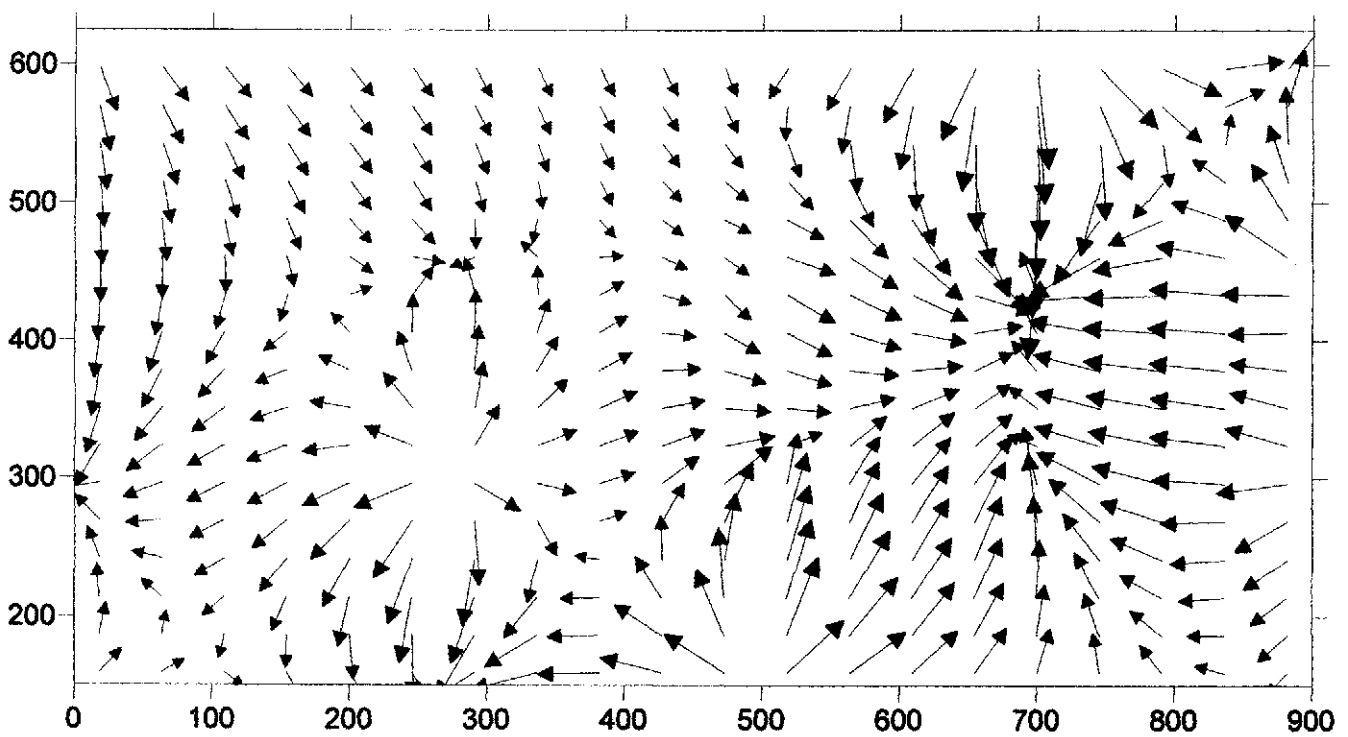
One Weeks Coal Production at A Surface Coalmine



NT-02-14

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I. INTRODUCTION

"One Weeks Coal Production at a Surface Coalmine", "Surface Mine Design", "Underground Mine Design", and "Coal Transportation". My Advanced Mathematics students were asked to pick one of these four topics as the central theme for our schools Coal Study Unit. They debated each topic and settled on "One Weeks Coal Production at a Surface Coalmine". "Surface Mine Design" came in a close 2nd. Their decision would launch a school wide investigation involving most aspects of operating a surface coalmine for one-week. Their unit would be an interdisciplinary integration project involving all academic departments at the school. It involved the active participation of two administrators, twenty teachers, and approximately 350 students. One department determined how much coal was at the mine site and determined its worth. Another department analyzed the coal and looked at separating it from the rock. Still other students worked on generating maps of the mine. Students in some departments simply did research, sang songs, drew pictures, wrote essays, or made chocolate and vanilla pudding.

The students at our school had fun participating in the unit and they learned a lot about surface coal mining.

As the list of topics for this year's coal study unit was narrowed down to the final four ideas that would be voted on by the class, it was decided that this year's unit should contain several elements. First, the unit should involve the participation of as many students as possible and include all academic disciplines at the school. Second, the unit should challenge students to solve real world problems encountered in coal mining. They should have to think critically, use problem solving skills, and be engaged at the highest levels of Blooms Taxonomy. Third, the unit should emphasis contextual learning. Students that are engaged in hands-on project based learning activities are much more likely

to retain what they have learned. Fourth, the unit should address core content in each academic area and should satisfy specific elements in our schools consolidated plan.

The unit began in the Advanced Topics classes. These students were given the task of developing a fictitious surface coalmine and then imagining all the steps involved in mining the coal at this relatively new mine over the course of a seven-day period. First, each group was assigned the task of coming up with a name for their mine. They decided on names like "Central Mine", "Big Sandy Coal", and "Diamond Inc".

During this investigation the following major objectives should be realized: The student will

1. Use techniques of Integral Calculus to estimate the amount of overburden and removable coal during the one-week period to within 20% of the accepted value.
2. Use core drilling data and geostatistical techniques of Inverse Distance and Delauney Triangulation, to predict the height of the coal seam at a selected location on the property to within two feet of the accepted height.
3. Use the polygonal method to estimate the volume of the remaining coal in the coal seam and determine its current market value to within 20% of the accepted value.
4. Use Surfer 8 computer software to estimate the volume of coal in the coal seam to within 10% of the accepted value.
5. Use Surfer 8 computer software to correctly draw at least two different 2-dimensional pictures of the coal seam.
6. Use Surfer 8 computer software to correctly draw at least two different 3-dimensional pictures of the coal seam.
8. Analyze the ash, moisture, BTU, and sulfur content of the coal that is mined at the site to within 15% of the accepted value.
9. Correctly use technology as a tool to assist in making decisions about the development and operation of the surface mine.
10. Correctly research the history of surface mining in Eastern Kentucky using at least 2 sources.
11. Given the material, bake a cake or pastry that correctly models the coal seam and the surrounding rock strata.
12. Given the necessary tools, be able to compose the music and/or lyrics of a song that is at least 3 minutes long and has coal as a central theme.
13. Given the materials, construct a 2-dimensional or 3-dimensional work of art that illustrates coal mining and its impact on the people of our area.
14. Be able to write a proficient short story or poem that has coal as the central cluster theme.
15 Use computer-modeling software to design a workable coal separation flow-chart using input data from the coal that is mined during the week.
16. Calculate the surface mine "stripping" ratio for the surface mine that is within 20% of the accepted value.

17. Collect a measurable amount of coal gas (methane, ect...) that is released from a lump of coal collected at the mine site.
18. Generate an accurate numerical picture of the surface mine.
19. Correctly use a current computer design software program to generate a 3-D picture of the mine.

ESSENTIAL QUESTION(S):

1. How can I use Integral Calculus to calculate the volume of the overburden.
2. What is the volume and current value of the coal located at the property?
3...How can I use core drilling data to predict the height of the coal at a particular point?
4. What is a coal separation flow-chart?
5. How has surface mining impacted the lives of the people in Eastern Kentucky?
6. How can I determine the ash, moisture, sulfur, and BTU content of the coal mined at the site?
7. How can computer design software be used in the design of surface mines?
8. How can I write a song about coal mining?
9. How is coal used in as a theme in different types of art?
10. How can I write a short story or essay about coal?
11. What is a surface mine ratio and how is it calculated?
12. What is coal gas and how can it be captured?

II. ACTIVITIES AND GOALS

This year's coal study unit was integrated horizontally across all subject area in such a way that the student participated in and became part of a total immersion learning activity. The student practiced cooperative learning and peer teaching skills by collaboration with and working with other students in small groups. They used critical thinking and problem solving skills to make decisions concerning the planning and operation of a surface coalmine while applying and transferring previously learned skills to real life problems face in today's surface mines. The following is a brief description of the learning activities implemented in each subject at our school.

A. MATHEMATICS

Math students made up core drilling data for the land tack and used the polygonal method to estimate the volume and value of the coal located on the property. A home was also placed on the property and the height of the coal seam beneath the home was estimated by using the techniques of

Delauney Triangulation and Inverse Distance to a Power. Each group then used the Surfer 8 computer software to verify the estimated height of the coal at the predicted point beneath the home.

Math students also used both Pre-Calculus and Integral Calculus techniques to determine the average cross-sectional area and volume of the overburden at the mine. They then used the volume of the coal and the volume of the overburden to calculate the "stripping ratio" for their surface mine.

B. SCIENCE

After reviewing proper laboratory safety procedures, chemistry students worked in groups of four to analyze the coal removed from the mine site. They determined the ash, moisture, and BTU content of the coal taken from the mine.

Physics students worked in groups of four to generate and capture the "coal gas" that was released by a fist size lump coal taken from their surface mine. After collecting the gas bubble each group ignited the gas. This demonstrated the possible economic value of collecting "coal gas" from coal seams that are deep underground and using the released gas to heat homes and businesses.

C. Pre-Engineering

Students enrolled in our Pre-engineering curriculum worked in groups of four to calculate the volume of overburden that would be removed during the one-week period. They used Surfer 8 Contouring and 3-D Mapping Computer Software to determine the volume of the coal on the property. This software was also used to draw at least four 2-D and 3-D pictures of the coal seam. Each group then generated a numerical picture of their surface mine and used a current mine design computer program to draw 2-D and 3-D maps of the mine.

Each group also performed a coal/rock separation experiment by counting the number of water pulses needed to separate a coal/rock mixture. They then used coal data supplied with a computer simulation software program to simulate the separation of a coal/rock mixture. This data was then used to generate a workable coal separation flow-chart that could possibly be used to separate the coal and rock extracted from their own surface mine.

D. ENGLISH

Senior English student wrote a short stories and essays with coal mining as a central cluster theme. Several students decided to use their papers as entries in the senior English portfolios.

E. SOCIAL STUDIES

Political science students used the library facilities to research topics related to the history of surface mining in Eastern Kentucky.

F. TECHNOLOGY

Students used technology in every academic area as a powerful tool to solve complex problems and make important decisions concerning the development and operation of their surface mine. The technology applications in this unit were both challenging and relevant to most aspects of surface mining. A list of some important types of technology used in our unit would include: Surpac Vision Mine Design Software, computers, Surfer 8 Contouring and 3-D Mapping Software, MODSIM: A Modular Simulation for Mineral Processing Plants, graphics calculators, VCR, TV, camcorders, sound mixers, digital camera, and the internet.

G. ART

Students in the art department were asked to produce 2-dimemsional and 3-dimenstional works of art with coal as the central theme. These could include sculpturing, posters, paintings, coal drawing, and photographs.

H. MUSIC

Music students composed and recorded songs about various aspects of coal mining and its impact on the people of Eastern Kentucky.

I. FOOD SCIENCES

Students in the culinary skills classes baked cakes and made puddings that illustrated a 3-dimensional cut-a way view of the coal seam and the surrounding rock strata.

III. SUMMARY

This year's coal study unit must be considered a success. It successfully exposed our students to most aspects of coal production at a surface coalmine over a seven-day period. The students learned in a contextual manner using hands-on, technology intensive activities that helped them retain what they learned. They became active learners in a coal related integration project involving all academic areas.

Our pre-engineering students will feel an additional positive impact of our unit. Due to the training they received with the mine design computer software, they will have an opportunity to market job ready skills to any number of engineering firms located in our area. This could provide them the training they need to work after school or during the summer at a challenging job earning double or triple the salary earned by their minimum wage earning peers.

Students participating in our unit were engaged at the highest levels of Blooms Taxonomy: analysis, synthesis, and evaluation. They were asked to judge the success of the entire unit and make recommendation for improvements. Several of these recommendations may be use to improve the unit when it is taught again. Students were also asked to judge and critique each other's culmination projects. They listed two things they liked about the project and noted one area in which the project could be improved. These evaluations became a valuable tool that many students used to improve their projects.

Participation teachers in each department evaluated their students using one or all of the following methods:

1. Formative Evaluation
    a. Daily oral questions of students by the teacher
    b. Oral presentation
    c. Open-response questions
    d. Investigation and group product evaluations
    e. Quizzes
2. Summative Evaluation
    a. Culminating projects
    b. Unit tests

The participating teachers and the unit coordinator evaluated the effectiveness of the unit based upon the degree to which the unit taught the high school core content, covered the program of studies, and met components of our schools consolidated plan. It was apparent that this unit met and exceeded all expectation set by participating teachers at the inception of the unit.

One aspect of this unit that will need improvement would be greater distribution if the computer simulation software at our school. Due to the expense of these software packages, we were only able to purchase one site license for both the contouring and mine design packages. This severely restricted the number of students that were able to use these software packages. Extra site licenses should be purchased when this unit is taught again.

The activities taught in this unit were designed to allow students the opportunity to learn in the type of multiple intelligence and style of learning that best suited their needs. All the participating teachers were able to differentiate their instruction to meet the needs of students containing IEP modification. These would include special education students, 504 students, and students in our school gifted and talented program. To see a complete list of these components see the coal study unit outline included in this report.

This year's coal study unit involved the active participation of 20 teachers, 350 students, and two administrators. It has excited the entire community at our high school. Almost every student has heard of at least one of the fictional surface mines designed at our school. The responses of the student that participated in the unit were overwhelmingly favorable. They believe that their knowledge of surface mining has been enhanced. They indicated that they especially like the hand-on nature of the instructional activities and they enjoyed working with other students in the cooperative learning peer teaching aspects of the unit.

In conclusion, this coal study unit must be considered a total success because the goal set for the unit was achieved. The 19 objectives were either met or exceeded and the four elements described in the introduction were all realized. Student learning was enhanced. Their critical thinking and

problem solving skills have been improved. Most importantly, these students will take with them an enhanced understanding of surface mining and a greater realization of just how important surface mining is to the economy of Pike County and the state of Kentucky.

LESSON PLAN

Date: January 2 – May 16, 2008 **Teacher:**
Type: ☐ Daily ☒ Unit Length: __70__ (# days) **Class :**

THEME/ORGANIZER:

Investigate most aspects of one weeks coal production at a typical surface coalmine in Eastern Kentucky.

