been identified that can be used to guide the establishment and management of switchgrass for biomass in the project area. These criteria are based primarily on:
 - (a.) Wildlife habitat quality components included in the environmental benefits index of the CRP.
 - (b.) Related research findings regarding the wildlife habitat impact of land enrolled in the CRP.
 - (c.) Wildlife habitat appraisal guides developed and used by federal and state agencies in Iowa and Missouri.
 - (d.) Soil mapping unit interpretations for wildlife habitat developed by the USDA/NRCS. The criteria have been developed in a manner that facilitates their application using the project's GIS capabilities.

Continued development of a scope of work for more extensive research regarding the wildlife habitat quality impacts of establishing and managing switchgrass for biomass in the project area. Planned research will include an evaluation of the field-level impacts of alternative biomass management practices, particularly a range of switchgrass harvest techniques, as well as an assessment of the region-wide impacts of large-scale switchgrass production as a biomass crop in the project area. The Iowa DNR Energy Bureau has committed a portion of the financial support required to conduct this wildlife habitat research

Water Quality

Water quality related activities during the reporting period continued to focus on identifying criteria that can be used to direct the establishment and management of switchgrass for biomass production to protect and improve water quality in the Rathbun Lake watershed. Specifically:

- Meetings and discussions with soil and water conservation practitioners and researchers from the USDA, Iowa Division of Soil Conservation (DSC), Iowa DNR, ISU, and local soil and water conservation districts continued to be held to obtain input and assistance regarding the project's water quality related activities;
- An initial set of water quality related criteria has been identified that can be used to guide the establishment and management of switchgrass for biomass in the Rathbun Lake watershed. These criteria are based primarily on:
 - (a.) A procedure developed by the USDA Natural Resources Conservation Service (NRCS) in Iowa to estimate sediment delivery (*See attachment 2*).
 - (b.) The results of water quality monitoring being conducted in Rathbun Lake and its major tributaries.
 - (c.) Related research findings regarding the potential impact of land use, including biomass production on water quality.
 - (d.) Water and soil quality components included in the environmental benefits indices of the Conservation Reserve Program (CRP) and Environmental Quality Incentives

Program (EQIP). The criteria have been developed in a manner that facilitates their application using the project's GIS capabilities;

- The Iowa DNR Energy Bureau has committed a portion of the financial support required for research in the areas of biomass cropping systems and wildlife habitat impacts, each of which will include activities related to the water quality impacts of biomass production; and
- Continued development of a scope of work for more extensive research regarding the water quality impacts of establishing and managing switchgrass for biomass in the Rathbun Lake watershed. Planned research will include field level data collection and analysis as well as a comprehensive assessment of resources and activities in the Rathbun Lake watershed related to switchgrass production for biomass and water quality.

The following accomplishments are reported for the field:

- Consulted with John Goode, Monroe County engineer, regarding use of county land for demonstration of cropping systems. Approximately 15 acres.
- Consulted with one farmer in Appanoose County who plans to seed 200 acres of switchgrass this spring. Discussed seeding equipment, soil preparation, seeding rate, and weed control.
- Consulted with one producer in Lucas County who has 40 acres of established switchgrass but would rather not have project staff coordinate the harvest. He would allow project staff to do sampling work.
- Consulted with two Wayne county producers who plan to seed 120 acres of switchgrass this spring, regarding seeding equipment, weed control seeding technique and soil preparation.
- Consulted with three Lucas county producers who plan to seed 120 acres of switchgrass this spring, regarding seeding equipment, weed control, seeding technique and soil preparation.

- A 2-page fact sheet titled "Switchgrass Seeding Recommendations For Production Of Biomass Fuel In Southern Iowa" has been prepared and the draft was circulated to ISU Agronomy Faculty for an initial review.

Problems Encountered: Continued wet field conditions did not allow for any harvesting.

Prairie Lands Bio-Products, Inc.

Prairie Lands Bio-Products, a switchgrass producers organization, continues to meet on a regular basis. In addition to serving as a land owner advisory team for project partners, Prairie Lands members' activities during this period focused on providing technical assistance to other producers with the establishment of switchgrass.

Prairie Lands members also continued their evaluation of alternative producer-based organizational structures for the long-term development of the biomass energy industry in southern Iowa. In addition, the group continued their efforts to identify and develop products and markets for switchgrass biomass including densified fuel for residential use and mulch for landscaping.

INFORMATION AND EDUCATION

Activities were as follows:

- Met in Chariton with Alan Teel to review slides for his presentation in Germany.
- Completed the project poster for presentations.
- Contacted area ISU Extension and NRCS personnel to inform them about the availability of project poster.
- Checked on costs associated with the development and maintenance of a new web site.
- Located two outlets to request estimates for the production of project signs.
- Wrote and distributed a switchgrass seeding/establishment article (*See attachment 3*).
- Wrote a draft article on the environmental benefits of switchgrass.
- Contacted Lee Burras about his study within the project.

