

**SOUTH DAKOTA PUBLIC UTILITIES COMMISSION**

**CASE NO. EL05-022**

**IN THE MATTER OF THE APPLICATION BY OTTER TAIL POWER COMPANY**

**ON BEHALF OF THE BIG STONE II CO-OWNERS**

**FOR AN ENERGY CONVERSION FACILITY SITING PERMIT FOR THE**

**CONSTRUCTION OF THE BIG STONE II PROJECT**

**PREFILED REBUTTAL TESTIMONY**

**OF**

**JOHN T. LEE**

**VICE PRESIDENT**

**BARR ENGINEERING COMPANY**

**JUNE 9, 2006**



**PREFILED REBUTTAL TESTIMONY OF JOHN T. LEE**

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1           **BEFORE THE SOUTH DAKOTA PUBLIC UTILITIES COMMISSION**

2                   **PREFILED REBUTTAL TESTIMONY OF JOHN T. LEE**

3 **I. INTRODUCTION**

4 **Q: Please state your name and business address.**

5 A: John T. Lee, 4700 West 77th St., Suite 200, Minneapolis, MN 55435-4803.

6 **Q: By whom are you employed and in what capacity?**

7 A: I am employed as Vice President at Barr Engineering Co. ("Barr").

8 **Q: Did you provide any direct testimony in this proceeding?**

9 A: Yes. My direct testimony is marked as Applicants' Exhibit 18.

10 **Q: What is the purpose of your rebuttal testimony?**

11 A: The purpose of this testimony is to update certain exhibits in Sections 4 and 5 of the  
12 Application and to update my Prefiled Direct Testimony with respect to additional analysis of the  
13 Project's water use.

14 **II. REVISED EXHIBITS TO SECTIONS 4 AND 5 OF THE APPLICATION**

15 **Q: What exhibits from Sections 4 and 5 of the Application have you revised?**

16 A: Applicants' Exhibits 36 A-L attached to this testimony are intended to replace the  
17 following exhibits in the Application:

- Applicants' Exhibit 36-A replaces Exhibit 4-1 in the Application;
- Applicants' Exhibit 36-B replaces Exhibit 4-4 in the Application;
- Applicants' Exhibit 36-C replaces Exhibit 4-5 in the Application;
- Applicants' Exhibit 36-D replaces Exhibit 4-6 in the Application;
- Applicants' Exhibit 36-E replaces Exhibit 4-7 in the Application;
- Applicants' Exhibit 36-F replaces Exhibit 4-8 in the Application;
- Applicants' Exhibit 36-G replaces Exhibit 4-9 in the Application;
- Applicants' Exhibit 36-H replaces Exhibit 4-10 in the Application;
- Applicants' Exhibit 36-I replaces Exhibit 4-11 in the Application;

- Applicants' Exhibit 36-J replaces Exhibit 4-12 in the Application;
- Applicants' Exhibit 36-K replaces Exhibit 5-4 in the Application; and
- Applicants' Exhibit 36-L replaces Exhibit 5-5 in the Application.

1 **Q: Why have the exhibits been revised?**

2 A: Since the Application was filed almost one year ago, there have been minor changes in  
3 the design of the plant and surrounding infrastructure, which are generally described in the  
4 Prefiled Rebuttal Testimony of Mark Rolfes. The specific revisions contained in Applicants'  
5 Exhibits 36 A-L include the location of the water supply pipeline and the expanded area for the  
6 construction lay down.

7 **III. WATER USE AND WATER SOURCES**

8 **Q: Has there been additional analysis done on the Project's water use and water**  
9 **sources?**

10 A: Yes. Barr has completed additional analysis of the Project's potential impact to Big  
11 Stone Lake levels and the Minnesota River flows. This analysis was conducted in conjunction  
12 with preparing the Application for Permit to Appropriate Water within the State of South Dakota  
13 for the Project, submitted to the South Dakota Department of Environment and Natural  
14 Resources in March 2006. The proposed water appropriation is to provide cooling and process  
15 makeup water for the existing Big Stone Unit I and the proposed Big Stone Unit II.

16 **Q: Do these new analyses materially change the conclusions in the Application and in**  
17 **your Prefiled Direct Testimony regarding the Project's potential impacts from the**  
18 **additional water appropriation?**

19 A: No. While some of the details of the most recent analysis are different from the previous  
20 analyses, the recent analysis still shows that incremental impacts to Big Stone Lake levels and

1 Minnesota River flows from the additional water appropriation will be small. Water levels on  
 2 Big Stone Lake are modeled to average about 2-1/2 inches lower over the 70-year model period  
 3 than they would be without the additional appropriations. The models show that Minnesota  
 4 River flows downstream of Big Stone Lake during critical low-flow periods will be significantly  
 5 less than the flows that would occur without the additional appropriations only about 1.4 percent  
 6 of the time. The limited impact from the additional water appropriation is primarily due to the  
 7 fact that the water diversion restrictions currently in place for the Big Stone Plant are tied to Big  
 8 Stone Lake water levels, and these restrictions will remain unchanged under the proposed  
 9 operating plan for both units.

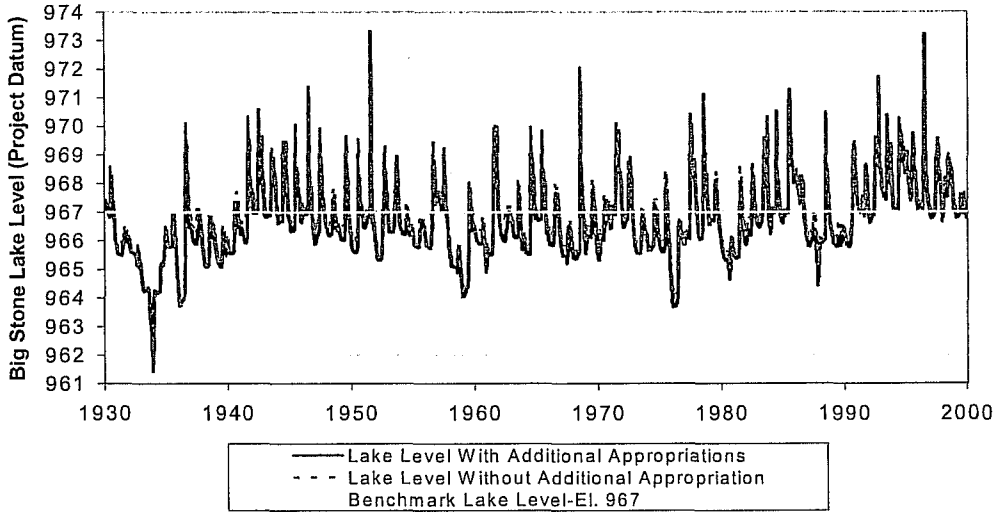
10 **Q: Please describe further the expected impacts to Big Stone Lake water levels.**