TARGET STANDARD(S): (Expressed in High Order Thinking Skills, "HOTS"/Williams and Blooms Taxonomies)
The students will be able to:

1. **Use techniques of Integral Calculus to estimate the amount of overburden and removable coal during the one-week period to within 20% of the accepted value.**
2. **Use core drilling data and geostatistical techniques of Inverse Distance and Delauney Triangulation, to predict the height of the coal seam at a selected location on the property to within two feet of the accepted height.**
3. **Use the polygonal method to estimate the volume of the remaining coal in the coal seam and determine its current market value to within 20% of the accepted value.**
4. **Use Surfer 8 computer software to estimate the volume of coal in the coal seam *to within 10% of the accepted value.***
5. **Use Surfer 8 computer software to correctly draw at least two different 2-dimensional pictures of the coal seam.**
6. **Use Surfer 8 computer software to correctly draw at least two different 3-dimensional pictures of the coal seam.**
8. **Analyze the ash, moisture, BTU, and sulfur content of the coal that is mined at the site to within 15% of the accepted value.**
9. **Correctly use technology as a tool to assist in making decisions about the development and operation of the surface mine.**
10. **Correctly research the history of surface mining in Eastern Kentucky using at least 2 sources.**
11. **Given the material, bake a cake or pastry that correctly models the coal seam and the surrounding rock strata.**
12. **Given the necessary tools, be able to compose the music and/or lyrics of a song that is at least 3 minutes long and has coal as a central theme.**
13. **Given the materials, construct a 2-dimensional or 3-dimensional work of art that illustrates coal mining and its impact on the people of our area.**
14. **Be able to write a proficient short story or poem that has coal as the central cluster theme.**
15 **Use computer-modeling software to design a workable coal separation flow-chart using input data from the coal that is mined during the week.**
16. **Calculate the surface mine "stripping" ratio for the surface mine that is within 20% of the accepted value.**
17. **Collect a measurable amount of coal gas (methane, ect…) that is released from a lump of coal collected at the mine site.**

18. **Generate an accurate numerical picture of the surface mine.**
19. **Correctly use a current computer design software program to generate a 3-D picture of the mine.**

ESSENTIAL QUESTION(S):

1. **How can I use Integral Calculus to calculate the volume of the overburden.**
2. **What is the volume and current value of the coal located at the property?**
3. **...How can I use core drilling data to predict the height of the coal at a particular point?**
4. **What is a coal separation flow-chart?**
5. **How has surface mining impacted the lives of the people in Eastern Kentucky?**
6. **How can I determine the ash, moisture, sulfur, and BTU content of the coal mined at the site?**
7. **How can computer design software be used in the design of surface mines?**
8. **How can I write a song about coal mining?**
9. **How is coal used in as a theme in different types of art?**
10. **How can I write a short story or essay about coal?**
11. **What is a surface mine ratio and how is it calculated?**
12. **What is coal gas and how can it be captured?**

DIFFERENTIATED INSTRUCTION: *(Place initials of students beside modifications needed)*

IEP Modifications:

- [x] Extended Time
- [x] Individualized Assistance
- [x] Reading Assistance
- [x] Reduced Work
- [ ] Preferential Seating
- [x] Modified Grading
- [x] Oral Assessment
- [x] Use of Calculators
- [ ] Highlight Information to be Learned
- [x] Slow the Rate of Presentation
- [ ] Other *(Explain)*

GT Modifications:

- [x] Additional Instruction and Assistance
- [x] Enrichment Activities
- [x] Research
- [ ] Other

Multiple Intelligencies:

- [x] Linguistics
- [x] Spatial
- [x] Logical/Mathematical
- [x] Musical
- [x] Bodily/Kinesthetic
- [x] Interpersonal
- [x] Intra-personal
- [x] Naturalist/Outdoors
- [ ] Other

Learning Styles:

- [x] Verbal
- [x] Active
- [x] Auditory/Verbal
- [x] Kinesthetic
- [x] Sensing
- [x] Sequential

LESSON PLAN

[x] Reflective [x] Introversion [x] Extraversion [x] Reflective [x] Visual [x] Intuitive
[x] Global

Cooperative Learning:

[x] Jigsaw [ ] Think-pair-share [ ] Other

Other:

PROCEDURES:

MATHEMATICS

1. Students will be placed in cooperative learning/peer teaching groups of 4 and assigned the task of designing a core drilling pattern for their mine site.
2. Each group will work in groups of four to determine the surface mine ratio at the mine site.
3. Each group will use the methods of inverse distance and delaunay triangulation to predict coal seam height at a specific point by using core drilling data.
4. Each group will use the polygonal method to estimate the volume of coal at the mine site and determine its current market value.
5. Each group will verify the height of the coal seam using Surfer 8 computer software.
6. Students in the AP Calculus class will work in groups of four to calculate the volume of overburden at the mine.

SCIENCE

1. Review laboratory methods and safety procedures with class.
2. Each student will be placed in a group with 3 other lab partners and assigned the task of determining the ash, moisture, BTU, and sulfur content of a sample of coal.

3...Each group of 4 will generate and capture the "coal gas" that is given off from a fist sized lump of coal by heating it and capturing the gases that are generated.

PRE-ENGINEERING

1. The Per-engineering students will work in groups of 4 and will calculate the amount of overburden that will be removed during the one-week interval.
2. Students will use the Surfer 8 contouring software to determine the volume of coal in the coal seam.
3. Each group will produce at least four 2 and 3-dimensional pictures of the coal seam using the Surfer 8 software.

4. Each group will generate a numerical picture of the surface mine. They will use this numerical picture to generate a 3-D picture of the mine using a current mine design computer program.
5. Each group of 4 will use a current computer simulation software program to generate a workable coal separation flow-chart using input data from the coal that is mined during the week.

ENGLISH

1. Each student will be assigned the task of writing a short story, poem, or essay involving coal as a central cluster theme.

SOCIAL STUDIES

1. Students will be taken to the library to research the history of surface mining in our area.
2. Each student will write a report on surface mining and its impact on the people of our area.

ART

1. Students will be assigned the task of producing a drawing or painting about coal mining or one that illustrates how coal mining has impacted the Eastern Kentucky area.

MUSIC

1. Students in the band and chorus classes will compose a song or write a musical play with coal as a central theme.

HOME ECONOMICS

1. Students will work with a partner to bake a cake or pastry that illustrates the coal seam and the surrounding rock strata.

Review of Previous Lesson:

ENABLING KNOWLEDGE

MATH

1. Understand variance and central tendency.
2. Apply right triangle trigonometry.
3. Solving matrix equations and evaluating 3x3 determinants by expansion of minors.
4. Graphing in 3-dimensions.
5. Calculate area and volume of polyhedrons.
6. Use a graphics calculator.

SCIENCE

LESSON PLAN

1. Understand the scientific method.
2. Follow basic experimental procedure.
3. Understand and follow lab safety rules.
4. Understand and apply basic concepts from algebra and geometry.
5. Balance chemical equations.

PRE-ENGINEERING

1. Apply right triangle trigonometry.
2. Graph in 3-dimensions.
3. Use a graphics calculator.
6. Calculate area and volume of polygons.

ENGLISH

1. Write a short story or essay.
2. Construct a paragraph.

SOCIAL STUDIES

1. Use the internet to research a topic.
2. Construct a report and document sources.

ART

1. Understand the basics of drawing.
2. Be able to use a camera and develop film.
3. Paint with acrylic or oil.

MUSIC

1. Read and sing written music.
2. Use recording instruments.
2. Compose a musical composition.

HOME ECONOMICS

1. Understand simple baking techniques.

Manipulatives/Materials/Resources:

Calculators, rulers, protractors, compass, overhead projector, tape, graph paper, lined paper, scissors, TV., VCR, flat square, string, straightedge, graphics calculators, digital camera, Bunsen burner, beakers, graduated cylinders, computers, simulation software, drawing paper, paint, brushes, pencils, wall paper paste, mapping hardware, camcorders, sound mixers, engineering texts, and lab manuals.

LESSON PLAN

Enrichment Activities/Learning Extensions:

Compare dust control at a surface mine to ventilation requirements at an underground coalmine.

Culminating Activities:

Coal Fair Projects

Review of Objectives in this Lesson:

Definitions and concepts introduced in this unit.

Assessment(s): *(Attach to Lesson Plan)* (F=Formal I=Informal)

[f] Multiple Choice	[f] Open Response	[i] On Demand	[f] Rubric
[f] *Writing Portfolio*	[f] *Activity*	[f] Quiz	[f] *Test*
[f] Graphic Organizer	[ ] Other (Explain):		

Scoring Guide: [x] Yes [ ] No *(Attach to Lesson Plan)*

Technology Utilized:

[x] Overhead Projector	[x] Digital Camera	[x] Scanner	[x] Computer	[ ] Databases
[x] Scan Converter	[x] Word Processor	[x] Power Point	[x] Spreadsheet	[x] Internet
[ ] Distance Learning	[x] Graphs/Charts/etc.	[x] Calculators	[x] Graphing Calculators	
[x] Other				

Pike County Central Comprehensive School Improvement Plan:

1a, 1b, 1c, 1d, 3a, 3c, 3d, 3e, 4a, 4d, 4c, 4d, 4e, 4f, 4g,

LESSON PLAN

Literacy Action Plan:

1. **Expand vocabulary specific it advanced mathematics.**
2. **Utilize power verbs in instruction and assessment.**
3. **Implement reading, writing, and organizing techniques in instruction.**
4. **Implement reading strategies to improve comprehension and reading speed.**
5. **Read to students and assign reading materials.**
6. **Parents will be contacted whenever a student is in danger of failing a course.**
7. **Graphic organizers will used in instruction.**

Content Specific Vocabulary:

Additional Information:

A. ACADEMIC EXPECTATIONS

Mathematics:	**1.5, 1.6, 1.7, 1.8, 1.9, 2.7, 2.8, 2.9, 2.10, 2.11, 2.12, 2.13, 5.1, 5.2, 5.3, 1.11, 1.12, 5.5, 6.1, 6.2, 6.3**
Science:	**2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 5.1, 5.2, 5.13, 5.3, 5.5, 6.1, 6.2, 6.3**
Social Studies:	**2.15, 2.16, 2.18, 2.19, 2.20, 5.1, 5.2, 5.5, 6.1, 6.2, 6.3**
Music:	**1.14, 2.22, 2.23, 2.25, 5.1, 6.1, 6.2**
Art:	**1.13, 2.22, 2.23, 2.25, 5.1, 6.1, 6.2**
English:	**1.1, 1.11, 1.12**

A. CORE CONTENT

Mathematics:	**1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.1.4, 3.1.8, 3.1.9, 3.1.10, 3.1.11, 3.1.12, 3.1.13 3.3,1, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.2.3,**
Science:	**1.1.3, 1.1.6, 1.1.8, 3.4.4, 4.6.1, 4.6.4, 4.6.5, 4.6.6, 4.6.7, 4.6.8, 4.7.2, 4.7.3**
Sc. Studies:	**1.1.3, 2.3.1, 3.1.1, 3.2.3, 3.4.3, 3.4.4, 4.1.3, 4.4.2, 5.1.1, 5.1.3, 5.3.6**

LESSON PLAN

Music: AH-H 1.1.12, AH-H 1.1.13, AH-H 1.1.34
Art: AH-H 4.1.41, AH-H 4.1.3.2, AH-H 4.2.32, AH-H 4.1.33
English: WR-H 1.3, WR-H 1.4

Adjustments to the Lesson Plan:

Reflections:

Pictures

Pictures

Pictures

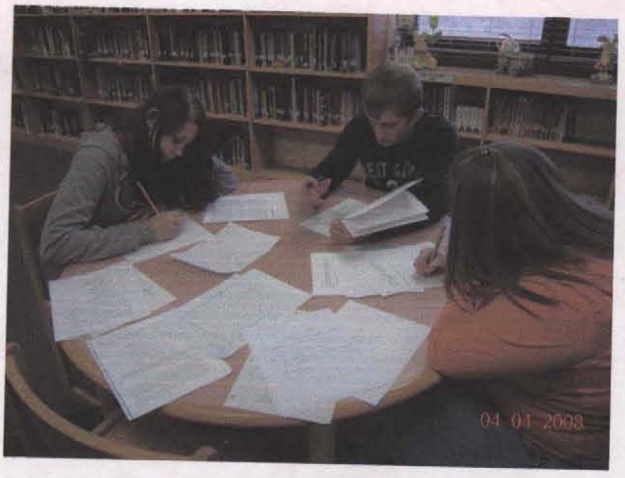
Capturing coal gas

Pictures

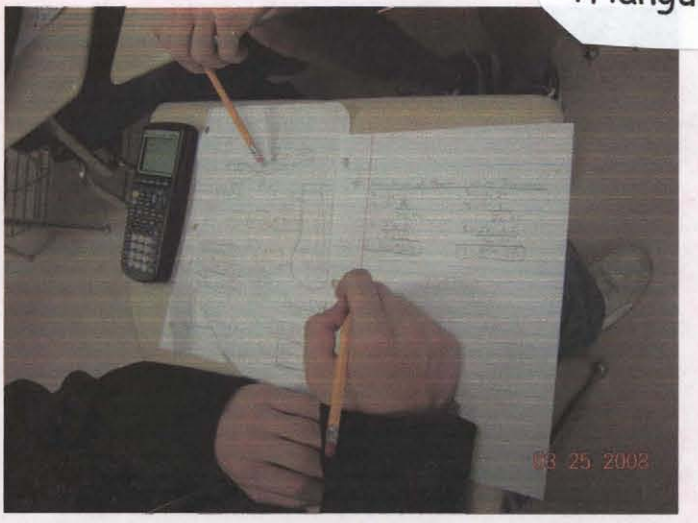
Pictures

Pictures

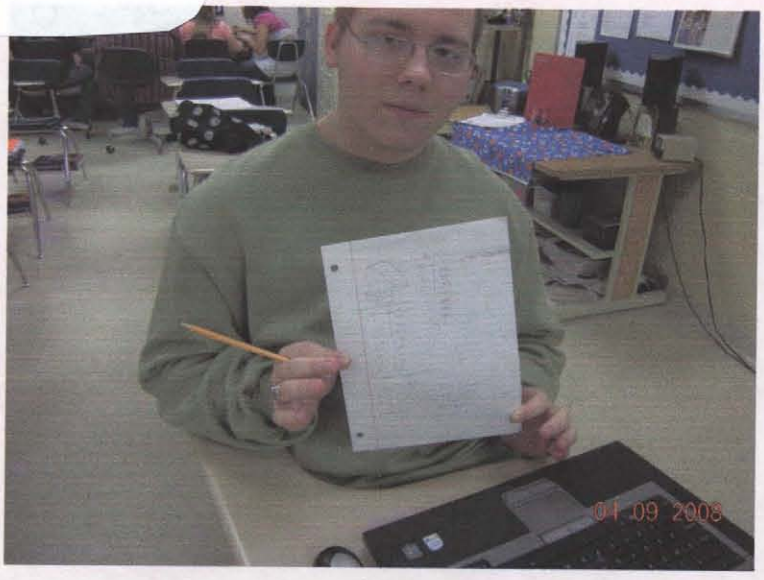
Mathematics



Estimating the height of the coal by Delauney Triangulation and Inverse Distance to a Square

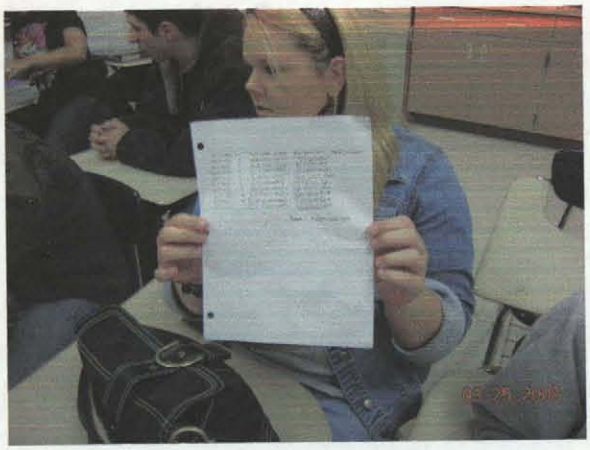


Using Heron's Formula to determine the area of each triangle for Delauney Triangulation

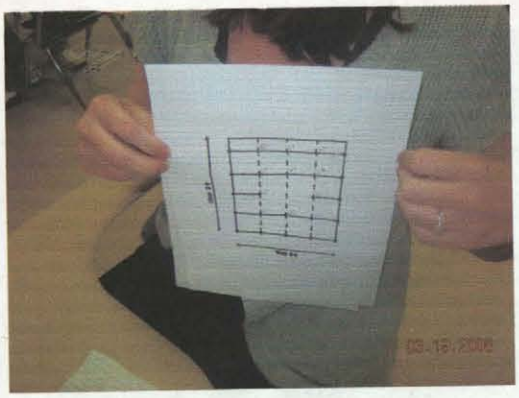


Using integral calculus to determine the average cross-sectional area and the stripping ratio

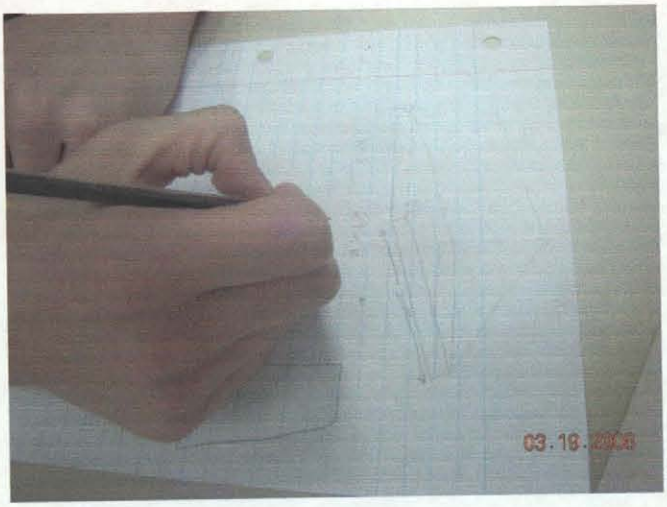
Mathematics



Adding the volume of each polygon gives the total volume of coal



Core drilling pattern



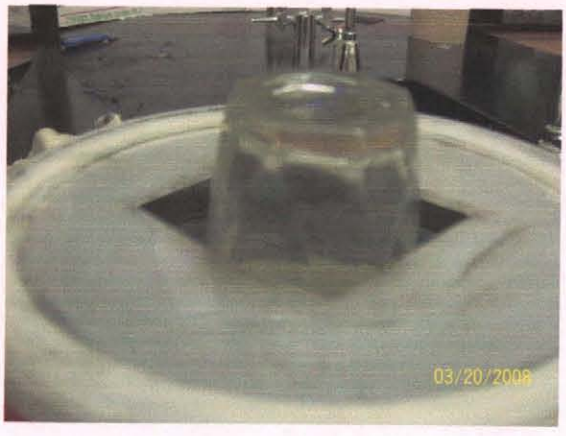
Overburden/coal

Calculating the stripping ratio of an old surface mine

Science

Coal behind the school?