- Completed final adjustments to a brochure. It is ready to distribute.
- Worked on improvements in slide presentation. For example, superimposing text over photos and adding colored text.
- Obtained photo documentation of Lee Burras and his graduate students as they soil sampled the switchgrass field at the Lodge land.
- Attended Senator Grassley visit to the Chariton Valley RC&D office.
- Delivered switchgrass posters to the four county field offices.
- Obtained quotes from two sources for project signs.
- Worked with the appointed sign contractor on specifications.
- Attended Senator Grassley's visit to the Chariton Valley RC&D. Followed up by sending articles to local papers (*See attachment 4*).
- The DNR will highlight the switchgrass project at their building at the Iowa State Fair. Located diagram of proposed modifications to the power plant for the display, as well as a diagram of the root system of switchgrass. Photographed Loren Eddy for the DNR publication to be available at the fair.
- Worked on the environmental poster. Poster will be similar to the current project poster with the focus on the environmental benefits.
- Continued working with Bingham Signs to ensure completion of 75 cooperator signs and lodge land sign.

APPENDIX

ATTACHMENT 1

Biomass Project

**Current Available GIS Data Layers
(Lucas, Wayne, Appanoose and Monroe Counties)**

Biomass Project – Current Available GIS Data Layers (Lucas, Wayne, Appanoose, Monroe Counties)

GIS Data Layer	Source	Scale	Original Format	Notes/Coverage Information
7.5' Quadrangle Boundaries	NRGIS	1:24K	ARC/INFO	State Coverage
Alluvial Aquifers/Alluvium	NRGIS	1:100K	ARC/INFO	State Coverage
County Boundaries	NRGIS	1:100K	ARC/INFO	State Coverage
Groundwater Vulnerability	NRGIS	1:100K	ARC/INFO	State Coverage
Hydrologic Unit Boundaries (11 Digit)	NRCS	1:100K	GRASS	State Coverage
Hydrologic Unit Boundaries (14 Digit) (In Progress)	RC&D	1:24K	Paper	RC&D Defined, Drawn, and Digitized from USGS 7.5 Minute Quads
Hydrologic Unit Boundaries (8 Digit)	NRGIS	1:100K	ARC/INFO	State Coverage
Incorporated Cities and Towns	NRGIS	1:100K	ARC/INFO	State Coverage
Rathbun Lake Watershed Boundary	RC&D, NRCS	1:100K	GRASS	RC&D Processed from USDA Records
Land Use Land Cover	NRGIS	1:250K	ARC/INFO	State Coverage
Landforms of Iowa	NRGIS	1:500K	ARC/INFO	State Coverage
Lucas County CRP	RC&D, USDA	1:24K	Paper, Photo	RC&D Digitized from USDA Records
National Wetlands Inventory	USFWS	1:24K	DLG	County Coverage
Program Participants (Field Boundaries)	RC&D, USDA	1:7,920	Paper, Photo	RC&D Digitized from USDA Aerial Photos (In Progress)
Public Land Survey System	NRGIS	1:24K	ARC/INFO	County Coverage
Public Lands - State	NRGIS	1:24K	ARC/INFO	State Coverage
Rathbun Lake Boundary	NRGIS	1:100K	ARC/INFO	RC&D Processed from NRGIS Original File
Recreation Areas (In Progress)	NRGIS, RC&D	1:24K	Paper, ARC/INFO	RC&D Processed from NRGIS Original File, Digitized from Maps
Rivers and Streams	NRGIS	1:100K	ARC/INFO	County Coverage
Soil Associations	USDA	1:250K	GRASS	State Soil Geographic (STATSGO) database
Soil Mapping Units and Interpretations	NRCS, ICSS	1:24K	ARC/INFO, Atlas GIS	ISPAID, MUIR Database
Switchgrass Research Plots	RC&D		GPS Points	RC&D Collected Using GPS Unit
Township Boundaries	NRGIS	1:100K	ARC/INFO	State Coverage
Transportation	NRGIS	1:100K	ARC/INFO	County Coverage
Water Quality Monitoring Points	USGS, USACE	1:100K	Paper	RC&D Digitized from USGS, USACE Records
Source Codes:				
USDA: USDA agencies including Natural Resources Conservation Service				
NRGIS: Iowa Department of Natural Resources GIS Library				
RC&D: Golden Hills Resource Conservation and Development				
NRCS: USDA Natural Resources Conservation Service				
ICSS: Iowa Cooperative Soil Survey				
USGS: United States Geological Survey				
USACE: United States Army Corps of Engineers				
USFWS: United States Fish and Wildlife Service				

ATTACHMENT 2

Erosion and Sediment Delivery

Erosion and Sediment Delivery

Introduction

Soil erosion consists of a series of natural processes that move earth and rock material. The land surface is worn away through the detachment and transport of soil and rock by moving water, wind, and other geologic agents. Although erosion is a natural process, disturbance of the land surface by humans has greatly increased this erosion rate. For years, efforts have been made to reduce this rate and protect the soil resource.