11 A: The water use model used for the Project takes 70 years of historical climate and lake  
 12 level data (1930 through 1999), superimposes the proposed water appropriation needs of the  
 13 combined Big Stone Unit I and Big Stone Unit II, and predicts the Big Stone Lake level over 70  
 14 years. The modeled lake levels with and without the additional Big Stone Unit II appropriations  
 15 are illustrated in Figure A below.

16  
 17  
 18  
 19  
 20  
 21  
 22  
 23

1

Figure A - Modeled Big Stone Lake Water Levels



2

3 Figure B below illustrates the modeled incremental change in lake water levels over the  
 4 same 70-year model period resulting from the additional Big Stone II water appropriations. As  
 5 can be seen in Figure B, lake level reductions generally are modeled at less than 6 inches and  
 6 only a handful of times are lake level reductions modeled to be greater than 12 inches.

7

8

9

10

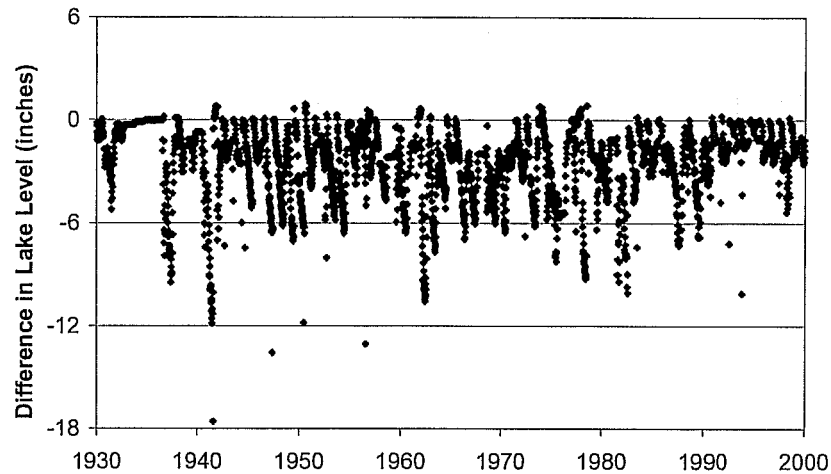
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13

1

**Figure B – Modeled Incremental Change in Big Stone Lake Level**



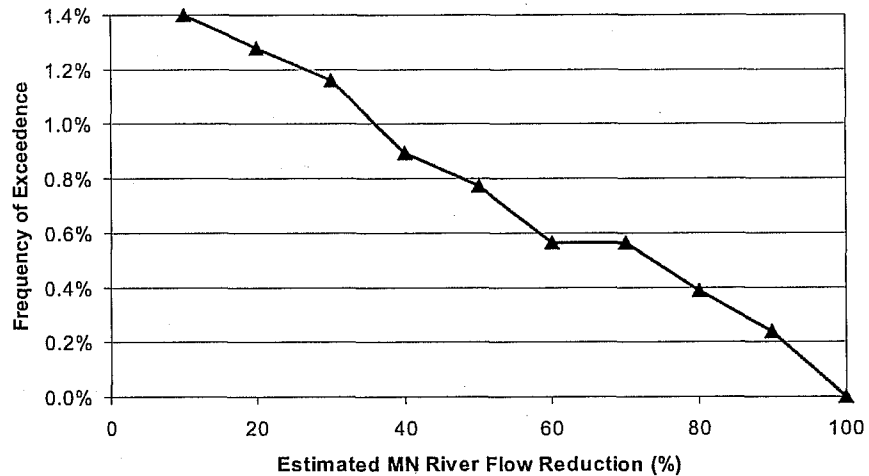
2

3 **Q: Please describe further the expected impacts to Minnesota River flows.**

4 A: The proposed increase in lake water usage from the Project (approximately 7,500 acre-  
 5 feet per year) represents less than ten percent of the average annual outflow from Big Stone  
 6 Lake. The occurrence of a noticeable flow reduction would depend on the interaction of a  
 7 number of variables, including the timing and volume of plant withdrawals, seasonal and shorter-  
 8 term runoff conditions, and other influences on lake levels such as temperature and solar  
 9 radiation. The overall storage capacity of the Project (18,900 acre-feet) allows some flexibility  
 10 in the timing and volume of withdrawals, such that their effects could be minimized. Modeling  
 11 indicates that additional lake withdrawals would have little or no effect on an average annual  
 12 basis or over most flow intervals. Using 2004 as an example, withdrawals for the existing plant  
 13 were made in May, June, July, and November, with most withdrawals made in May. All of these  
 14 months, except November, are relatively high flow months on the upper Minnesota River, and  
 15 withdrawals are expected to have minimal effect.

1 Examination of flow impacts on the Minnesota River downstream of Big Stone Lake  
 2 focus on the periods when flows are relatively low, less than 80 cubic feet per second (cfs).  
 3 Historically, these low flows occur about 75 percent of the time. The water use model was used  
 4 to predict the frequency of flow reductions during such low flow periods resulting from the  
 5 additional Big Stone Unit II appropriations. Those flow reduction impacts are illustrated in  
 6 Figure C.

7 **Figure C – Effect on Minnesota River Low Flows**



8  
 9 This graph illustrates that Minnesota River flow reductions greater than about 10 percent  
 10 during low flow periods are predicted to occur only about 1.4 percent of the time over the 70  
 11 years modeled. As another example, Figure C illustrates that Minnesota River flow reductions  
 12 greater than about 80 percent during low flow periods are predicted to occur less than 0.4 percent  
 13 of the time over the 70 years modeled.