Setting up the collecting apparatus

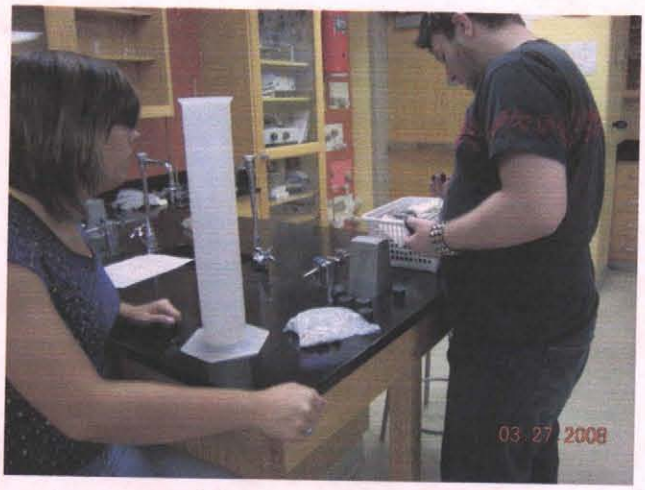


A real coal gas bubble!

Crushing the Coal

Science

Getting the initial weight of the coal



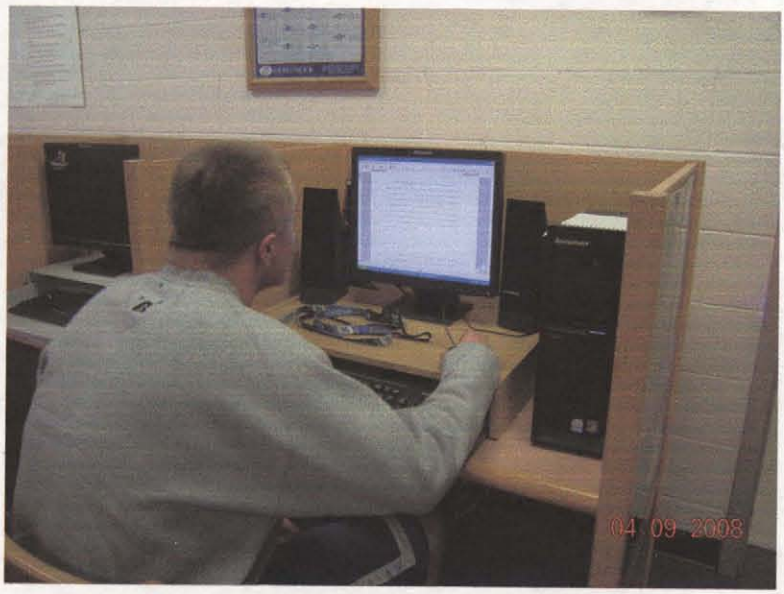
Preparing a coal/rock separation experiment

0 water pulses
Begin simulation

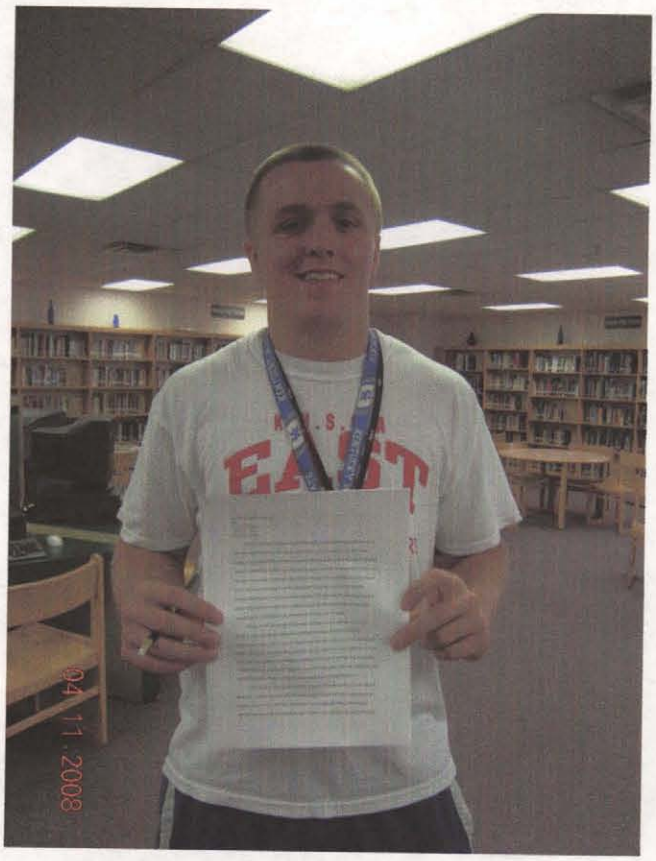
8 water pulses
40% separation?

16 water pulses
60% separation?

English



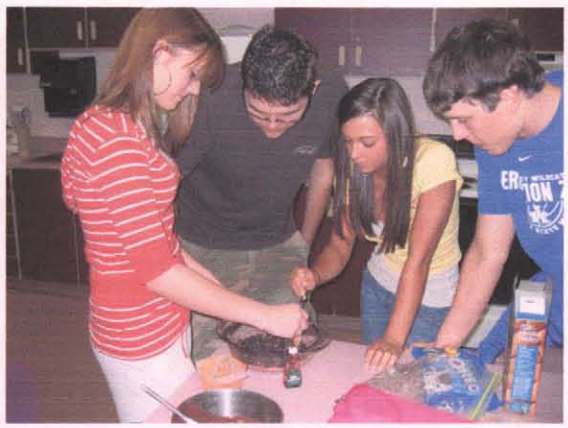
Writing my coal essay.



Finished at last!

Mixing the layers

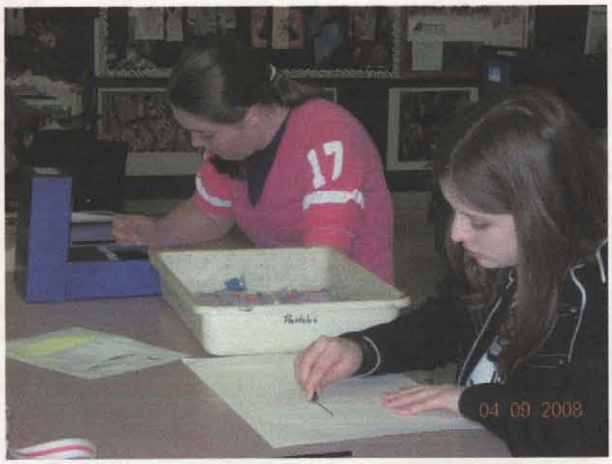
Food Science



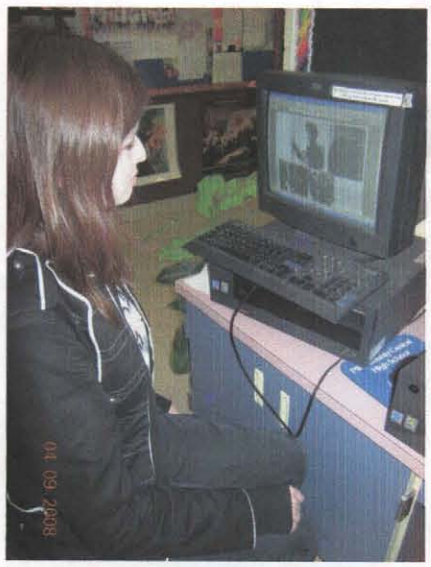
Adding the next layer

The rock and coal layers

Art



Coal Drawings in art class



Downloading coal photos

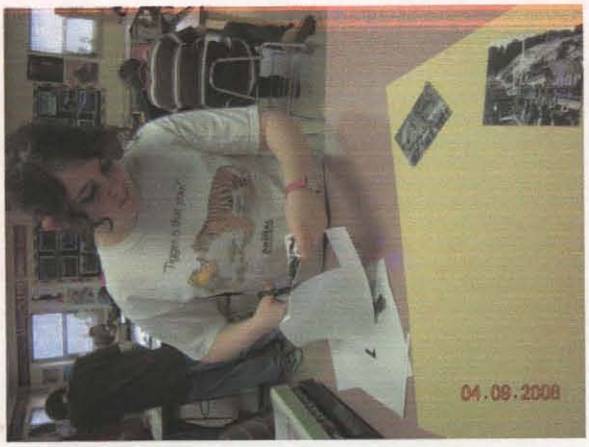
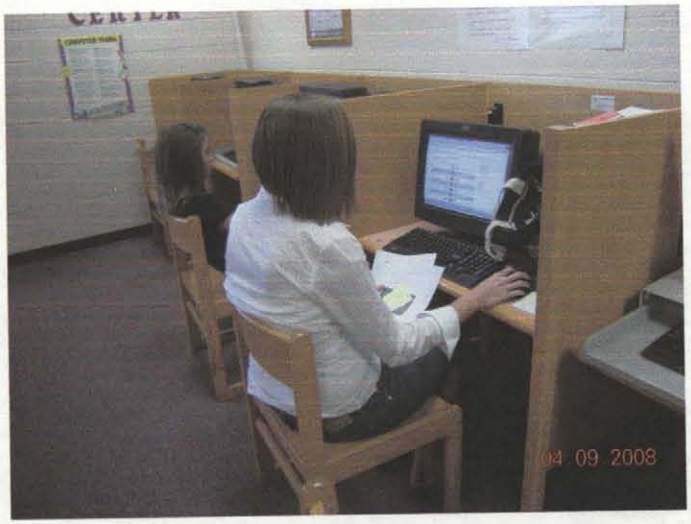
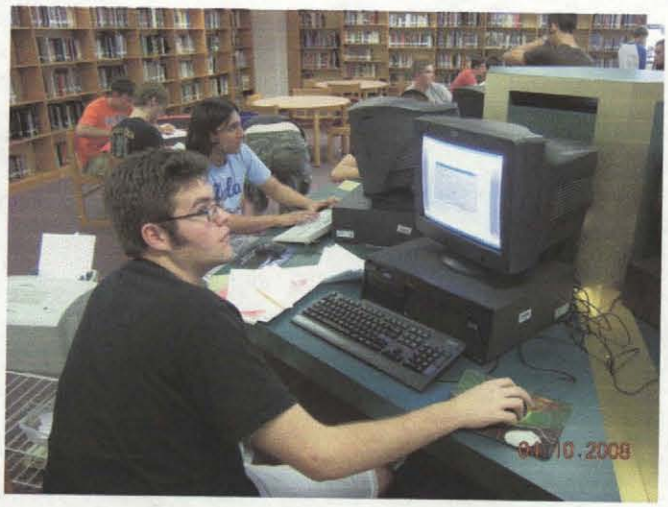