In the past, offsite sediment delivery concerns have been mainly for sediment storage requirements of ponds and reservoirs. Sediment delivery procedures available in the "Iowa Small Structure Design Manual, Subpart C - Sediment Storage" and the "EFM Chapter 11, Ponds and Reservoirs, Amendment IA27" have been used to determine storage requirements. Recently there has been increasing concern in these offsite effects. Eroded soil is delivered to lakes, rivers, streams, etc. and produces various environmental impacts. Many water quality projects are being directed toward reducing these impacts.

Determining location and sources that are delivering sediment to these resources will help optimize project inputs. Erosion sources need to be identified and amounts (rate) quantified. Common sources of erosion are sheet and rill, ephemeral gullies, gullies, streambanks, roads, construction sites, and feedlots. After source and quantity are identified, a sediment delivery procedure can be used to determine delivery to a specific location. For water quality projects it's important to know the quantity of sediment presently being delivered and the kind of affect that can be expected by applying conservation practices and reducing erosion. Estimating this amount is not easy and requires considerable technical judgment.

Following is a general description of erosion and sediment delivery processes. The primary objectives are to help identify sources of erosion, quantify erosion amounts, and provide information on sediment delivery procedures.

Sediment Sources

Sheet and Rill

Sheet and rill erosion is the detachment and removal of soil from the land surface by raindrop impact, and / or overland runoff. It occurs on slopes with overland flow and where runoff is not concentrated. The Universal Soil Loss Equation (USLE) is used to calculate sheet and rill erosion and estimates average annual erosion in tons/acre/year. Procedures for USLE can be found in the NRCS "Field Office Tech Guide" .

Ephemeral gully

Ephemeral gullies occur where runoff from adjacent slopes forms concentrated flow in drainageways. Ephemerals are voided areas that occur in the same location every year. They are crossable with farm equipment and are often partially filled in by tillage. Because they are filled by tillage, they need to be measured after a significant runoff event. After crops are out in the fall is a good time to measure. Determining erosion from ephemerals is basically a volume/density calculation and is known as the direct volume method.

$$\text{Channel length} \times \text{Channel width} \times \text{Channel depth} \times \text{density of soil (lbs/ft}^3\text{)} / 2000\text{lbs} = \text{tons / year}$$

The dimensions of ephemeral gullies should be measured in the field when possible. Length can be measured by pacing the channel distance. Several width and depth measurements should be taken with a surveying rod and averaged. In many soils, depth of the ephemeral gully may be the same as tillage depth. Remote methods using aerial photos, soil surveys, topographic maps, etc. can be used to measure length if necessary, but don't allow for accurate measurement of width and depth. Density of the soil can be obtained from the soil survey. Typical densities are 85-95 lbs/ft³.

Drainage systems usually form a branching network as shown in Figure 1. An ordering system allows channels of similar width and depth to be grouped together for easier calculation, especially for larger watersheds. The total length of similar order channels are added together to allow one calculation to be done per channel order. For example, in Figure 1 all 1st order channel lengths would be added together to get a total 1st order length. An average width and depth of 1st order channels would be obtained from several field measurements. A similar method is used for all channel orders.

Channel Order	Total Length		Average Width		Average Depth		soil density lbsft ³ / 2000 = Tons
1st	_____	X	_____	X	_____	X	_____ / 2000 = _____
2nd	_____	X	_____	X	_____	X	_____ / 2000 = _____
3rd	_____	X	_____	X	_____	X	_____ / 2000 = _____
							Total = _____

$$1'' = 200'$$

Channel ordering sytem: Channel order increases when two channels of similar order come together. Examples: (1+1=2), (1+2=2), (2+2=3)

Figure 1

Streambank and Gully Erosion

Streambank and gully erosion is also calculated by direct volume method, which is simply a bank height X widening rate X eroding length calculation. Widening rate is the lateral movement in ft/yr of the bank. Rates can be estimated using Table 1. The volume is then multiplied by soil density to determine tons. Streams and gullies are usually not eroding throughout their entire length so eroding length needs to be measured. An average bank height and widening rate can be used.

$$\text{Eroding Length} \times \text{bank height} \times \text{widening rate} \times \text{soil density (lbs/ft}^3\text{)} / 2000 \text{ lbs} = \text{tons/yr}$$

(Gully)

Gullies form as a headcut (overfall) develops and moves up the drainageway. Gullies are often actively eroding at the headcut and will stabilize as the headcut moves up the drainageway (Figure 2). The eroding area should be determined by field measurement. Measure eroding length by tape measure or pacing and bank height with a surveying rod. Use Table 1 to estimated widening rate. Account for both the headcut surface and the bank widening surface to determine volume and soil loss.