14 **Q: Does this conclude your testimony?**

15 **A: Yes.**












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-  Property Boundary
-  10ft Contours

**Project Features**

- ID**
-  1 Cooling Tower Blowdown Pond
  -  2 Cooling Tower
  -  3 New Plant
  -  4 Construction Parking
  -  5 Ethanol Plant
  -  6 Construction Laydown
  -  7 Makeup Storage Pond
  -  8 Water Pipelines
  -  Water Pipeline Corridors

Data Source: Contour lines created from USGS Digital Elevation Model

**EXHIBIT**  
APPLICANT'S  
EXHIBIT 36A

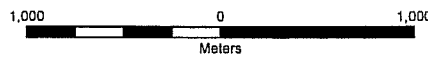
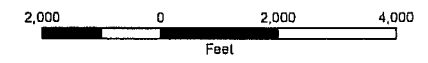


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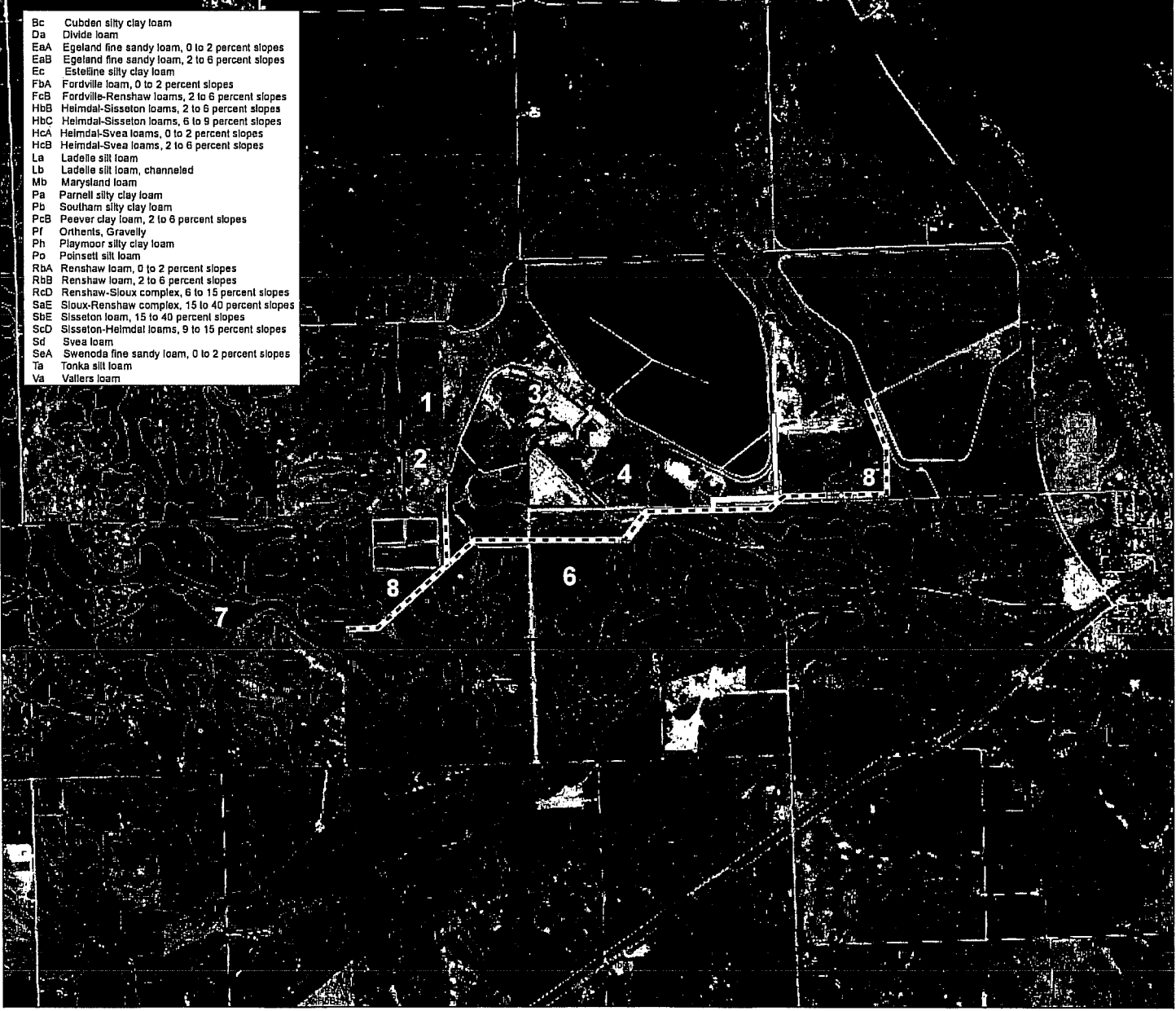
TOPOGRAPHIC MAP  
OF PROJECT VICINITY  
Big Stone II Project  
Big Stone II Co-owners

Revised June 2006

4827

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- Bc Cubden silty clay loam
- Da Divide loam
- EaA Egeland fine sandy loam, 0 to 2 percent slopes
- EaB Egeland fine sandy loam, 2 to 6 percent slopes
- Ec Esteline silty clay loam
- FbA Fordville loam, 0 to 2 percent slopes
- FcB Fordville-Renshaw loams, 2 to 6 percent slopes
- HbB Heimdal-Sisseton loams, 2 to 6 percent slopes
- HbC Heimdal-Sisseton loams, 6 to 9 percent slopes
- HcA Heimdal-Svea loams, 0 to 2 percent slopes
- HcB Heimdal-Svea loams, 2 to 6 percent slopes
- La Ladelle silt loam
- Lb Ladelle silt loam, channeled
- Mb Maryland loam
- Pa Parnell silty clay loam
- Pb Southam silty clay loam
- PcB Peever clay loam, 2 to 6 percent slopes
- Pf Orthents, Gravelly
- Ph Playmoor silty clay loam
- Po Poinsett silt loam
- RbA Renshaw loam, 0 to 2 percent slopes
- RbB Renshaw loam, 2 to 6 percent slopes
- RcD Renshaw-Sioux complex, 6 to 15 percent slopes
- SaE Sioux-Renshaw complex, 15 to 40 percent slopes
- SbE Sisseton loam, 15 to 40 percent slopes
- ScD Sisseton-Heimdal loams, 9 to 15 percent slopes
- Sf Svea loam
- SeA Swanoda fine sandy loam, 0 to 2 percent slopes
- Ta Tonka silt loam
- Va Vallers loam