Photo collage about mining camps

Social Studies

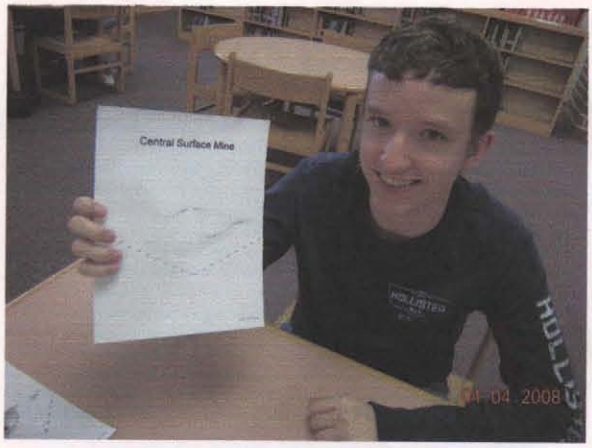


Researching history of surface mining

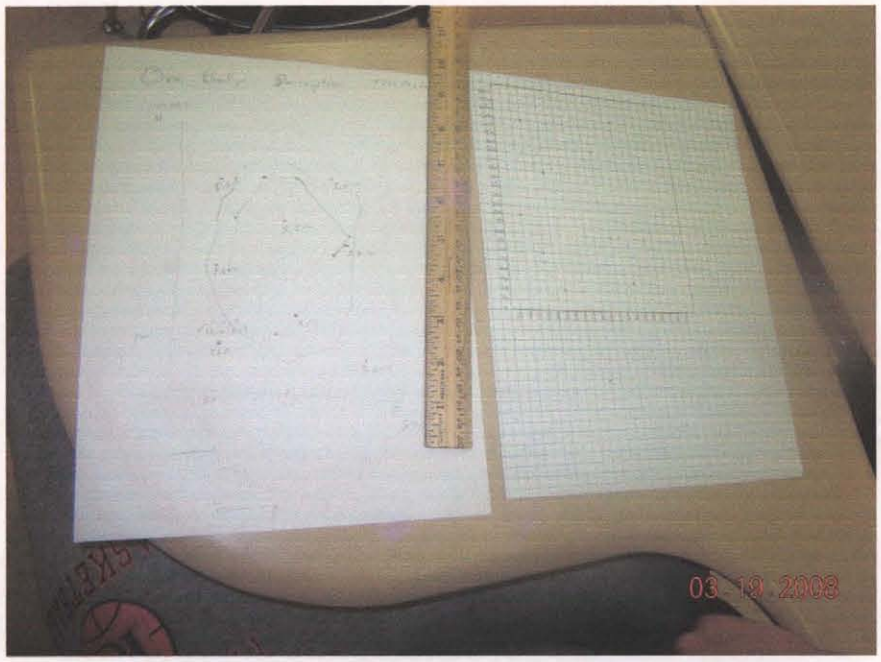


Research

Pre-engineering

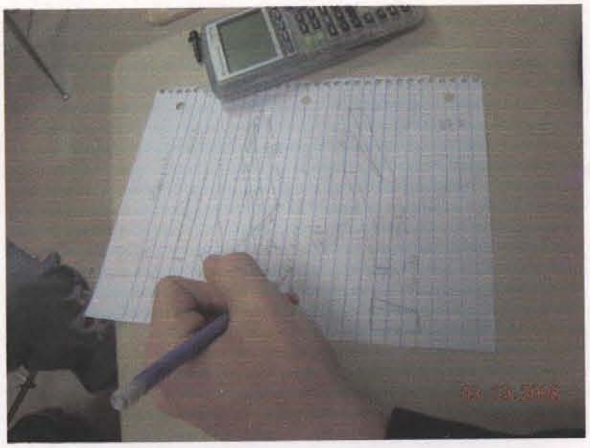


3-dimennaional map of the coal seam using Surfer 8

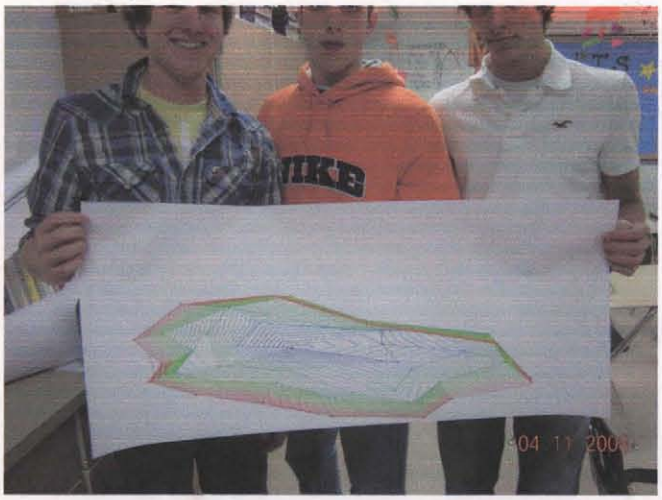


Preliminary core drilling data and Numerical picture of surface mine

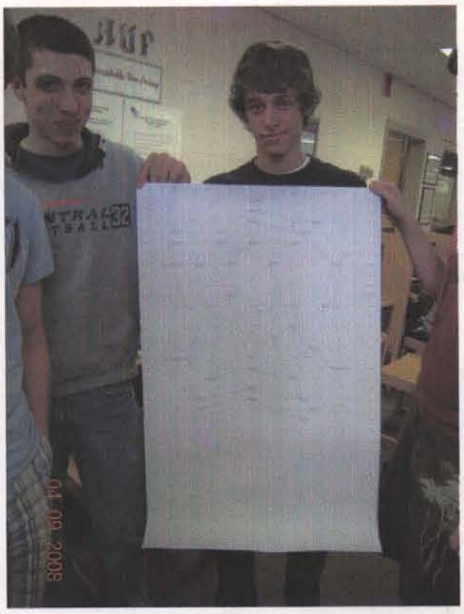
Pre-engineering



Calculating the amount of overburden
Removed during the week

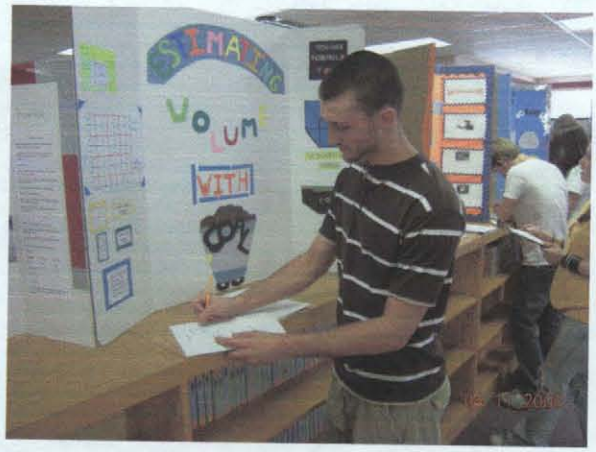


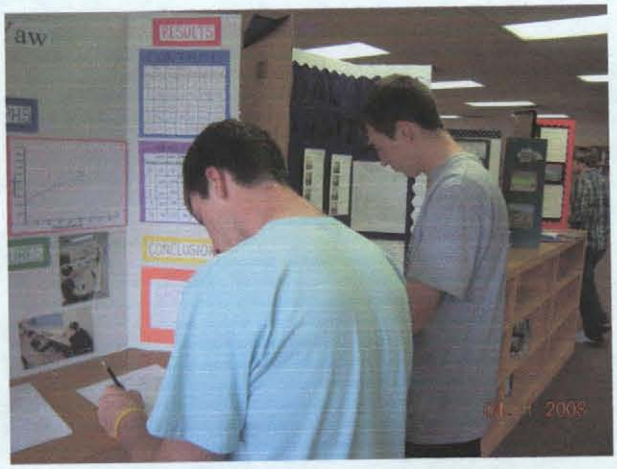
3-dimensional map of the surface mine



2-demsional map of the surface mine

Judging the Coal Fair



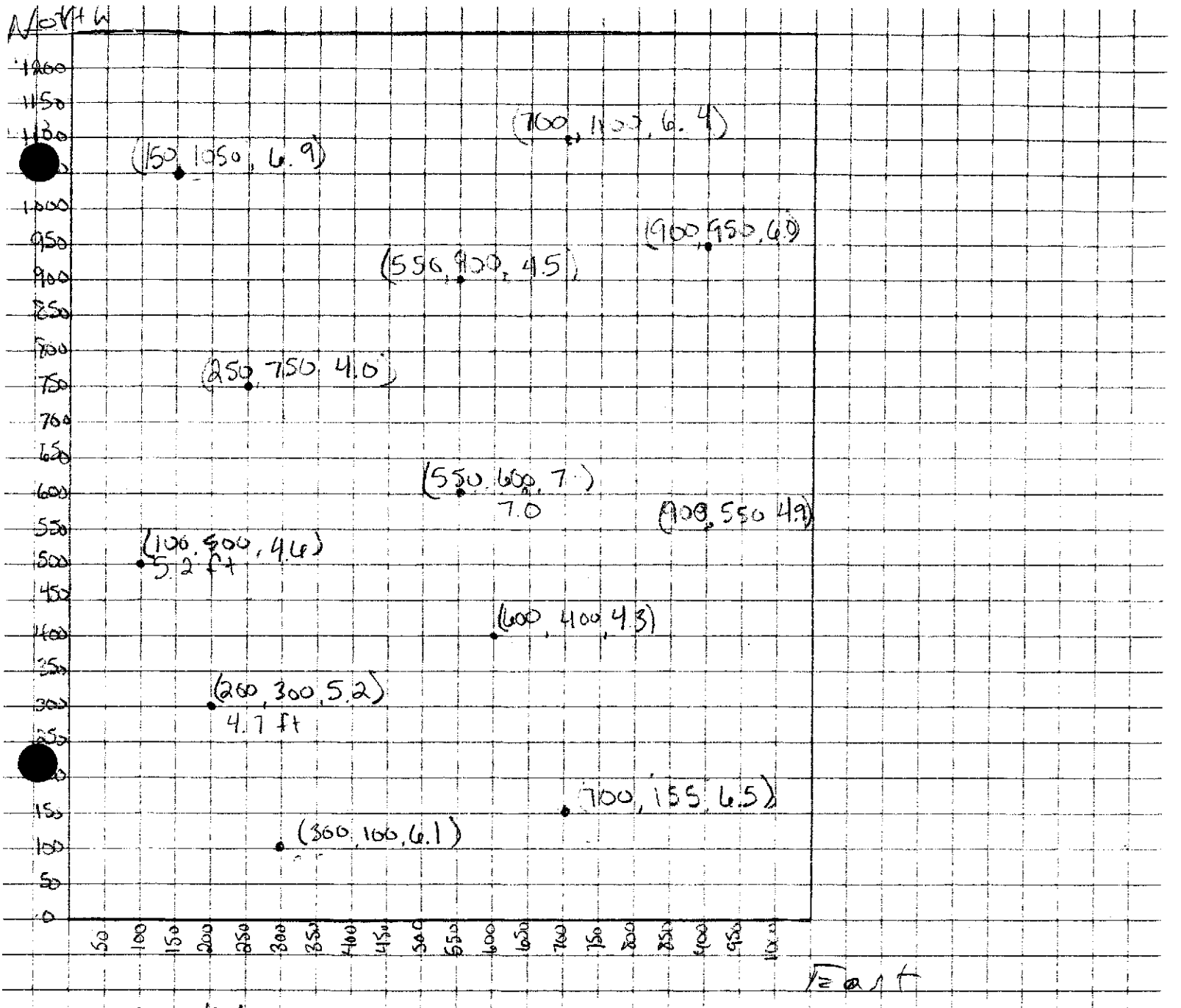


Samples Of Student Work

A. Pre-engineering group #1 (Central Surface Mine)
B. Mathematics Group #2 (Diamond Inc.)
C. Mathematics Group #3
D. Mathematics Group #1.
E. Music Group
F. English Essay Sample

Pre-engineering group #1 (Central Surface Mine)

a. Land track and core drilling data showing coal seam height
b. Numerical picture of the surface mine with roadway
c. Preliminary sketch of the mine on graph paper
d. 2 and 3-dimensional maps of the coal seam using Surfer 8
e. Volume of the coal on the property using Surfer 8
f. Coal separation flow schematic using "Modeling & Simulation of Mineral Processing Systems" (Used coal data supplied with the simulation program)
g. 2 and 3-dimensional maps of the surface mine using a current mine design program



Survey #1

1.) (300, 1050, 0)

0

3

4

5

	(X, Y, Z)
1	500, 1200, 1
2	800, 1150, 3
3	950, 1000, 2
4	900, 750, 1
5	950, 450, 0
6	800, 250, 6
7	750, 200, 4
8	500, 300, 4
9	250, 250, 3
10	100, 500, 5
11	150, 750, 6
12	100, 950, 2
13	150, 1100, 1
14	350, 1100, 3
15	500, 1150, -11
16	750, 1100, -10
17	900, 950, -13
18	850, 750, -14
19	900, 450, -20
20	750, 300, -19
21	500, 350, -18
22	250, 300, -20
23	150, 500, -16
24	200, 750, -17

OAT drop

15K bench

25 150, 950, -13

26 150, 1050, -17

27 350, 1050 -20

28 500, 1056 21

29 700, 1650, -24

30 700, 750 -37

31 800, 550 -30

32 700, 400 -31

33 500, 450 -28

34 300, 1100, -23

35 800, 500 -22

36 300, 750 -24

37 250, 950, -21

38 400, 950 -30

39 600, 980, -34

40 700, 650 -34

41 600, 600, -37

42 510, 500 -33

43 400, 800 -41

Road

1. 600, 600, -37.