Figure 2

(Streams and Channels)

Natural, unchannelized streams usually have a meandering pattern where erosion occurs mainly on the outside bends (cutbanks) of these meanders. Most of this eroded material is usually deposited on the inside bends (pointbars) of meanders downstream. This natural process may not be a concern unless its rate is excessive or it is impacting human activities. Straightened, modified, or disturbed channels, may be contributing significant sediment to a resource. Erosion may be occurring on both banks at the same time as well as downcutting of the channel bottom. Rate of downcutting is often difficult to determine but can be estimated from exposed culverts, tile lines, bridge piles, etc. Keep in mind that rate of bed degradation usually slows or may stop as the stream approaches a stable grade.

To calculate erosion amounts, volume eroded must be determined. For small watersheds simply measure the length of eroding bank (Figure 3), the bank height, and the widening rate to determine soil loss. For larger watersheds it is sometimes easiest to determine channel soil loss by using a sample reach of the stream. The sample reach's eroding length is divided by the sample reach's total length. Multiple this ratio by the total length of stream/channel in the watershed to get a total eroding length. Measure average bank height and estimate channel widening rate (Table 1). Several sample reaches may be needed to get a good representation of the watershed. Remember to account for both sides of the stream.

Total length of sample reach (A) _____

Total eroding length of sample reach (B) _____

% of sample reach eroding (B/A) _____

Total length of watershed channel X % eroding = eroding length

X _____ = _____

Figure 3

Meandering Channel

Straightened Channel

Table 1

(Recession Rate) Widening (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank, but active erosion not readily apparent. Some rills but no vegetative overhang. Maybe some exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots, but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen trees and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads and trails. Channel cross-section becomes more U-shaped as opposed to V-shaped
> 0.5	Very severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-shaped and stream course or gully may be meandering.

The previous discussion has provided information on how to identify and quantify several major sources of erosion. There are many other sediment sources most of whose quantities are figured using either the USLE or direct volume method. Several other methods are sometimes used to estimate erosion rate. Comparing airphotos from different time periods may show a difference in channel location. Setting a survey point and measuring the movement over a period of years is sometimes possible. Rate is simply calculated by dividing distance moved by length of time

SEDIMENT DELIVERY RATIO

Gross erosion means all erosion in the watershed, (i.e., sheet and rill, gully, streambank, landslides, roads, roadbanks, construction sites, etc). Sediment yield is the quantity of gross erosion that is delivered to a specific location. Sediment delivery ratio (SDR) is defined as the sediment yield from an area divided by the gross erosion of that same area. SDR is expressed as a percent and represents the efficiency of the watershed in moving soil particles from areas of erosion to the point where sediment yield is measured. Different sources of erosion have different SDR's. Each erosion source is multiplied by its SDR to get the sediment yield from that source. Other methods used to estimate sediment delivery include sediment surveys, stream sediment gages, and predictive equations. NEH Section 3 Sedimentation (Chapter 6 & 7) and T. R. 32 & 55 contain further information on sediment delivery.

Sediment delivery ratios (SDR's) are probably the simplest and most likely method to be used in the field. SDR's have been derived from numerous sediment surveys. A graph developed from watershed characteristics and drainage area is used to obtain percent delivered (Chart I). Drainage area shows one of the best relationships with sediment delivery.

Sediment surveys are the measurement of reservoir volume lost to deposited sediment. The original reservoir volume, along with landuse (gross erosion) records for the time period measured must be known. The sediment that passes through the reservoir must also be accounted for. The total amount of sediment delivered to the reservoir is divided by the gross erosion in the watershed to determine sediment delivery ratio. This method may correlate well if used in a watershed with similar characteristics in the same geographic region.

Stream sediment gages are used to measure suspended sediment transported by a stream. Gages are usually located on larger streams which may limit their correlation with smaller drainage areas. They also don't measure bedload which could be a significant portion of the total sediment delivered in some areas. Sediment gage data is usually available from the USGS Water Resources Division.

Predictive equations are sometimes used to estimate sediment delivery. They are usually calibrated from sediment surveys or stream gages. The formulas can be complicated which may make them difficult to use.

Factors to Consider for SDR's

SDR's vary between watersheds due to differing physical attributes.

Drainage Area

Large watersheds will generally have a lower SDR than small watersheds due to the increased number of areas within a watershed that can trap soil particles. Chart I shows this general relationship between watershed size and SDR. There may be considerable variation and actual SDR value could be considerably higher or lower than the value on the chart depending on other physical characteristics of the watershed. Using a drainage area relationship is a good way to get a first approximation of a SDR but other watershed factors should be examined to adjust this initial estimate.

Land Use

Land use can change both the cover condition and the permeability of a watershed. A watershed with poor cover will have a high SDR because nothing impedes runoff. If the runoff is not slowed by growing vegetation or litter, the chance for eroded soil particles to deposit is low. Increased runoff also occurs in watersheds with impermeable soils.

Particle Size

Clay and silt sized soil particles are much more readily moved through a watershed than sand or gravel particles.

Channel Density

Channels are very efficient at transporting sediment. A high channel density (total length of channel/drainage area) means that the distance from eroding areas to a channel is short. There is less chance for soil particles to deposit when moving a short distance so a high channel density indicates a high SDR. Shape of the watershed also affects SDR by changing distance from erosion source to a channel.