Property Boundary  
Soils

**Project Features**

- ID
- 1 Cooling Tower Blowdown Pond
- 2 Cooling Tower
- 3 New Plant
- 4 Construction Parking
- 5 Ethanol Plant
- 6 Construction Laydown
- 7 Makeup Storage Pond
- 8 Water Pipelines
- Water Pipeline Corridors

Data Source: USDA NRCS  
Soil Survey Geographic (SSURGO)

**EXHIBIT**  
*APPLICANTS'*  
**EXHIBIT 36-B**

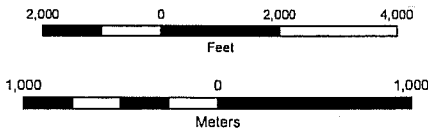
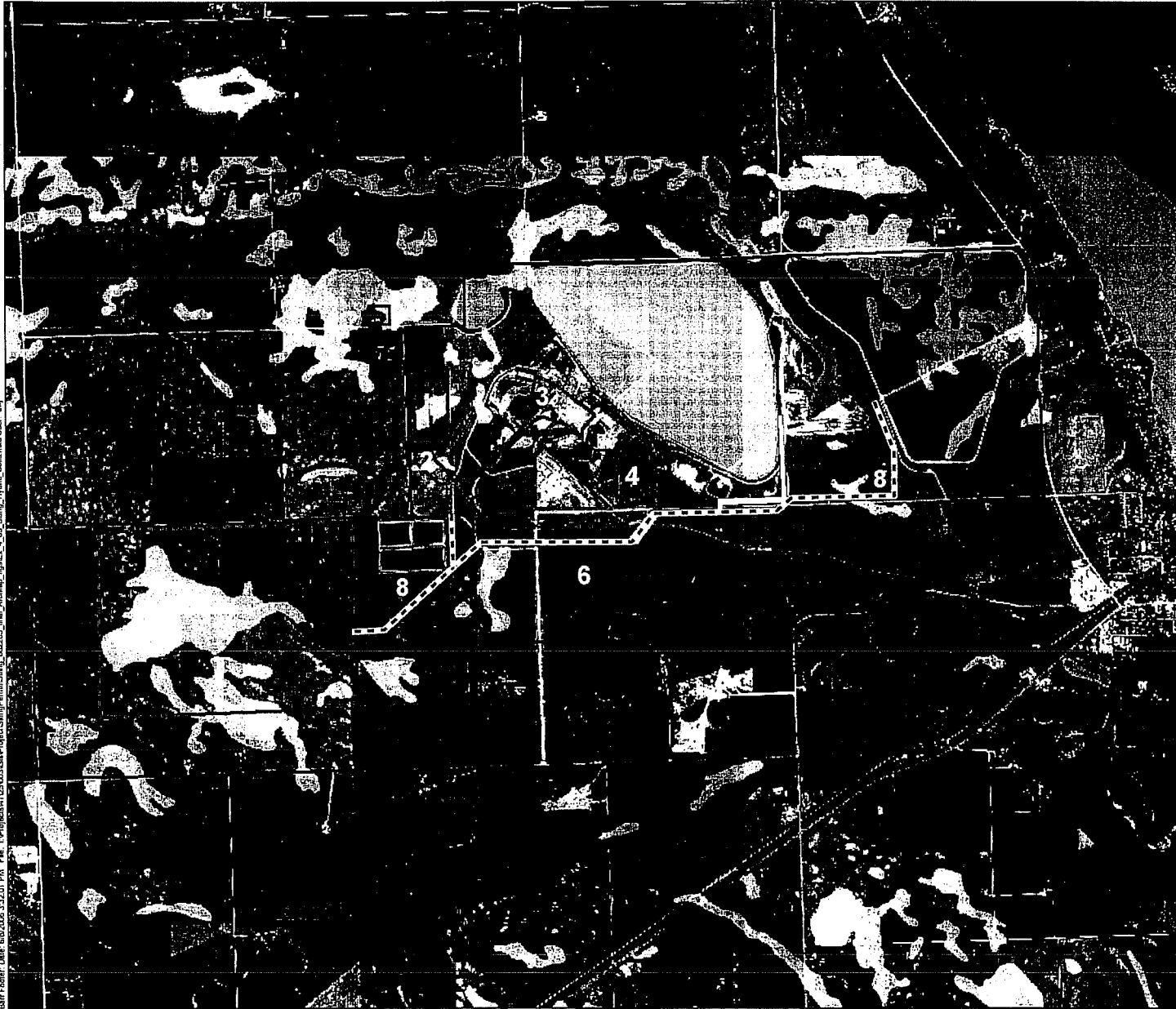


Exhibit 4-4  
SOILS  
Big Stone II Project  
Big Stone II Co-owners  
Revised June 2006

4828

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Property Boundary  
Hydric Soils

**Project Features**

- ID
- 1 Cooling Tower Blowdown Pond
  - 2 Cooling Tower
  - 3 New Plant
  - 4 Construction Parking
  - 5 Ethanol Plant
  - 6 Construction Laydown
  - 7 Makeup Storage Pond
  - 8 Water Pipelines
  - Water Pipeline Corridors

Data Source: USDA NRCS  
Soil Survey Geographic (SSURGO)

**EXHIBIT**  
Applicants'  
Exhibit 3b-C

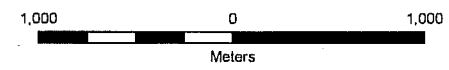


Exhibit 4-5

HYDRIC SOILS  
Big Stone II Project  
Big Stone II Co-owners

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4829














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Property Boundary

**Project Features**

ID

-  1 Cooling Tower Blowdown Pond
-  2 Cooling Tower
-  3 New Plant
-  4 Construction Parking
-  5 Ethanol Plant
-  6 Construction Laydown
-  7 Makeup Storage Pond
-  8 Water Pipelines
-  Water\_Pipelines\_Buffer2
-  Subwatershed Divides
-  Watershed Boundaries
-  10ft Contours
-  Streams