2 700, 650 -34

3 700, 400 -31

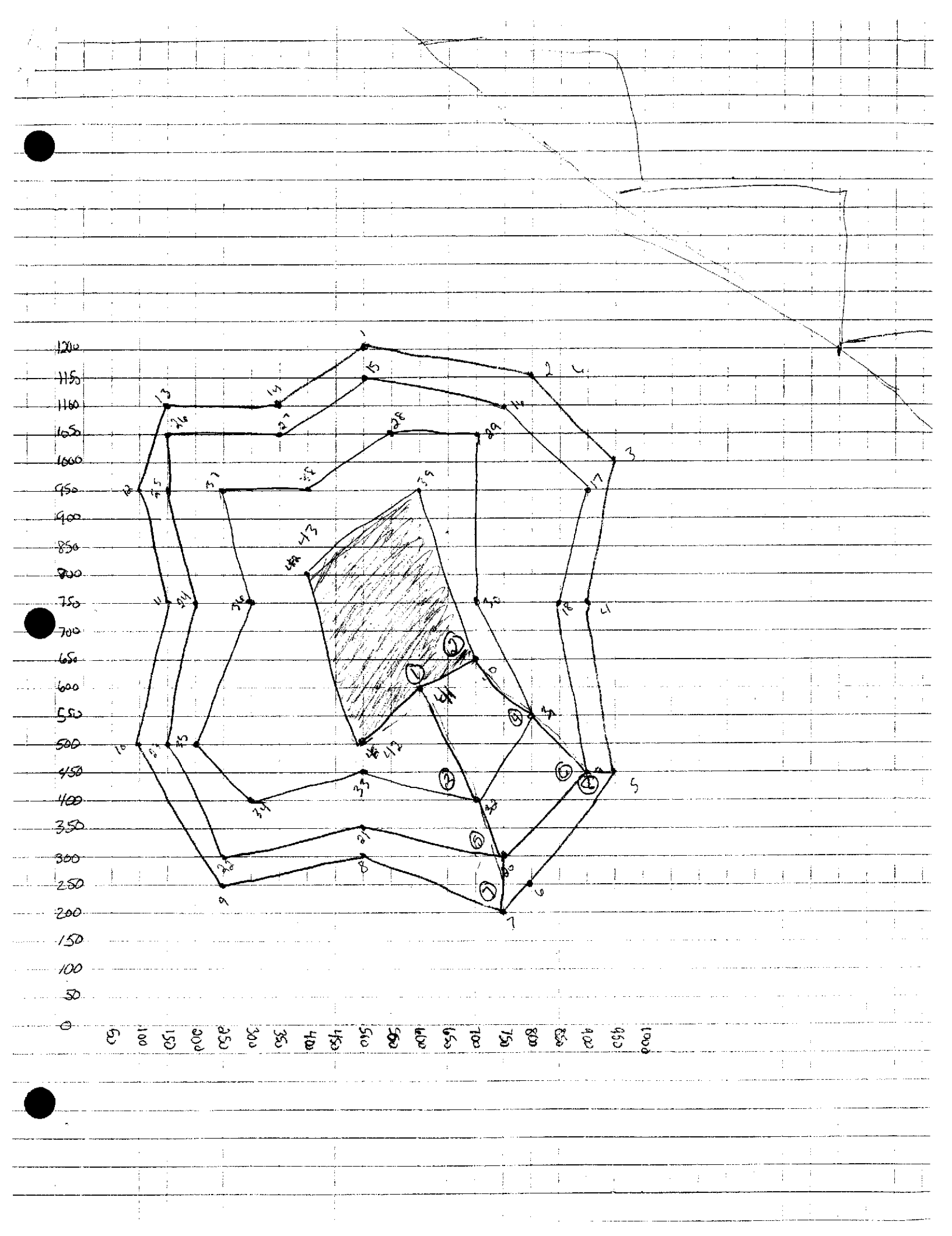
4 800, 550, -30

5. 750, 300 -17

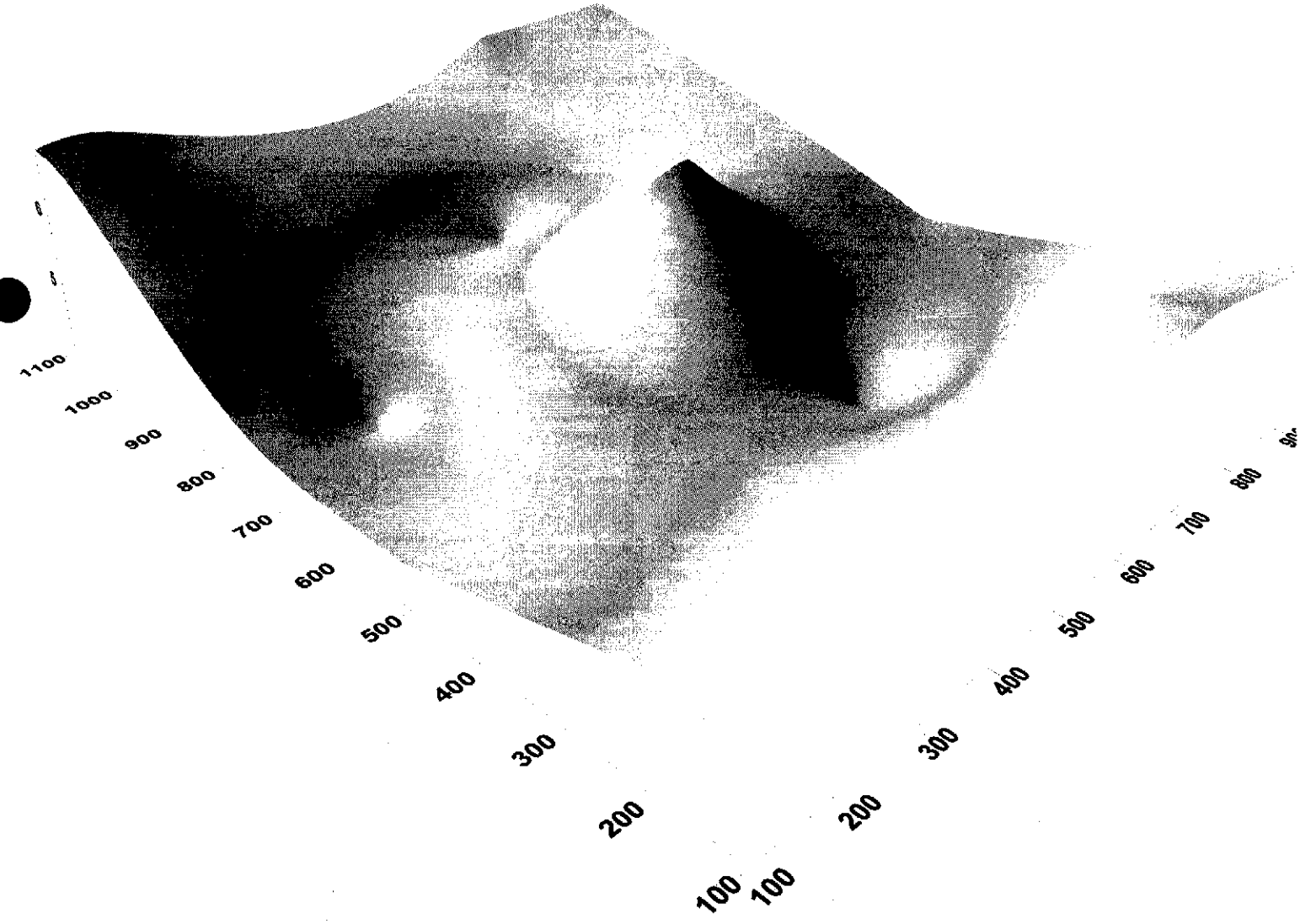
4 400, 450, -20

7 750, 300, 4

8 950, 450, 4

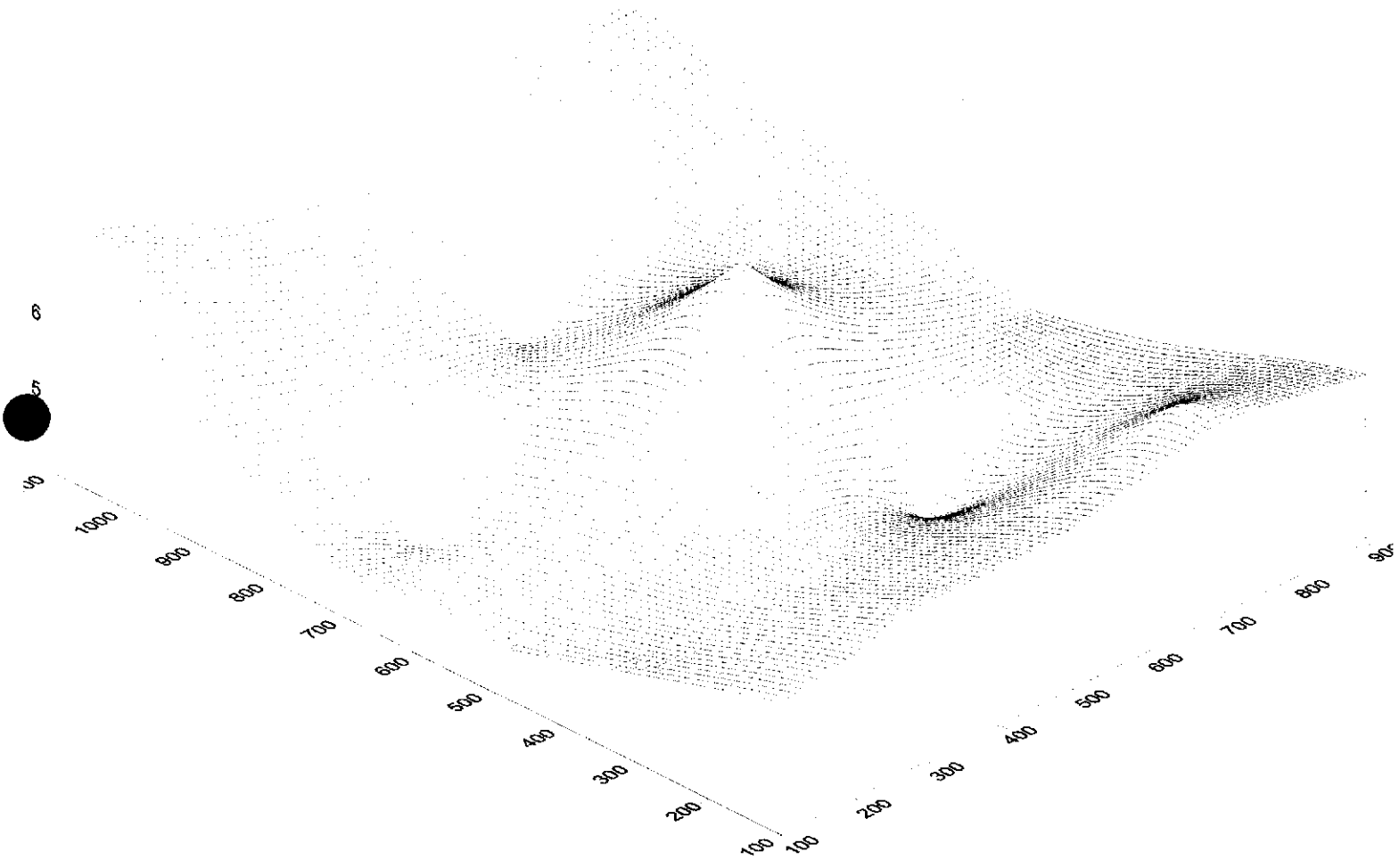


Central Surface Mine



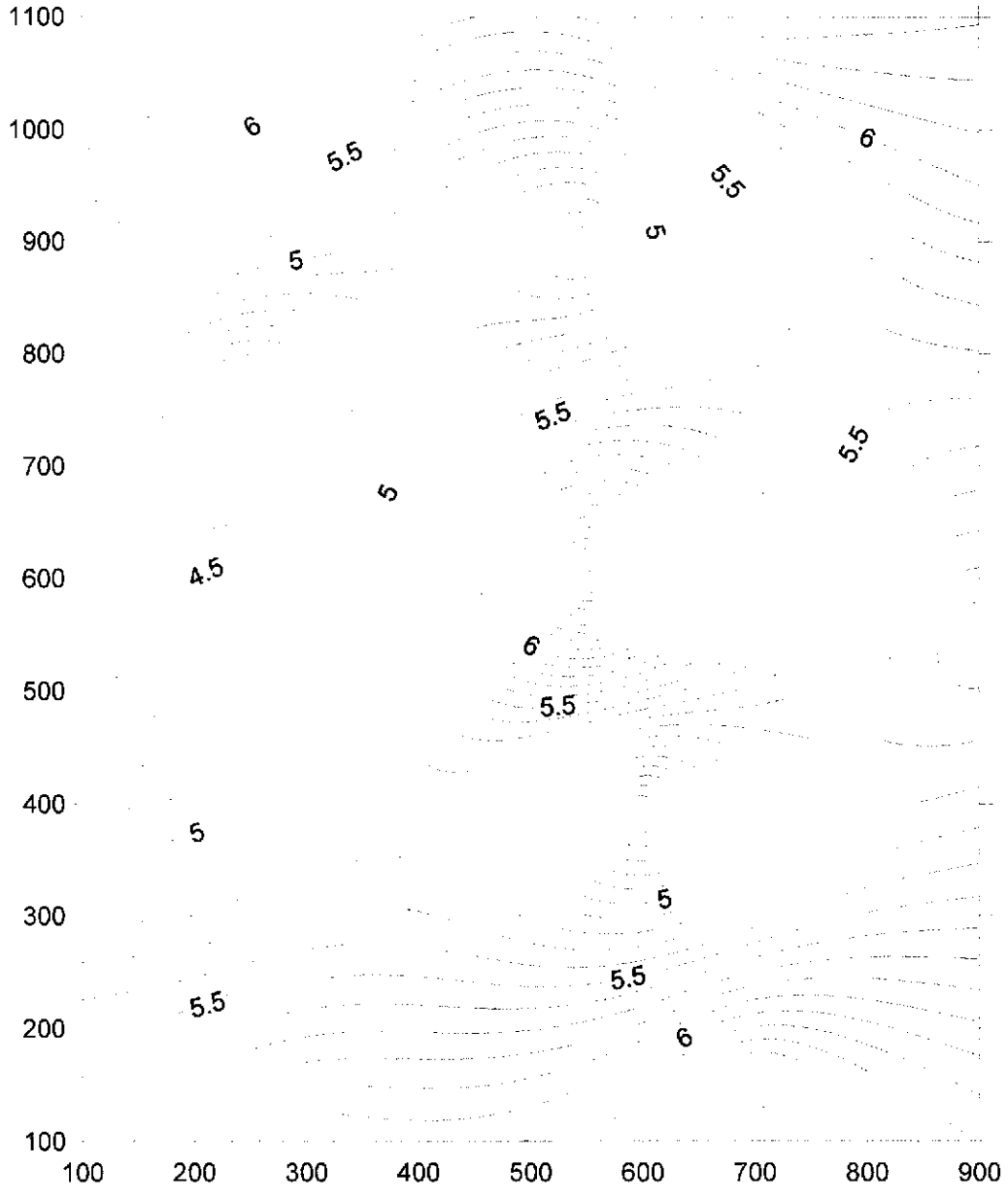
Noah, Dieb, Ben

Central Surface Mine



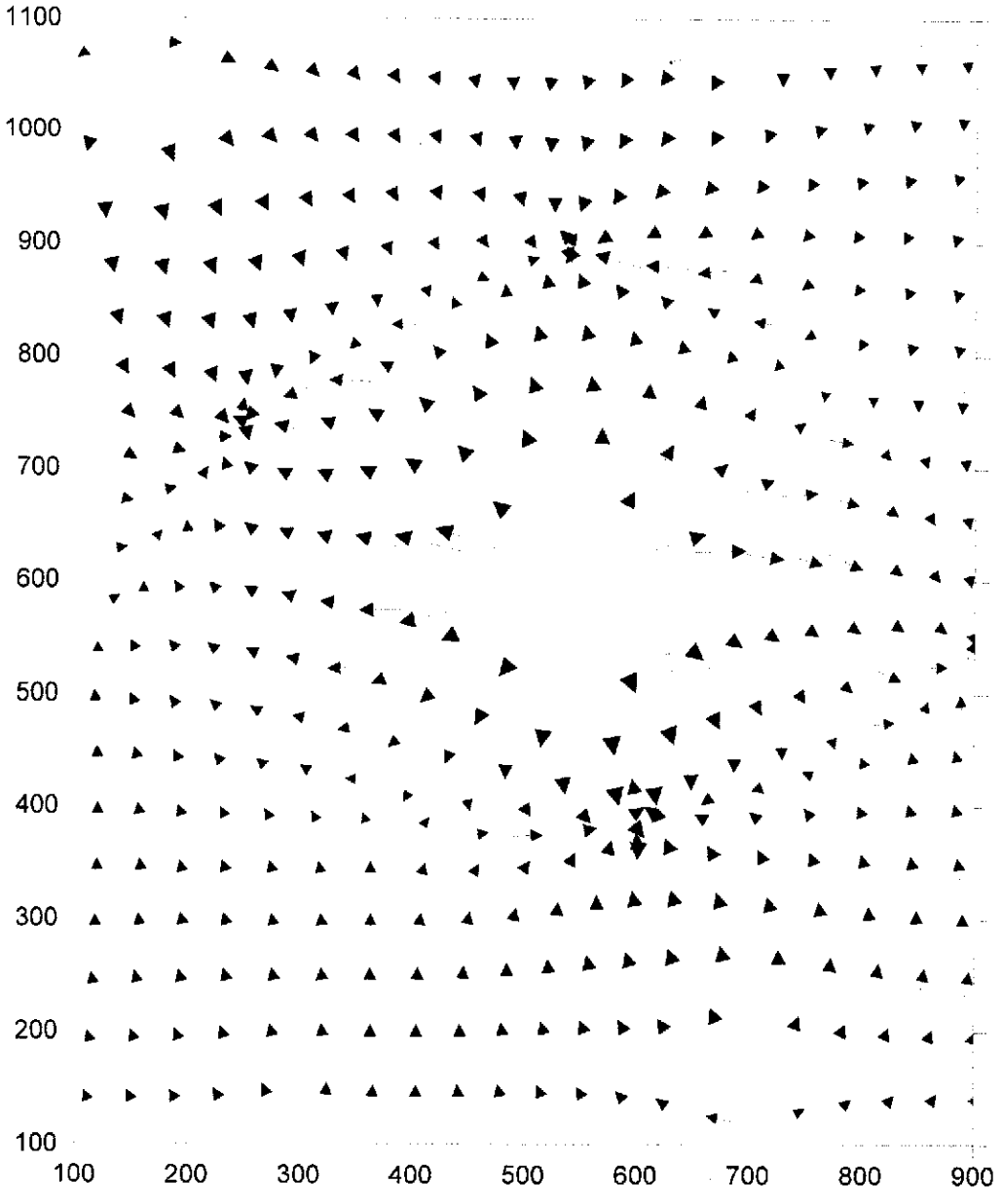
Noah, Dieb, Ben

Central Surface Mine



Noah, Dieb, Ben

Central Surface Mine



Noah, Dieb, Ben

Grid Volume Computations

Upper Surface

Grid File Name:	A:\Core Drilling Data Central mine.grd
Grid Size:	100 rows x 80 columns
X Minimum:	100
X Maximum:	900
X Spacing:	10.126582278481
Y Minimum:	100
Y Maximum:	1100
Y Spacing:	10.10101010101
Z Minimum:	4.0213123865002
Z Maximum:	6.9175525758652

Lower Surface

Level Surface defined by Z = 0

Volumes

Z Scale Factor:	1

Total Volumes by:

Trapezoidal Rule:	4326404.8483998
Simpson's Rule:	4326355.7258319
Simpson's 3/8 Rule:	4326360.4451613