Topography

Eroded soil cannot get to a channel unless runoff carries it. Short, steep slopes will deliver more sediment to a channel than a watershed with long, complex slopes. A complex slope is a combination of convex, concave, and flat surfaces. Whenever changes in slope occur, deposition may also occur. Also a watershed with a large flood plain area will usually have a lower SDR since flood plains are natural deposition areas.

Sediment Source

Sediment from streambank and gully erosion has a much higher chance of being delivered than does sediment from sheet and rill erosion due to the high transport capacity of gullies and streams. Watersheds with a high percentage of channel erosion will have a higher SDR than a watershed with predominantly sheet and rill erosion.

By reviewing the above factors it can be seen that SDR's are affected by many highly variable physical features. It is difficult to imagine developing an equation that would tie all the variables together and estimate their cumulative impacts on SDRs. "Considerable technical judgment is required to select and use SDR's".

SEDIMENT ROUTING THROUGH WATERSHEDS

Much conservation work today is aimed at offsite environmental benefits. Sediment yield to environmentally sensitive areas must be determined to evaluate conservation practice impacts on such areas. Sediment data collected should be in a flexible format so sediment delivery can be estimated at any point in the watershed. Large watersheds can be broken down into subwatersheds to allow much of this flexibility. A SDR is applied to the subwatershed gross erosion to estimated sediment yield from each subwatershed. This yield is then routed through the next subwatershed. If debris basins, terraces, reservoirs, floodplain, etc. are located in a subwatershed you may have to subtract sediment from the total load during sediment routing to account for deposited sediment.

Sheet and Rill Delivery

Chart I was produced using soil association areas and has been converted to the major landform regions of Iowa (Figure 4). SDR is determined by measuring drainage area in square miles and reading the plot for the specific landform region. Table 2 should be used to adjust the SDR for other variables in the watershed. The modifiers can simply be added to the SDR from Chart I. This SDR is then applied to gross sheet and rill erosion to determine the amount sediment delivered. Remember that SDR is a percentage when multiplying.

Example: 500 acre watershed in Paleozoic Plateau Region. The watershed averages 5 t/ac/yr from sheet and rill erosion. Gross sheet and rill erosion is 2500 t/yr

Drainage area .78 sq/mi
Graph Plot # 2

	Description	Modifier
Watershed shape	<u>2-1</u>	(2)
Predominant topography	<u>rolling C slope</u>	(0)
Channel density	<u>100-200 ft/ac</u>	(2)
Channel	nonincised	(0)
Drainage	integrated	(2)

Total +6

SDR + Modifier = Total SDR
38 + (+6) = 44

Gross erosion x SDR = Tons delivered /yr
2500 x .44 = 1100

Landform Regions of Iowa

Figure 4

Plot to use

Loess Hills	_____	1
Southern Iowa Drift Plain, Northwest Iowa Plains, Paleozoic Plateau	_____	2
Iowan Surface	_____	3
Des Moines Lobe, Missouri Alluvial Plain, Mississippi Alluvial Plain	_____	4

Chart I. Estimated sediment delivery for Landform Regions

Table 2

These modifiers can be used to adjust the landform regions sediment delivery ratios. The modifiers are added to the sediment delivery ratio. Refer to section "Factors to Consider" for guidance.

Watershed shape Modifier

Length	Ratio to	Width	
2	to	1	or >
1	to	1	
1	to	2	or <
			Modifier
			2
			0
			-2

Predominant topography (slope)

Steep (E and steeper)	4
Steeply rolling (D)	2
Rolling (C)	0
Gently Rolling (B)	-2
Flat (A)	-4

Channel Density *

Ft/ac	
> 200	4
100-200	2
50-100	0
0-50	-2

* Length of all channels (ephemeral, gully, stream, etc) added together and divided by acres

Channel

Deeply incised..(severely downcut)	4
Incised (downcut)	2
Non-incised	0

Drainage

Integrated (connected)	2
Non-integrated	-2

Concentrated Flow Erosion Delivery

As stated earlier different sources of erosion have different delivery ratios. Concentrated flow erosion such as ephemeral gully, gully, and streambank erosion usually have a higher delivery ratio than sheet and rill erosion. If the drainage system is integrated (continuously connected) and the channel incised (downcut) delivery rates may be high. If the drainage system is nonintegrated and nonincised, delivery may be low. Typical streambank and gully delivery rates for an incised channel are 80% -100% . Delivery rates for a nonincised channel or gully may be 60% -80%. Ephemeral gully delivery rates for an integrated system are typically 50% - 90% and for a nonintegrated system, 20% -50%. Gross erosion amounts are multiplied by these rates to determine amount delivered.