**EXHIBIT**  
*APPLICANTS!*  
**EXHIBIT 36D**

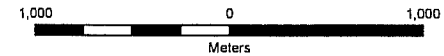
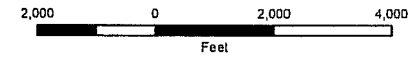


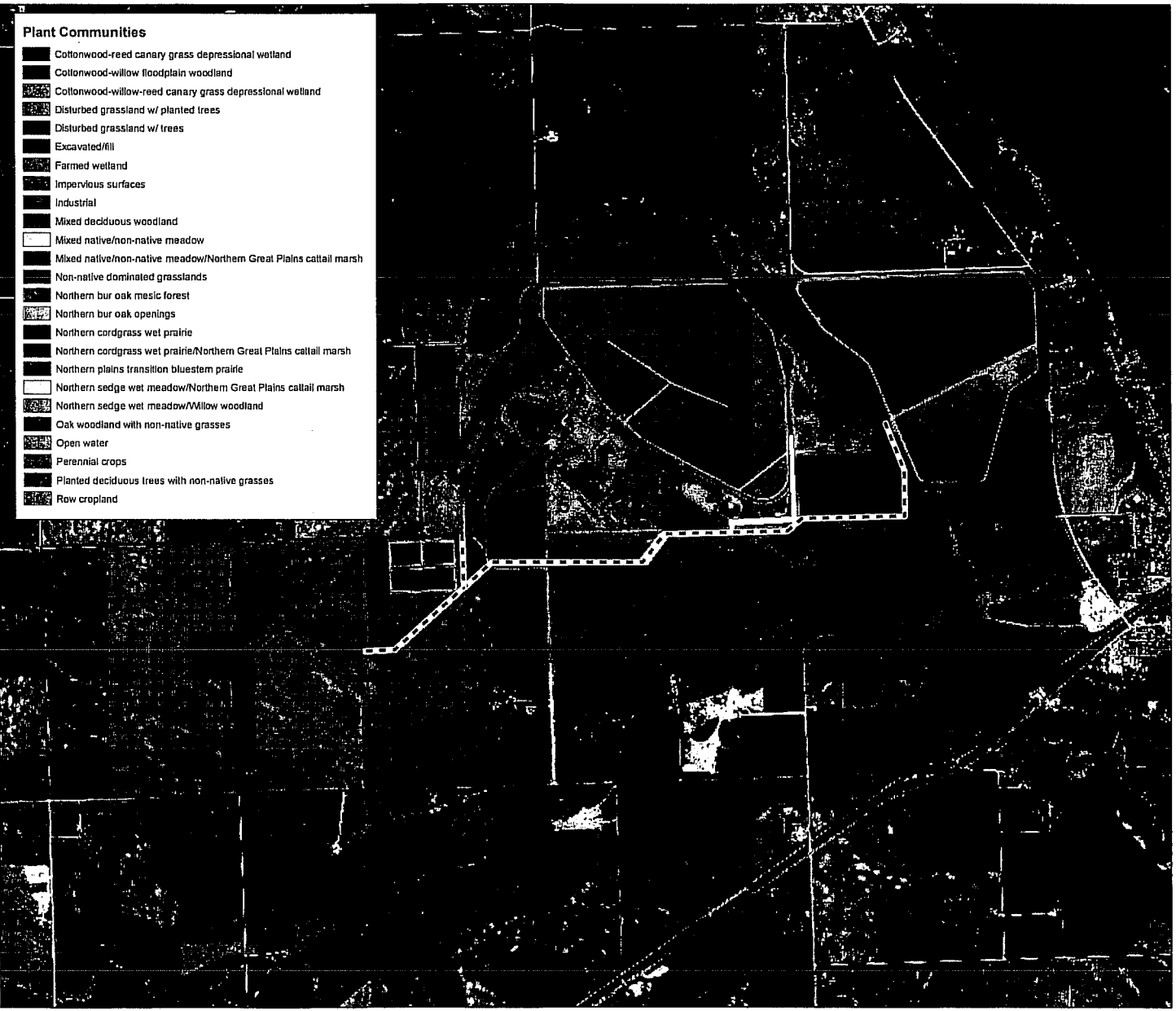
Exhibit 4-6

**STREAM NETWORK &  
WATERSHED DIVIDES**  
Big Stone II Project  
Big Stone II Co-owners

Revised June 2006

4830

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- Plant Communities**
- Cottonwood-reed canary grass depressional wetland
  - Cottonwood-willow floodplain woodland
  - Cottonwood-willow-reed canary grass depressional wetland
  - Disturbed grassland w/ planted trees
  - Disturbed grassland w/ trees
  - Excavated/fill
  - Farmed wetland
  - Impervious surfaces
  - Industrial
  - Mixed deciduous woodland
  - Mixed native/non-native meadow
  - Mixed native/non-native meadow/Northern Great Plains cattail marsh
  - Non-native dominated grasslands
  - Northern bur oak mesic forest
  - Northern bur oak openings
  - Northern cordgrass wet prairie
  - Northern cordgrass wet prairie/Northern Great Plains cattail marsh
  - Northern plains transition bluestem prairie
  - Northern sedge wet meadow/Northern Great Plains cattail marsh
  - Northern sedge wet meadow/Willow woodland
  - Oak woodland with non-native grasses
  - Open water
  - Perennial crops
  - Planted deciduous trees with non-native grasses
  - Row cropland

- Property Boundary
- Project Features**
- ID**
- 1 Cooling Tower Blowdown Pond
- 2 Cooling Tower
- 3 New Plant
- 4 Construction Parking
- 5 Ethanol Plant
- 6 Construction Laydown
- 7 Makeup Storage Pond
- - - 8 Water Pipelines
- Water Pipeline Corridors

Plant community data collection by Barr Engineering Company in September 2004.