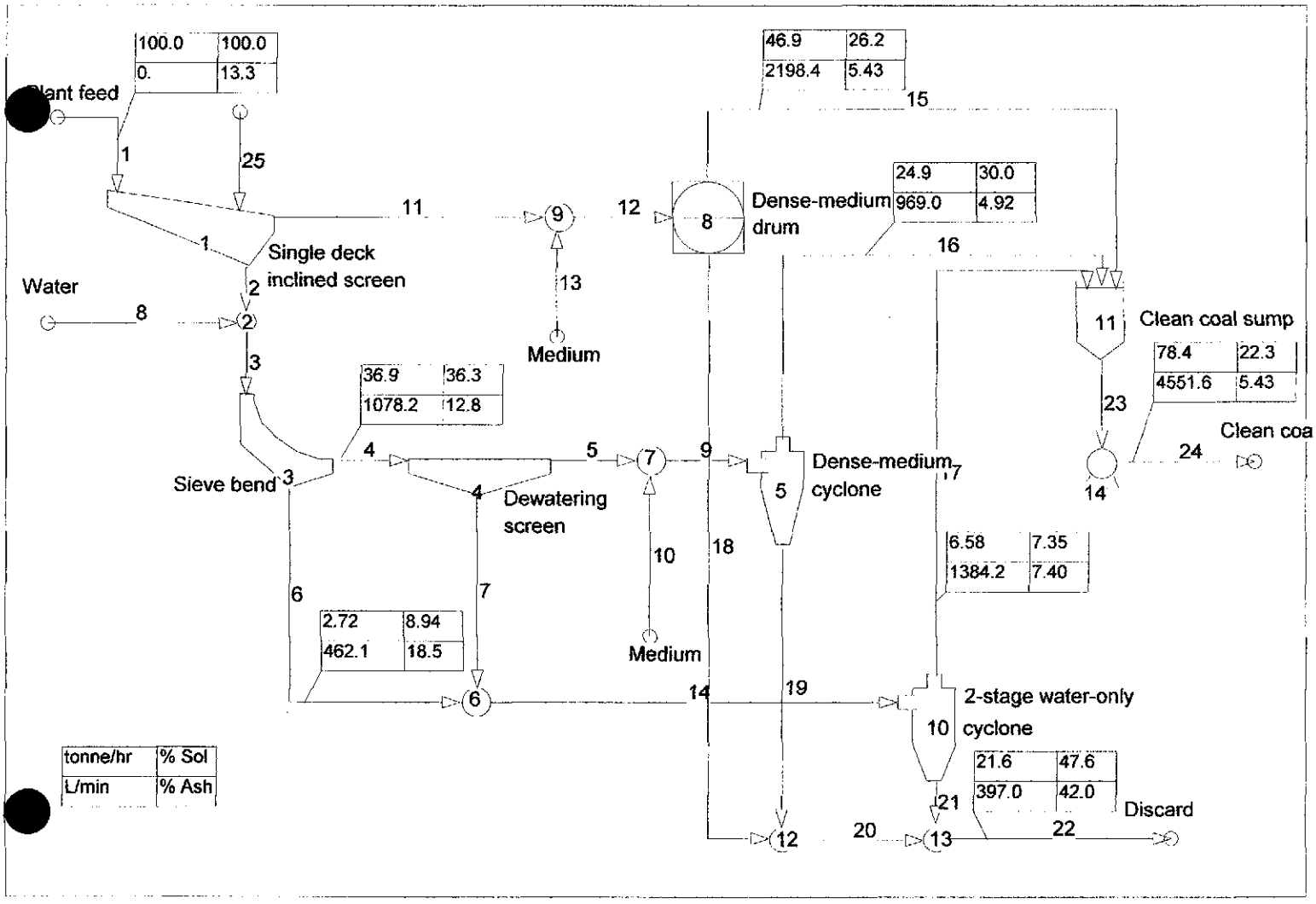
Cut & Fill Volumes

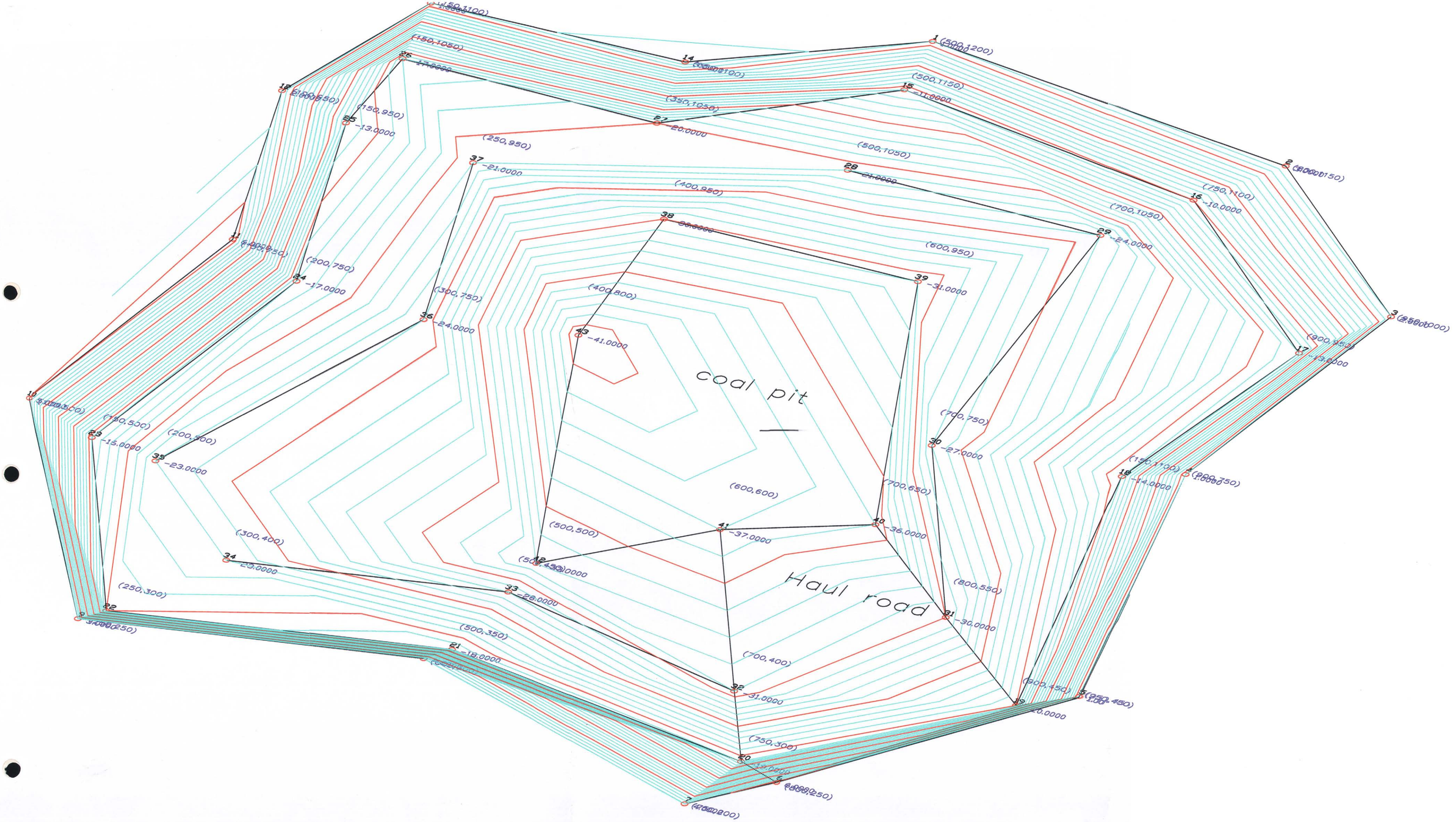
Positive Volume [Cut]:	4326413.4838778
Negative Volume [Fill]:	0
Net Volume [Cut-Fill]:	4326413.4838778

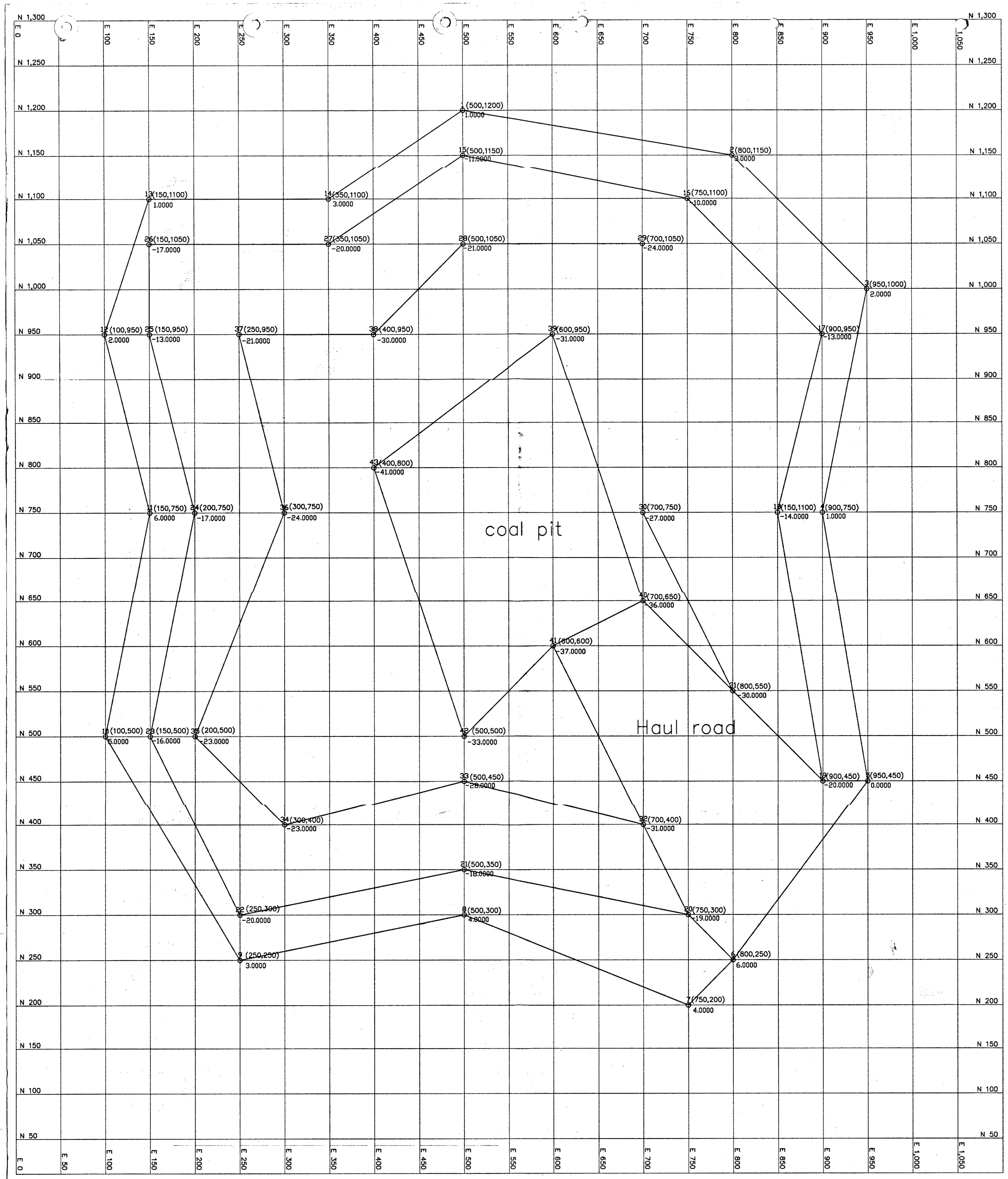
Areas

Planar Areas

Positive Planar Area [Cut]:	800000
Negative Planar Area [Fill]:	0
Blanked Planar Area:	0
Total Planar Area:	800000


100.0 100.0
0. 13.3
Plant feed
1
25
11
9
12
8
Dense-medium drum
46.9 26.2
2198.4 5.43
15
24.9 30.0
969.0 4.92
16
1
Single deck inclined screen
2
Water
8
2
13
Medium
3
36.9 36.3
1078.2 12.8
11
Clean coal sump
78.4 22.3
4551.6 5.43
23
Clean coa
24
4
5
7
9
Dense-medium cyclone
5
17
14
Sieve bend
3
4
Dewatering screen
10
18
6.58 7.35
1384.2 7.40
6
7
2.72 8.94
462.1 18.5
Medium
6
14
19
2-stage water-only cyclone
10
21.6 47.6
397.0 42.0
Discard
21
20
13
22
12
tonne/hr
% Sol
L/min
% Ash

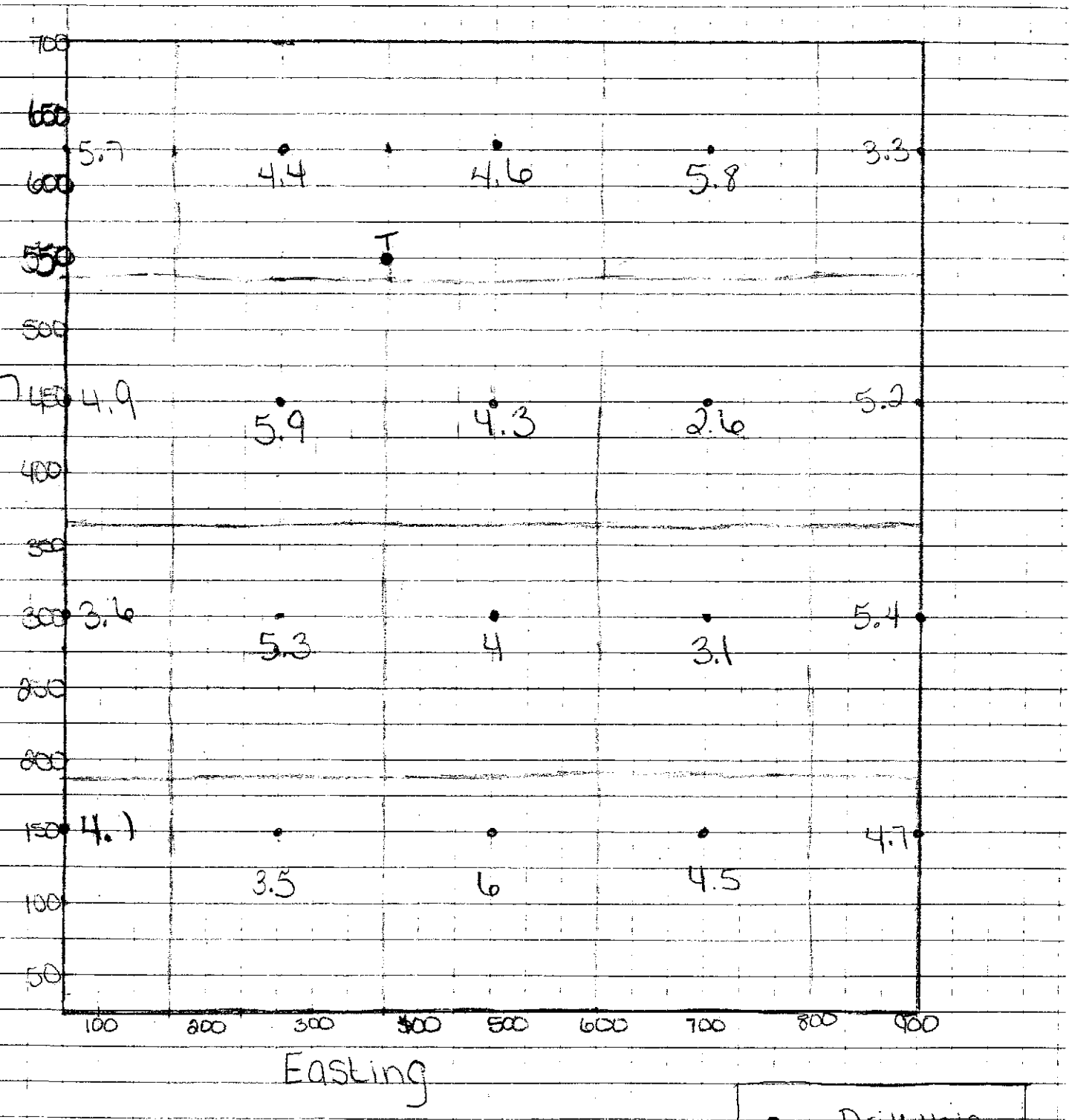

coal pit
Haul road


1(500,1200) 1.0000
2(800,1150) 3.0000
15(500,1150) -11.0000
13(150,1100) 1.0000
14(350,1100) 3.0000
16(750,1100) -10.0000
26(150,1050) -17.0000
27(350,1050) -20.0000
28(500,1050) -21.0000
29(700,1050) -24.0000
3(950,1000) 2.0000
12(100,950) 2.0000
25(150,950) -13.0000
37(250,950) -21.0000
38(400,950) -30.0000
39(600,950) -31.0000
17(900,950) -13.0000
43(400,800) -41.0000
11(150,750) 6.0000
24(200,750) -17.0000
36(300,750) -24.0000
30(700,750) -27.0000
18(150,1100) -14.0000
4(900,750) 1.0000
coal pit
40(700,650) -36.0000
41(600,600) -37.0000
31(800,550) -30.0000
10(100,500) 5.0000
23(150,500) -16.0000
35(200,500) -23.0000
42(500,500) -33.0000
Haul road
33(500,450) -28.0000
19(900,450) -20.0000
5(950,450) 0.0000
34(300,400) -23.0000
32(700,400) -31.0000
21(500,350) -18.0000
22(250,300) -20.0000
8(500,300) 4.0000
20(750,300) -19.0000
9(250,250) 3.0000
6(800,250) 6.0000
7(750,200) 4.0000

Mathematics Group #3 (Diamond Inc.)

- Land track and core drilling data showing coal seam heights
- Calculations showing the estimated the height of the coal seam at point "T" using Inverse Distance to a Square
- Estimated the volume of coal on the land track using the Polygonal Method
- Verified the height of the coal at Point "T" using Surfer 8
- Four 2 and 3-dimensional maps of the coal seam using Surfer 8

Diamond Inc.



•	Drill Hole
T	main Drilling Hole
——	Distance to [illegible] hole

SAMPLE	distance	1/distance			
1	145.7	.00686348	.2875	4.6	1.0465
2	100.3	.00997009	.3306	4.4	1.4546
3	141.4	.00707214	.2845	5.9	1.3835
4	160.0	.00625	.2072	4.3	.8909
Sums:		.03015516 42		4.7755	

① $d = \sqrt{(500-375)^2 + (625-550)^2}$

$d = \sqrt{15625 + 5625}$

$d = \sqrt{21250}$

$\boxed{d = 145.7 \text{ ft}}$

② $d = \sqrt{(275-375)^2 + (425-550)^2}$

$d = \sqrt{10000 + 175}$

$d = \sqrt{100.75}$

$\boxed{d = 100.3 \text{ ft}}$

③ $d = \sqrt{(275-375)^2 + (450-550)^2}$

$d = 10000 + 10000$

$d = \sqrt{20000}$

$\boxed{d = 141.4 \text{ ft}}$

add all together

(4) $d = \sqrt{(500 - 375)^2 + (450 - 550)^2}$

$d = \sqrt{15625 + 10000}$

$d = \sqrt{25625}$

$d = 160.0$ ft

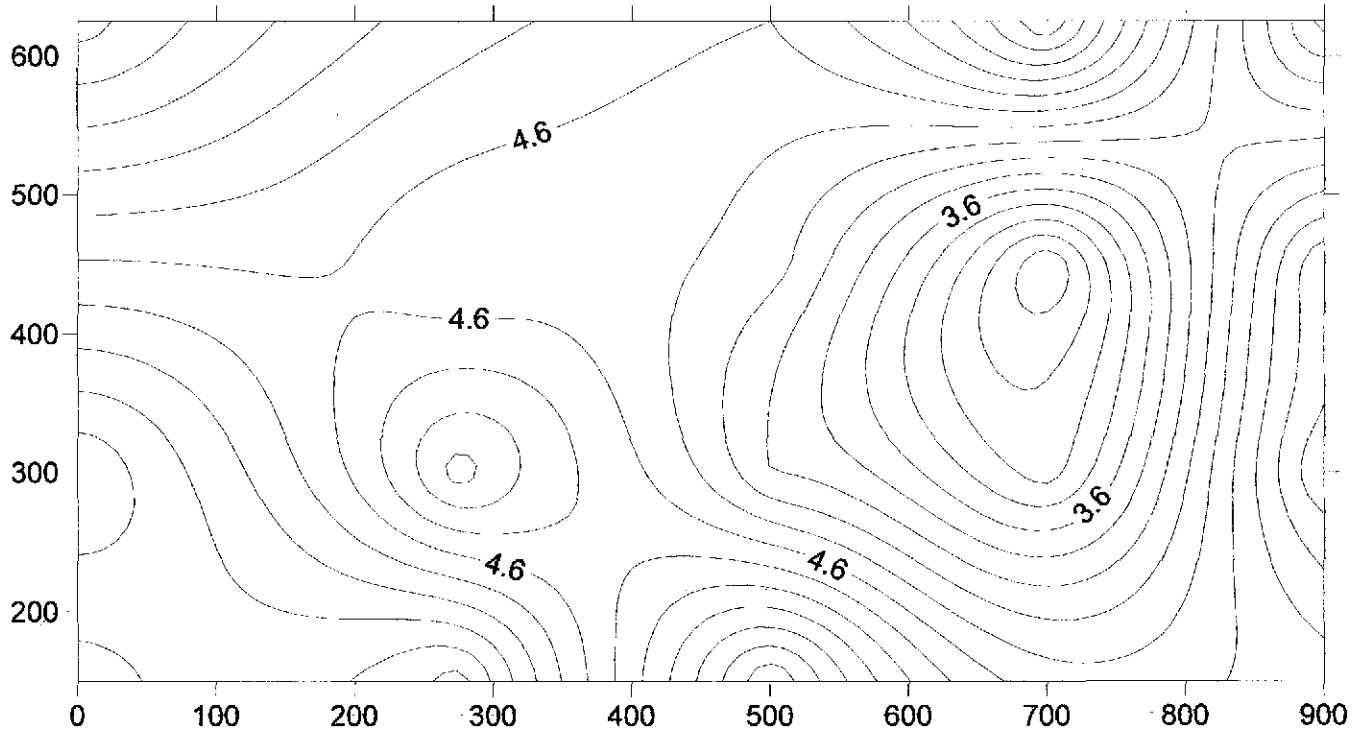
Drill				
1	5.7	× 100	× 160	= 91200
2	4.4	200	160	140800
3	4.6	200	160	147200
4	5.8	200	160	185600
5	3.3	100	160	52800
6	4.9	100	160	78400
7	5.9	200	160	188800
8	4.3	200	160	137600
9	2.6	200	160	83200
10	5.2	100	160	83200
11	3.6	100	160	57600
12	5.3	200	160	169600
13	4.0	200	160	128000
14	3.1	200	160	99200
15	5.4	100	160	81400
16	4.1	100	160	65600
17	3.5	200	160	112000
18	6.0	200	160	192000
19	4.5	200	160	144000
20	4.7	100	160	75200
Total				2191600 ft^3