Table 3

**Typical delivery rates for concentrated flow erosion
(watersheds < 20,000 acres)**

	Integrated drainage Incised channel	Nonintegrated drainage Nonincised channel
Ephemeral gully	50-90	20-50
Classic gully	80-100	60-80
Streambank	80-100	60-80

Sediment reduction and trapping efficiency

As sediment is transported through the watershed, there are many places for it to be deposited. Common locations are the base of slopes, fence rows, waterways, ditches, terraces, and ponds. The trapping efficiency of these may range from 0-100%. Technical judgment will be necessary to estimate the trapping efficiency. Below are a few typical trapping efficiencies that are used for structures and terraces. Flood control structures will normally have a trap efficiency toward the higher range of ponds and reservoirs. These rates assume that structures are in good working condition. Structures are also designed for a given size storm so sediment may pass through on larger storms. Terraces, for example are designed for a 10 year storm, so if a 25 year storm occurs the trap efficiency will be considerably less.

Table 4

<u>Structure</u>	<u>Trap efficiency</u>
Ponds and reservoirs	80-95
<u>Terraces</u>	
Graded	80
Tile intake	95
Level	100

"Sediment routing is basically a series of additions and subtractions as sediment moves through a watershed."

Sample Watershed Exercise

Prepared by J Smith

Watershed Name Sample

Date 0/0/0

Present or Future

**Watershed is located in the Paleozoic Plateau Region. Drainage area 200 acres (.31 sq/mi).
Sheet and rill erosion averages 6/t/ac/yr**

Ephemeral gully Order	Total Channel Length	Eroding lengths
1	<u>3100'</u>	
2	<u>2350'</u>	
3	<u>400'</u>	
Gully	1250' x 2 sides = <u>2500'</u>	100' x 2 sides = <u>200'</u>
Channel	1000' x 2 sides = <u>2000'</u>	300' x 2 sides = <u>600'</u>
Feedlot	80 tons (calculated based on # animals present)	

Concentrated Flow Erosion Worksheet

Prepared by J. Smith

Watershed name	Sample
----------------	--------

Date 0/0/96

Present or Future

This worksheet is designed to help calculate concentrated flow erosion (ephemeral, gully, streambank). The direct volume method is used and is basically a volume x density calculation. Similar channels and gullies can be grouped together. Watersheds may need to be subdivided to help prioritize areas. Sample areas may want to be used for large watersheds. Further explanation on how to figure amounts is contained in the previous text.

Ephemeral Gullies

Channel Order	Length		Width		Depth		lbs/ft3	/ 2000	=	Tons
1	3100	X	1	X	.3	X	85	/ 2000	=	40
2	2350	X	1.2	X	.3	X	85	/ 2000	=	36
3	400	X	1.4	X	.3	X	85	/ 2000	=	7
Total										83

Gullies

Number Gullies	Eroding Length		Rate		Depth		lbs/ft3	/ 2000	=	Tons
5	200	X	0.2	X	5	X	90	/ 2000	=	9
_____	_____	X	_____	X	_____	X	_____	/ 2000	=	_____
Total										9

Streambank (Channel)

Reach #	Eroding Length		Rate		Height		lbs/ft3	/ 2000 =	Tons
1	600	X	0.3	X	7	X	90	/ 2000 =	57
_____	_____	X	_____	X	_____	X	_____	/ 2000 =	_____
								Total	57

"If sample reach used"

Total length of sample reach (A) _____

Total eroding length of sample reach (B) _____

% of sample reach eroding (B/A) _____

$$\frac{\text{Total length of watershed channel}}{X} \times \% \text{ Eroding} = \text{Eroding length}$$

Sediment Delivery Worksheet

Prepared by J. Smith
Watershed name Sample
Date 0/0/96
Present or Future

Multiply gross erosion by sediment delivery ratio (SDR) to determine sediment delivered. For explanation of terms and formulas refer to the text. Chart 1 & Figure 4 should be used to help determine SDR for sheet and rill. Use Table 2 for with concentrated flow SDR. Tables 1 & 3 should be used to adjust SDR's.

	Gross Erosion		SDR		Total Delivered
Sheet & Rill					
	1200	X	.42	=	504
Ephemeral					
	83	X	.5	=	42
Gully					
	9	X	.7	=	6
Streambank					
	57	X	.8	=	46
Feedlot					
	80	X	.6	=	48
Other					
_____	_____	X	_____	=	_____
Total					645

"Measurements are best taken in the field"

Concentrated Flow Erosion Worksheet

Prepared by _____
 Watershed name _____
 Date _____
 Present or Future _____

This worksheet is designed to help calculate concentrated flow erosion (ephemeral, gully, streambank). The direct volume method is used and is basically a volume x density calculation. Similar channels and gullies can be grouped together. Watersheds may need to be subdivided to help prioritize areas. Sample areas may want to be used for large watersheds. Further explanation on how to figure amounts is contained in the previous text.