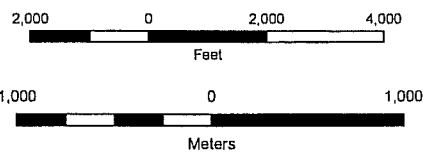


Exhibit 4-7  
**PLANT COMMUNITIES**  
 Big Stone II Project  
 Big Stone II Co-owners  
 Revised June 2006

4031

EXHIBIT APPLICANTS' EXHIBIT 36-E

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Property Boundary

**Project Features**

ID

- 1 Cooling Tower Blowdown Pond
- 2 Cooling Tower
- 3 New Plant
- 4 Construction Parking
- 5 Ethanol Plant
- 6 Construction Laydown
- 7 Makeup Storage Pond
- 8 Water Pipelines
- Water Pipeline Corridors

**Plant Communities**

Quality

- Low
- Medium
- High

Plant community data collection by Barr Engineering Company in September 2004.



**EXHIBIT**  
APPLICANTS'  
**EXHIBIT 36-F**

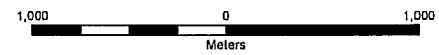
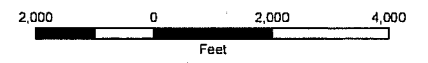


Exhibit 4-8



PLANT COMMUNITY QUALITY  
Big Stone II Project  
Big Stone II Co-owners

Revised June 2006











4832

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-  Property Boundary
-  Extended Study Area

**Project Features**

- ID**
-  1 Cooling Tower Blowdown Pond
  -  2 Cooling Tower
  -  3 New Plant
  -  4 Construction Parking
  -  5 Ethanol Plant
  -  6 Construction Laydown
  -  7 Makeup Storage Pond
  -  8 Water Pipelines
  -  Water Pipeline Corridors
  -  Bald Eagle Nest

Field observations made by Barr Engineering Company. South Dakota Natural Heritage Database query completed on September 24, 2004 by the SD Department of Game, Fish and Parks.



**EXHIBIT**  
*APPLICANTS'*  
**EXHIBIT 36-G**

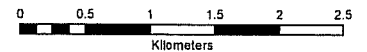
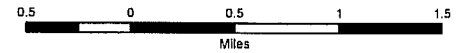


Exhibit 4-9






WILDLIFE  
Big Stone II Project  
Big Stone II Co-owners

Revised June 2006










4833

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-  Delineated wetlands
-  NWI Wetlands
-  Property Boundary
-  Watershed Boundaries
-  10ft Contours

**Project Features**

- ID**
-  1 Cooling Tower Blowdown Pond
  -  2 Cooling Tower
  -  3 New Plant
  -  4 Construction Parking
  -  5 Ethanol Plant
  -  6 Construction Laydown
  -  7 Makeup Storage Pond
  -  8 Water Pipelines
  -  Water Pipeline Corridor

Data Sources: USFWS National Wetlands Inventory.  
Wetlands delineation and data collection within property boundary by Barr Engineering Company.

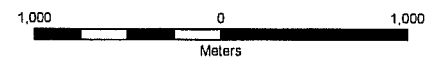
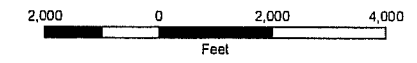


Exhibit 4-10

DELINEATED WETLANDS  
Big Stone II Project  
Big Stone II Co-owners

4834

Revised June 2006





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- Land Use**
- Disturbed grassland w/ trees
  - Farmed wetland
  - Farmstead
  - Grassland
  - Grassland pasture
  - Hayfield
  - Impoundments
  - Industrial
  - Mixed deciduous woodland
  - Mixed native/non-native meadow
  - Non-native dominated grassland
  - Northern bur oak
  - Roadways/railroads
  - Row crops
  - Wetland
  - Windbreak
  - Wooded pasture

Property Boundary

**Project Features**

- ID**
- 1 Cooling Tower Blowdown Pond
  - 2 Cooling Tower
  - 3 New Plant
  - 4 Construction Parking
  - 5 Ethanol Plant
  - 6 Construction Laydown
  - 7 Makeup Storage Pond
  - 8 Water Pipelines
  - Water Pipeline Corridors
- Noise Monitoring Site

Plant community data collection by Barr Engineering Company. Simplified version of NCLD created by Barr Engineering Company.