	A	B	C	D
1	0	150	150	-4.13E-09
2	0	300	300	-0.023458
3	0	625	625	-3.86E-09
4	275	150	425	-0.032724
5	275	300	575	0.0556326
6	275	450	725	-0.016237
7	500	150	650	2.699E-09
8	500	300	800	-0.021983
9	500	450	950	0.0064616
10	500	625	1125	5.205E-09
11	700	150	850	6.324E-09
12	700	300	1000	-0.028355
13	700	450	1150	-0.031164
14	700	625	1325	-5.83E-09
15	900	150	1050	-4.69E-09
16	900	300	1200	0.0270164
17	900	450	1350	0.0182650
18	900	625	1525	3.455E-09
19	375	550	925	-4.578652 ✓

Inverse distance to a square – 4.8 ft

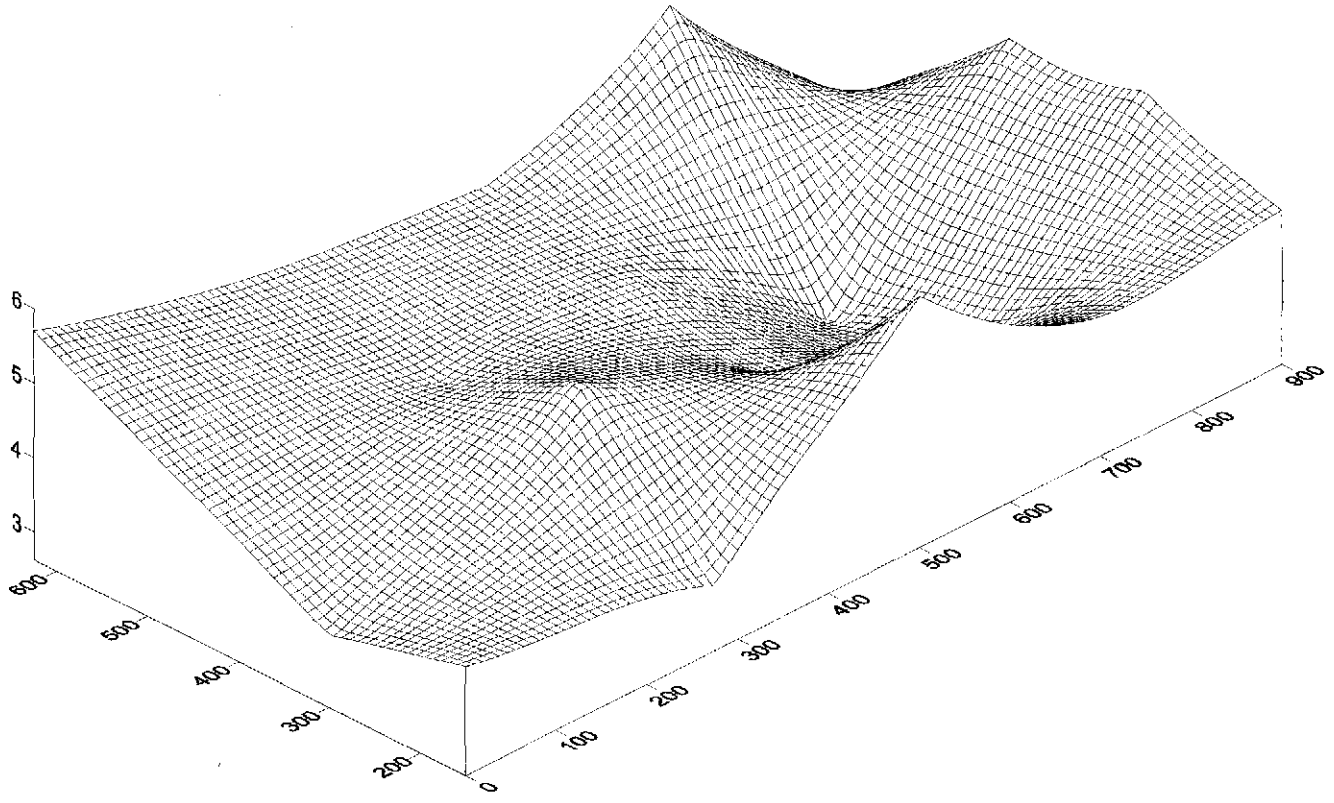
Surfer 8 – 4.6 ft

Diamond Inc



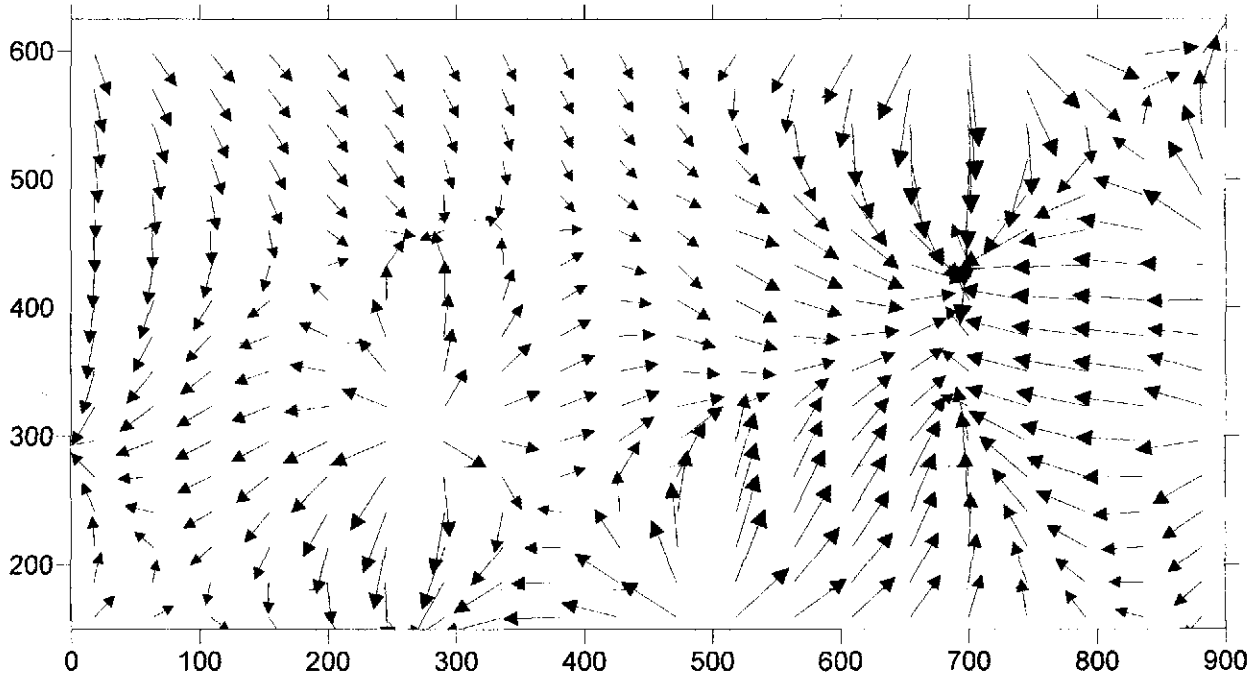
Contour Map

Diamond Inc



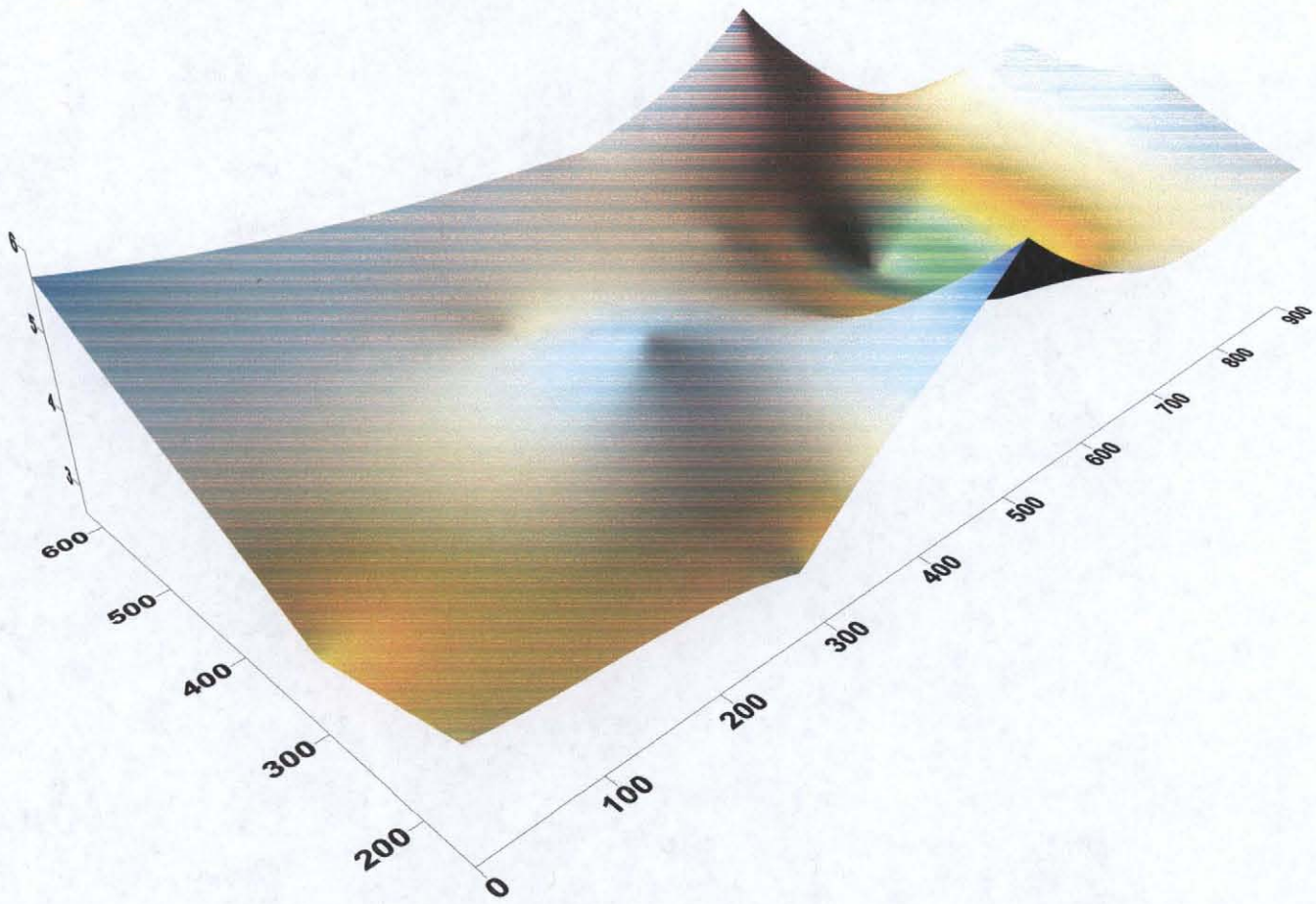
Wireframe Map

Diamond Inc



Vector Map

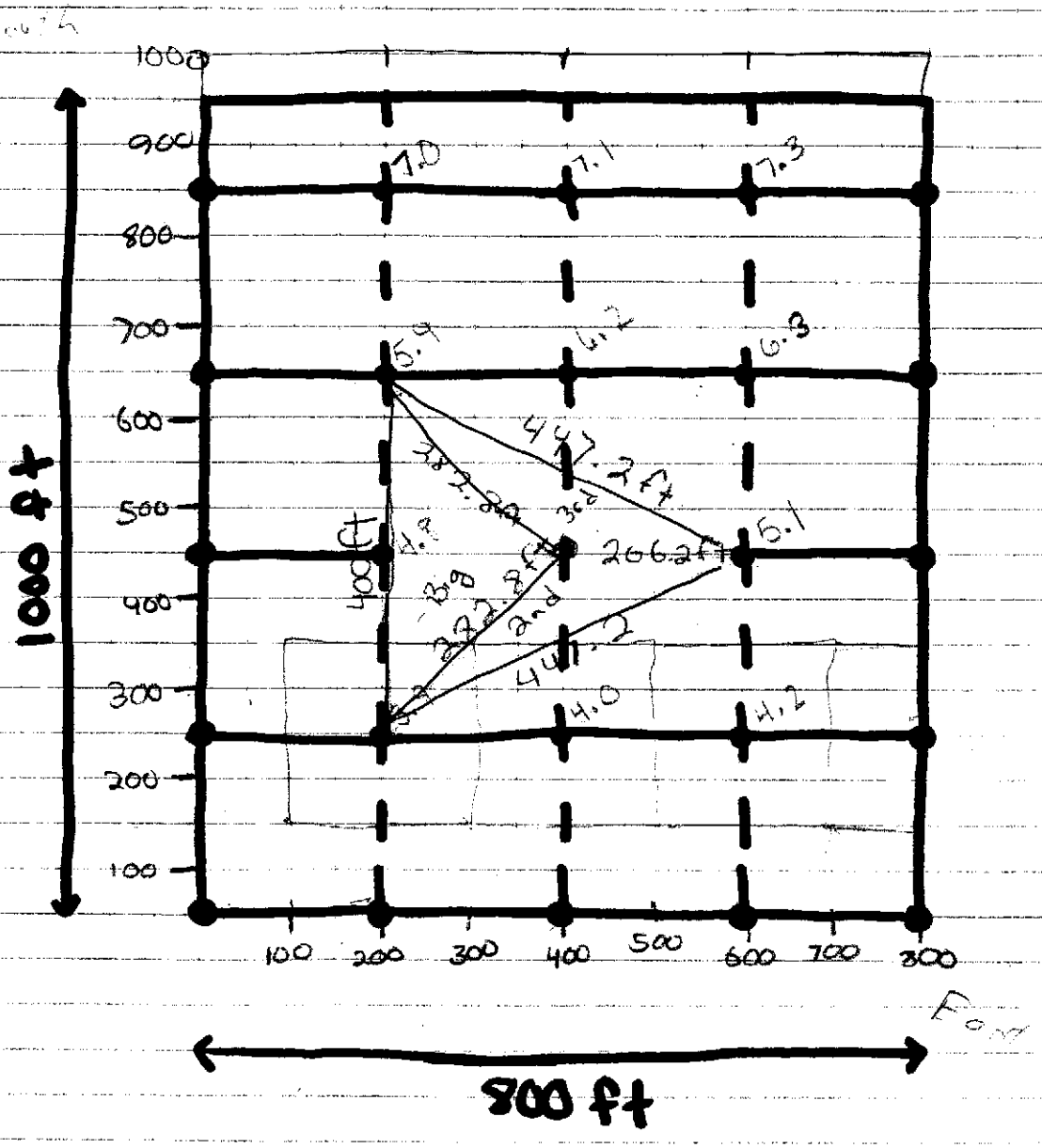
Diamond Inc



Surface Map

Mathematics Group #2

- Land track and core drilling data showing coal seam Heights and triangles #1, 2, and 3
- Calculations showing the estimated the height of the coal seam at a point using Delauney Triangulation
- Land track and core drilling data showing areas of influence
- Estimated the volume of coal on the land track using the Polygonal Method
- Verified the height of the coal at a Point using Surfer 8