Ephemeral Gullies

Channel Order	Length		Width		Depth	lbs/ft ³	/ 2000	=	Tons
_____	_____	X	_____	X	_____	X _____	/ 2000	=	_____
_____	_____	X	_____	X	_____	X _____	/ 2000	=	_____
_____	_____	X	_____	X	_____	X _____	/ 2000	=	_____
Total									_____

Gullies

Number Gullies	Eroding Length		Rate		Depth	lbs/ft ³	/ 2000	=	Tons
_____	_____	X	_____	X	_____	X _____	/ 2000	=	_____
_____	_____	X	_____	X	_____	X _____	/ 2000	=	_____
Total									_____

Streambank (Channel)

Reach	Eroding Length		Rate		Height	lbs/ft ³	/ 2000	=	Tons
_____	_____	X	_____	X	_____	X _____	/ 2000	=	_____
_____	_____	X	_____	X	_____	X _____	/ 2000	=	_____
Total									_____

"If sample reach used"

Total length of sample reach (A) _____
 Total eroding length of sample reach (B) _____
 % of sample reach eroding (B/A) _____

Total length of watershed channel _____ X _____ % Eroding _____ = Eroding length _____
 _____ X _____ = _____

Sediment Delivery Worksheet

Prepared by _____

Watershed name _____

Date _____

Present or Future _____

Multiply gross erosion by sediment delivery ratio (SDR) to determine sediment delivered. For explanation of terms and formulas refer to the text. Chart 1 & Figure 4 should be used to help determine SDR for sheet and rill. Use Table 2 for with concentrated flow SDR. Tables 1 & 3 should be used to adjust SDR's.

	Gross Erosion		SDR		Total Delivered
Sheet & Rill	_____	X	_____	=	_____
Ephemeral	_____	X	_____	=	_____
Gully	_____	X	_____	=	_____
Streambank	_____	X	_____	=	_____
Other	_____		_____	=	_____
Other	_____	X	_____	=	_____
Total					_____

"Measurements are best taken in the field"

ATTACHMENT 3

Successful Establishment of Switchgrass Not a Mystery

April 22, 1998
Kathleen Chester,
Information and Education, Chariton Valley Biomass Project

Successful establishment of switchgrass not a mystery

Switchgrass, a warm season grass native to Iowa, has become an increasingly popular choice among land owners for conservation and wildlife cover. Most recently switchgrass has been promoted for its potential as a fuel and fiber crop through the Chariton Valley Biomass Project.

More than a dozen private agencies and public organizations participate in the project. One project participant is Prairie Lands Bio-Products, Inc., a group of switchgrass growers leading efforts to develop products and markets for this versatile native grass. Prairie Lands members include more than 30 switchgrass growers in several southern Iowa counties. Member growers have considerable experience in the establishment and management of switchgrass, which has provided valuable lessons.

John Sellers, Vice-president of the group says, "The method for planting switchgrass goes against everything we've learned about compaction and conventional planting." According to Sellers, the use of a packing device on soil that has been tilled is not only beneficial, but recommended before and after seeding.

Alan Teel, project field specialist agrees, "An extremely firm seed bed is essential to ensure good seed to soil contact." In addition to the importance of a firm seed bed, the group has found the following methods contribute to the successful planting of switchgrass:

- Land that was used to grow soybeans makes an ideal seed bed. Bean ground that is level can be seeded and rolled without packing prior to planting;
- Seed should be planted (rolled in) no deeper than 1/8 inch into a very firm seed bed;
- Given favorable weather conditions, switchgrass can be seeded through the beginning of June. Stand success in year one may suffer in later seedings but should improve in year two;
- Avoid the use of herbicides on freshly planted seed within 48 hours of a germinating rain; and
- Mowing can be a very effective means of controlling weeds in young switchgrass stands. Use of a sickle mower is preferred.

Sellers says when working on marginal land take the following approach, "Till the soil, pack it, seed it, and pack it again."

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Importance of seed and timing

According to Prairie Lands member, John Osenbaugh, three combined factors contribute to the successful establishment of a switchgrass stand; seed, timing, and planting method. Since switchgrass seed may have a high dormancy rate it is important to know the status of your seed. If your seed is less than one year old, dormancy could result in an unsuccessful attempt at establishing switchgrass.

Osenbaugh, a Lucas County producer, has grown switchgrass on 1,200 acres for seed production since 1980. For the past ten years, Osenbaugh has supplied the seed for a dormancy research project conducted at the University of Virginia at Blacksburg, Virginia.

Osenbaugh says study results reveal that if seed harvested the previous year is planted before April 15, 100 percent germination was achieved, while seed planted by May 11, produced 75 percent germination. After June 1, no visible signs of switchgrass growth were seen.

"Ideally, switchgrass should be planted by April 15, however, switchgrass can still be established after that date by stratifying the seed," says Osenbaugh. Stratifying seed is the process of advancing the aging process which diminishes seed dormancy.

Osenbaugh says a producer can either hold back seed until it has aged for a year or stratify seed. "Submerge the seed in water and soak for 24 hours. Then place on a drain rake and store in a cooler for two weeks with a temperature between freezing and 50 degrees."