EXHIBIT APPLICANTS' EXHIBIT 36-I

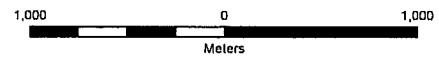
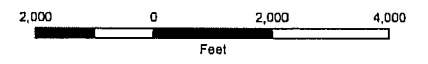
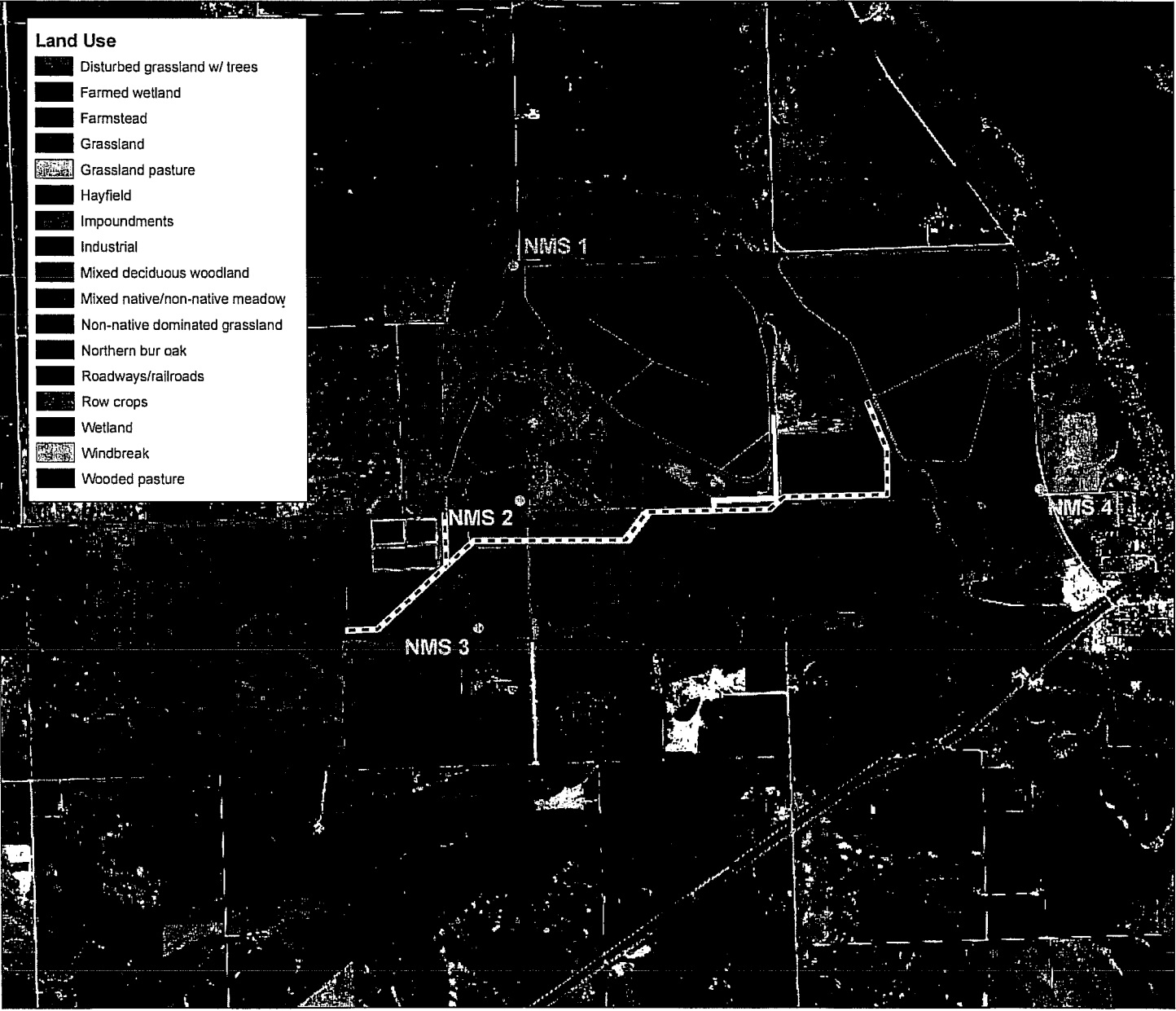


Exhibit 4-11  
LAND USE  
Big Stone II Project  
Big Stone II Co-owners

4835

Revised June 2006



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- Property Boundary
- Project Features**
- ID**
- 1 Cooling Tower Blowdown Pond
- 2 Cooling Tower
- 3 New Plant
- 4 Construction Parking
- 5 Ethanol Plant
- 6 Construction Laydown
- 7 Water Storage Pond
- 8 Water Pipelines
- Water Pipeline Corridors
- Zoned Commercial

Data Source: 1st District Watertown GIS  
Grant County, SD.

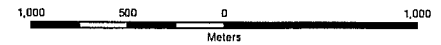


Exhibit 4-12

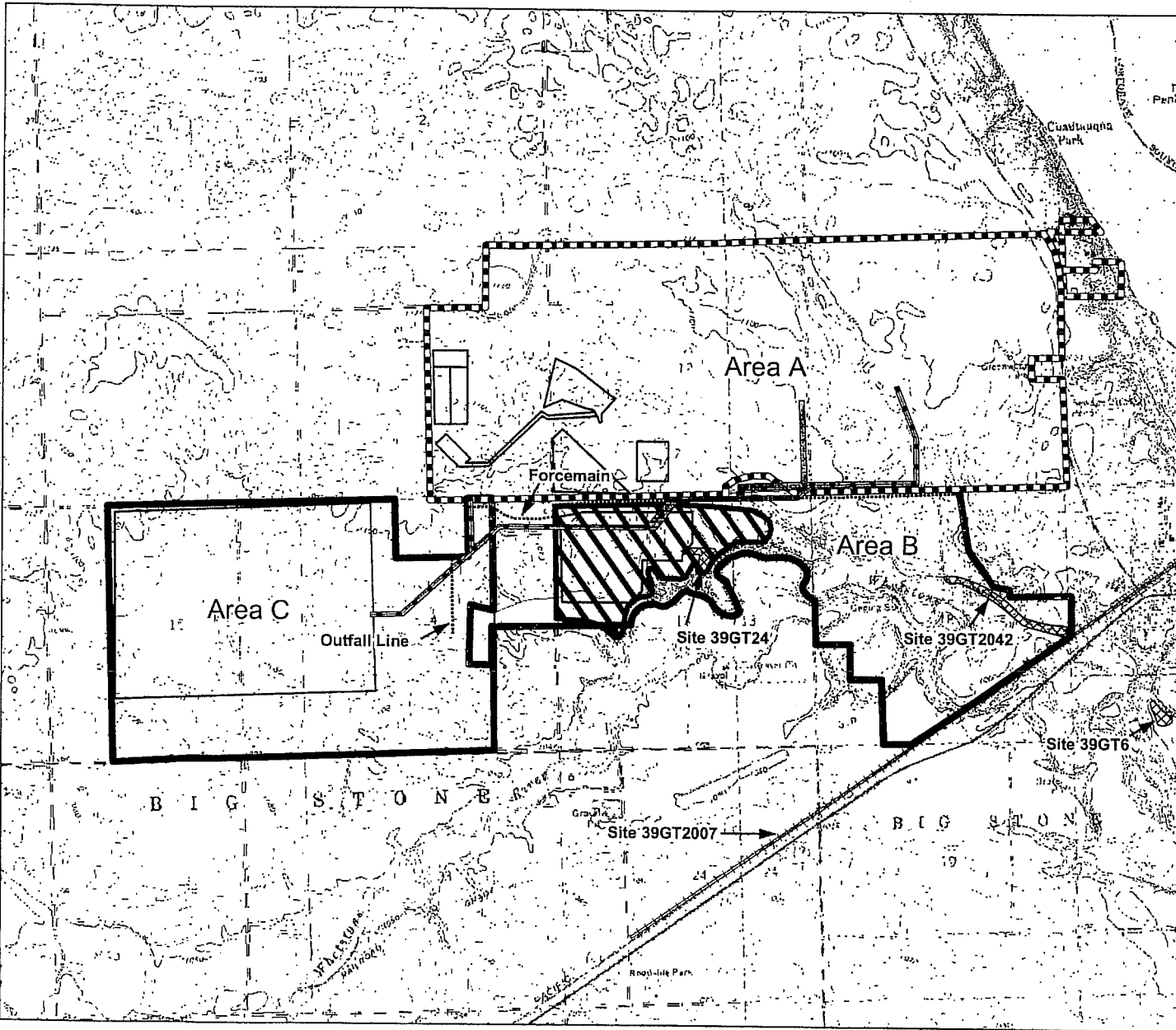
BIG STONE PROPERTY CURRENTLY  
ZONED COMMERCIAL  
Big Stone II Project  
Big Stone II Co-owners

Revised June 2006








40836

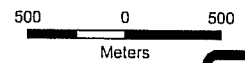
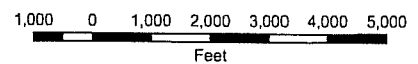
EXHIBIT  
APPLICANTS'  
EXHIBIT 36-J

Ben Foster Date: 6/2/2006 8:32:18 AM File: I:\Programs\12506031\GIS\Project\Site\Survey\Permit\Siting\_062206\_1.mxd ArchApp\_G6a1E\_5\_04\_Archaeology\_Assessment.mxd User: dm



### Legend

-  Site Boundary
-  Project Features
-  Water Pipeline
-  Water Pipeline Corridors
-  High Potential
-  1994 Survey
-  1996 Survey



**EXHIBIT**  
APPLICANTS  
EXHIBIT 36-K

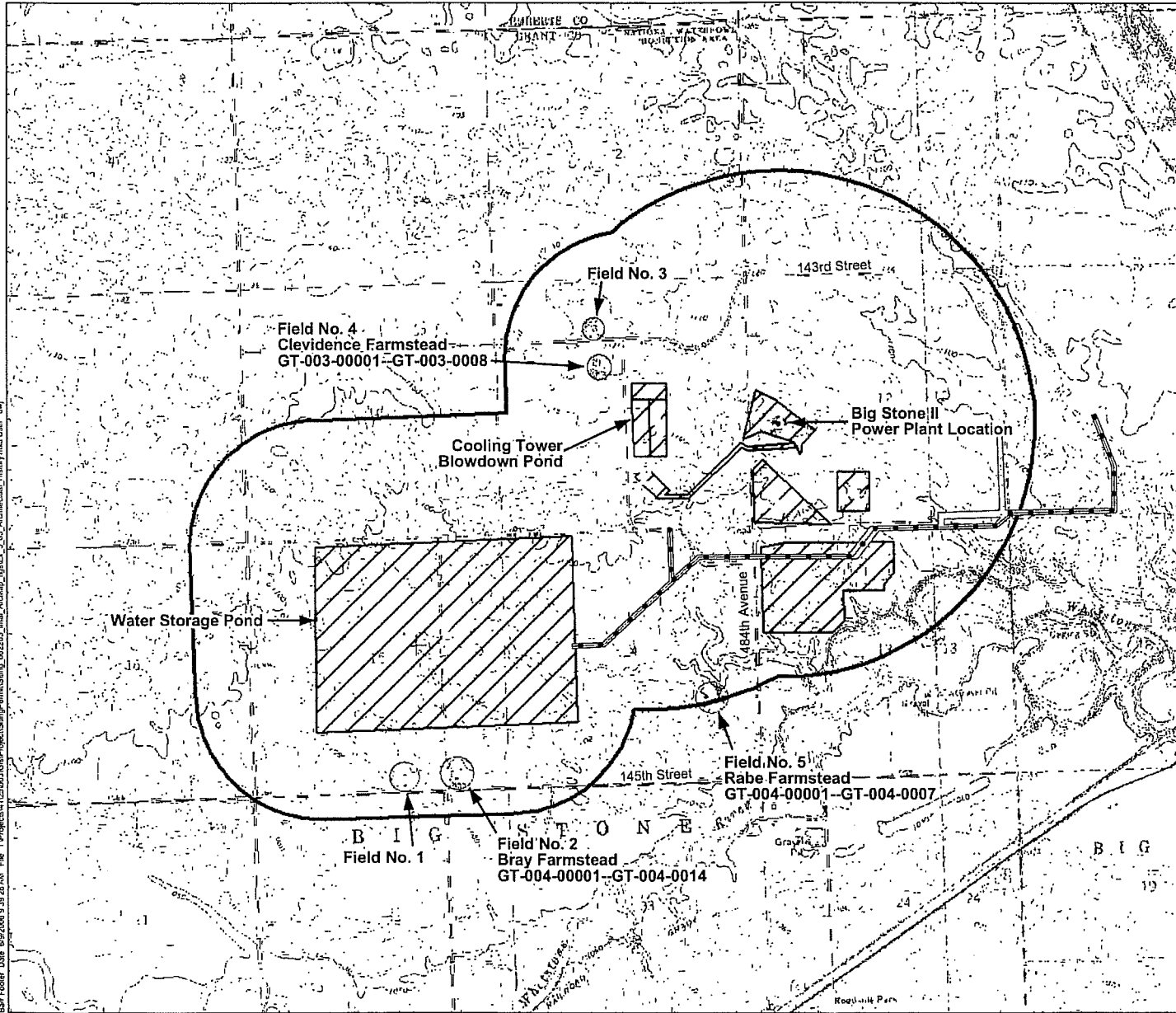
Exhibit 5-4

ARCHAEOLOGY ASSESSMENT RESULTS  
Big Stone II Project  
Big Stone II Co-owners






Revised June 2006

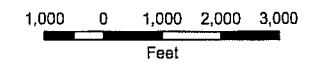
4837

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### Legend

-  Architectural History Surveyed Properties
-  Architectural History Area of Potential Effect
-  Project Features
-  Water Pipeline
-  Water Pipeline Corridors



**EXHIBIT**  
Applicant's  
**EXHIBIT 36-L**

Exhibit 5-5

ARCHITECTURAL HISTORY  
SURVEY RESULTS  
Big Stone II Project  
Big Stone II Co-owners

Revised June 2006

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