"Once the seed has been stratified, 1997 harvested seed can be planted with success through July 31, if there is good soil moisture," he says. Osenbaugh recommends five pounds pure live seed per acre and reminds that the seed will not germinate until soil temperatures reach about 60 degrees.

Sellers, on the other hand, prefers to let the seed stratify naturally and says if seed fails to produce a desired stand the first year not to lose heart. "Let mother nature take its course. If the seed doesn't germinate the first year, it will age naturally and germinate the following season." Whichever method a producer chooses, it is important to know the status or age of the seed.

Seed bed, seed depth, and early weed control critical

Once seed specifications have been met, there are planting methods to be followed. Alan Teel, field specialist with the Chariton Valley Biomass Project, says switchgrass is very sensitive to planting depth.

"Do not plant switchgrass seed deeper than a quarter inch," Teel says. Switchgrass requires a very firm seed bed to achieve good seed to soil contact. "Regardless of planting method, a seed bed that is firm enough *not* to show a foot print when walked on is required," says Teel. "When using a slot type seeder, this firm seed bed must be obtained." The use of a packing device is strongly recommended using multiple passes over the field.

Weed control is essential at the time of germination and during the first six to eight weeks of growth. Local ag-chem dealers should be able to work with producers regarding herbicide recommendations.

"Producers cooperating in the biomass project are permitted to use up to one and a half pounds of Atrazine® under a special 24C label," says Teel. Mowing can also be used to control weeds. Teel recommends allowing weeds to attain a height of six inches and mowing to a height of four to five inches. "This may need to be done two to three times during the first growing season," he says.

For more information about how to achieve a successful switchgrass establishment, the publication, *PM 1710-Management Guide for the Production of Switchgrass for Biomass fuel in Southern Iowa*, is available at the local county extension office. Or contact the Chariton Valley RC&D office, 515-437-4376. Producers with questions about switchgrass or Prairie Lands organization can contact John Sellers at 515-872-2657, Loren Eddy at 515-856-2223, or John Osenbaugh at 515-766-6790.

ATTACHMENT 4

**Legislative Support Remains Strong for Biomass Project
Senator Grassley Visits Chariton Valley RC&D**

CHARITON VALLEY RESOURCE CONSERVATION & DEVELOPMENT

June 8, 1998

Kathleen Chester,

Information and Education, Chariton Valley Biomass Project

Legislative support remains strong for biomass project *Senator Grassley visits Chariton Valley RC&D*

Local producers and representatives from various agencies gathered recently at the Chariton Valley RC&D office in Centerville to visit with Senator Charles Grassley.

Jim Cooper, Chariton Valley RC&D Coordinator, presented an overview of the Chariton Valley Biomass Project, explaining the economic and environmental benefits of using switchgrass as a renewable energy source. The focus of the project is the potential use of switchgrass as a fuel to replace a portion of the coal burned at Alliant Power's (formerly IES Utilities) Ottumwa generating station.

"Using switchgrass as a biomass fuel would allow producers to use the land while achieving the environmental and economic benefits of the CRP," Cooper said. "We're looking for alternatives that are compatible with Southern Iowa soils, instead of just row crop."

Bill Belden, with the Iowa Farm Bureau Federation, explained to Senator Grassley that use of an existing tax credit for biomass would make the cost of using switchgrass as fuel more attractive to power plants. "What we need is a tax credit for switchgrass to make it competitive with coal, just like the tax credit given to ethanol," Belden said.

In addition, a tax credit would help create a market that encourages producers to grow this alternative crop on marginal land. Farm Bureau member, Mark Haines added, "We would like to keep as much of the land as possible under forage, as in CRP, and protect the Rathbun Lake watershed if we can."

Senator Grassley listened as project coordinator, Marty Braster, explained that wording in the current legislation prohibits the project's use of the renewable resources electricity tax credit. What stands in the way of the project's eligibility for the tax credit is the definition a qualified facility.

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CHARITON VALLEY RESOURCE CONSERVATION & DEVELOPMENT

Currently, only facilities which are placed in service or have had modifications made within a specified time period qualify. If the legislation were changed to include the project's power plant, the value of switchgrass, when used as an energy crop, would increase by \$21 per ton. This would help make switchgrass more competitive with coal and other fuels.

Grassley provided leadership on legislation that created the income tax credit for wind and closed-loop biomass facilities. Closed-loop biomass refers to biomass grown specifically for energy generation.

In a visit last fall, U.S. Secretary Dan Glickman and Iowa Senator Tom Harkin pledged continued legislative support for renewable energy sources such as switchgrass. At that time, the USDA announced a \$44,700 grant for the Chariton Valley Biomass Project.

Also present for Senator Grassley's visit were Chariton Valley RC&D, Inc. board members, Leon Kauzlatich and Paul Koffman, Farm Bureau member, Marlan Korthaus, and Alliant Power Engineer, Gary Walling.

For more information regarding switchgrass or the Chariton Valley Biomass Project, contact Jim Cooper or Marty Braster at 515-437-4376.

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