1000
900
800
700
600
500
400
300
200
100
7.0
7.1
7.3
5.9
6.2
6.3
6.1
4.0
4.2
400 ft
1000 ft
100
200
300
400
500
600
700
800
800 ft

Total = 42,890,000 ft²

D = (200, 650) (600, 450)

$D = \sqrt{(600-200)^2 (450-650)^2}$

$(400)^2 \quad (-200)^2$

160000 + 40,000

$D = \sqrt{200,000}$

D = 447.2 ft

D = (400, 450) (200, 250)

$D = \sqrt{200-400^2 + 250-450}$

$-200^2 + -200^2$

40,000 + 40,000

$D = \sqrt{80,000}$

D = 282.8 ft

D = (400, 450) (200, 650)

$D = \sqrt{200-400^2 + 650-450^2}$

$-200^2 \quad 200^2$

40,000 + 40000

$D = \sqrt{80,000}$

D = 282.8 ft

D = (400, 450) (600, 450)

$D = \sqrt{600-400^2 + 450-400^2}$

$200^2 + 50^2$

40,000 + 2500

$D = \sqrt{42500}$

D = 206.2 ft

D = (200, 250) (200, 650)

$D = \sqrt{200-200^2 + 650-250^2}$

$D = \sqrt{0^2 + 400^2}$

0 + 160000

$D = \sqrt{160000}$

D = 400

D = (200, 250) (600, 450)

$D = \sqrt{600-200^2 + 450-250^2}$

$400^2 + 200^2$

160,000 + 40,000

$D = \sqrt{200000}$

D = 447.2 ft

Big Triangle

$S = \frac{1}{2}(400 + 282.8 + 282.8)$

$S = \frac{1}{2}(965.6\text{ft})$

$S = 482.8$

$A = \sqrt{482.8(482.8-400)(482.8-282.8)}$

$A = \sqrt{482.8(82.8)(200)(200}$

$A = \sqrt{482.8(3,312,000)}$

$A = \sqrt{1599033600}$

$A = 39987.9\text{ft}$

2nd 3rd

$S = \frac{1}{2}(282.8 + 447.2 + 206.2)$

$S = \frac{1}{2}(936.2)$

$S = 468.1$

$A = \sqrt{468.1(468.1-282.8)(468.1-447.2)}$

$A = \sqrt{468.1(185.3)(20.9)(261.}$

$A = \sqrt{4747837 48.5}$

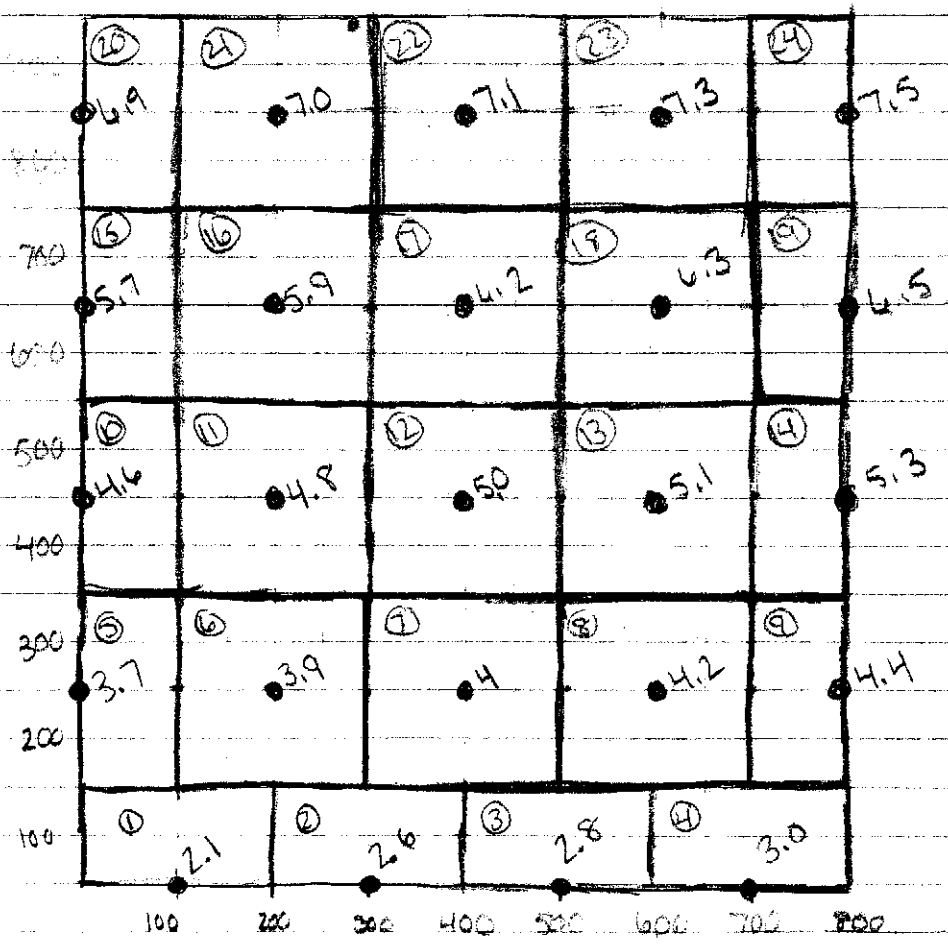
$A = 21789.5$

$\frac{5.1(39987.9) + 5.9(21789.5)}{83566.9}$ $3.9(21789.5)$

$\frac{203938.29 + 128558.05 + 84979.05}{83566.9}$

$\frac{417475.39}{83566.9}$

5.0ft


20
21
22
23
24
6.9
7.0
7.1
7.3
7.5
16
17
19
5.7
5.9
4.2
6.3
6.5
15
11
12
13
14
4.6
4.8
5.0
5.1
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5
6
8
9
3.7
3.9
4
4.2
4.4
1
2
3
4
2.1
2.6
2.8
3.0
700
600
500
400
300
200
100
100
200
300
400
500
600
700
800

① (200 x 150) x 2.1 = 63,000 ft²
② (200 x 150) x 2.6 = 78,000 ft²
③ (200 x 150) x 2.8 = 84,000 ft²
④ (200 x 150) x 3.0 = 90,000 ft²
⑤ (100 x 200) x 3.7 = 74,000 ft²
⑥ (200 x 200) x 3.9 = 156,000 ft²
⑦ (200 x 200) x 4 = 160,000
8 (200 x 200) x 4.2 = 168,000
9 (100 x 200) x 4.4 = 88,000
10 (100 x 200) x 4.6 = 92,000
11 (200 x 200) x 4.8 = 192,000
12 (200 x 200) x 5.0 = 200,000
13 (200 x 200) x 5.1 = 204,000
14 (100 x 200) x 5.3 = 106,000
15 (100 x 200) x 5.7 = 114,000
16 (200 x 200) x 5.9 = 236,000
17 (200 x 200) x 6.2 = 248,000
18 (200 x 200) x 6.3 = 252,000
19 (100 x 200) x 6.5 = 130,000
20 (100 x 200) x 6.9 = 138,000
21 (200 x 200) x 7 = 280,000
22 (200 x 200) x 7.1 = 284,000
23 (200 x 200) x 7.3 = 292,000
24 (100 x 200) x 7.5 = 150,000

3979,000 ft

	A	B	C	D
1	100	0	2.1	-0.011981
2	300	0	2.6	0.0003033
3	500	0	2.8	-0.000747
4	700	0	3	-0.004511
5	0	250	3.7	0.0008303
6	200	250	3.9	0.0047790
7	400	250	4	0.0019217
8	600	250	4.2	0.0016841
9	800	250	4.4	-0.004255
10	0	450	4.6	-0.003310
11	200	450	4.8	-0.002428
12	400	450	5	0.0001980
13	600	450	5.1	-0.015818
14	800	450	6.5	0.0216683
15	0	850	6.9	-4.39E-09
16	200	850	7	0.0016036
17	400	850	7.1	0.0010484
18	600	850	7.3	0.0008720
19	800	850	7.5	2.154E-10
20	400	450	0	-4.999802

Delauney Triangulation – 5.0 ft

Surfer 8 – 5.0 ft

) Same!

Mathematics Group #1

- Calculated the average cross-sectional area using Integral Calculus and determined the volume of the overburden. Calculated the stripping ratio (6:1)
- Calculated the volume of a slurry pond on the property using the shell method

Side 1		Side 2	
x	y	x	y
0	800	0	675
1	725	1	625
2	675	2	550
3	510	3	470
4	410	4	370
5	290	5	250
6	165	6	125
7	0	7	0

$y_1 = -0.000538x^2 - .7557x + 800.625$

$y_2 = -0.000670x^2 - .5104x + 676.958$

$V_{total} = \frac{A_1 + A_2}{2} d$

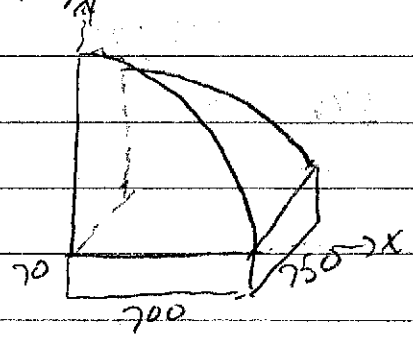
$A_1 = \int_0^{700} -0.000538x^2 - .7557x + 800.625 = 313779.667$

$A_2 = \int_0^{700} -0.000670x^2 - 0.5104x + 676.958 = 273619.267$

$V_{total} = 293699.467 \cdot 750 = 220274600.3$ cu. ft.

$V_{coal} = 70 \cdot 700 \cdot 750 = 36750000$

$\text{Stripping Ratio} = \frac{V_{mountain}}{V_{coal}} = \frac{220274600.3}{36750000} = \frac{5.994}{1} \approx \frac{6}{1}$



Megan Edmonds

Modeling Data A pond is approximately circular, with a diameter of 400 feet (see figure). Starting at the center, the depth of the water is measured every 25 feet and recorded in the table.

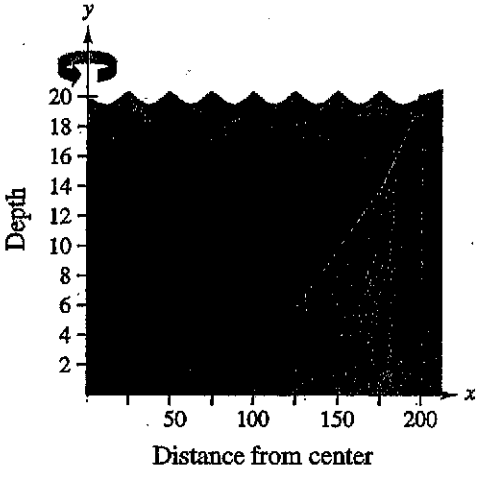
	0	25	50	75	100	125	150	175	200
Depth	20	19	19	17	15	14	10	6	0

Put in list
stat plots
Quad Reg Y,

a. Use the regression capabilities of a graphing utility to find a quadratic model for the depths recorded in the table. Use the graphing utility to plot the depths and graph the model.

b. Use the integration capabilities of a graphing utility and the model in part (b) to approximate the volume of water in the pond. Shell method [0, 200] x-axis

c. Use the result in part (c) to approximate the number of gallons of water in the pond if 1 cubic foot of water is approximately 7.48 gallons.



(a) $y = -0.00056104x^2 + 0.0189x + 19.394$

(b) $\int_0^{200} 2\pi(\text{radius})(\text{height})\,dx = 2\pi\int_0^{200} x(\text{function})\,dx$

$V = 1{,}343{,}314.192\ ft^3$

(c) $1{,}343{,}314.192 \times 7.48 =$ 10,047,990.16 gallons

Music Group

Wrote original lyrics "Astro Coal Miners" to the tune "Astro Zombies - Misfits"

Heather Rathff

Astro Zombies - Misfits

Oh, all I want to know
All I want

With just a touch of my burning hand
I send my astro zombies to rape the land
Prime directive, exterminate
The whole human race

And your face drops in a pile of flesh
And then your heart, heart pounds
Till it pumps in death
Prime directive, exterminate
Whatever stands left

All I wanted to say
And all I gotta do
Who'd I do this for
Hey, me or you

And all I wanted to say
And all I gotta do
Who'd I do this for
Hey, me or you

Oh, all I want to know
All I want

With just a touch of my burning hand
I'm gonna live my life to to destroy your world
Prime directive, exterminate
The whole ~~fuckin'~~ race

Then your face drops in a pile of flesh
And then your heart, heart pounds
And it pumps in death
Prime directive, exterminate
The whole ~~fuckin'~~ place well

All I wanted to say
And all I gotta do
Who'd I do this for
Hey, me or you

And all I wanted to say
And all I gotta do
Who'd I do this for
Hey, me or you

Oh, all I want to know
All I want to know
All I want to know
All I want oh
Go

(rewritten) Heather Ratliff

Astro Coalminers

Oh, all I want to know
All I want

With just a touch of my dirty hand
I send my astro coalminers to rape the land
Prime directive, exterminate
This whole dark place

And your face drops in a pile of coal
And then your heart, heart pounds
Till it pumps in death
Prime directive, exterminate
Whatever stands left

All I wanted to say
And all I gotta do
Who'd I do this for
Hey, me or you

And all I wanted to say
And all I gotta do
Who'd I do this for
Hey, me or you

Oh, all I want to know
All I want

With just a touch of my burning hand
I'm gonna live my life to to power your world
Prime directive, exterminate
The whole flippin' place

Then your face drops in a pile of coal
And then your heart, heart pounds
And it pumps in death
Prime directive, exterminate
The whole flippin' place well

All I wanted to say
And all I gotta do
Who'd I do this for
Hey, me or you

And all I wanted to say
And all I gotta do
Who'd I do this for
Hey, me or you

Oh, all I want to know
All I want to know
All I want to know
All I want oh
Go

English Essay Sample

Titled "Coal in Eastern Kentucky"

Coal in Eastern Kentucky
By:
Tyler Hamilton
April 11, 2008
Coal Fair Essay

Being a lifelong resident of eastern Kentucky, I realize first hand just how much coal helps the economy of the Appalachian region, and our nation as a whole. Coal mining is the main industry throughout eastern Kentucky. The jobs it provides is the main source of income for families who live here because coal is the most abundant resource in this area. According to www.uky.edu the Eastern Kentucky Coalfield covers the eastern end of the state, stretching from the Appalachian Mountains westward across the Cumberland Plateau to the Pottsville Escarpment. The Kentucky Coal Resources article reports that the Eastern Kentucky coalfield covers 10,500 square miles and contains approximately 51.90 billion tons of remaining coal that can be mined.

With over 24,000 people in Kentucky working in some capacity in the coal industry, many people throughout the coalfields of Eastern Kentucky would be unemployed without coal. It not only helps many families in this area, but it also benefits people throughout the world. Many families see coal mining as a way of life, and in some cases, there are generations of families working side by side. You often hear of people complaining about coal and the pollution, but not in these parts. They are thankful for this valuable mineral because it is what provides an existence for their families.

Coal provides many opportunities for jobs as it has been produced in the eastern Kentucky coalfield since the early 19th century and has been the state's most important mineral resource since that time, according to www.kltprc.net. Many of my family members have jobs that are related to coal, whether it is working in the coal mine itself,

driving a coal truck, or being employed as a mining engineer. Coal not only provides people with essential jobs, but good paying jobs, as the coal miners average salary is $50,000 dollars per year, according to the Coal Industry and Technology website at www.careenergy.com. Coals economic contribution to coal counties and the state economy is critical.

With the abundant supply of coal that is in Kentucky, the first thing that must happen is for skilled mining engineers to calculate the most productive way for the coal to be mined. According to www.connexions-direct.com, mining engineers evaluate potential mining sites, plan the type, size, location, and construction of mines, work out the cost of mining projects, design opencast and underground mines, develop mining equipment, plan and oversee the construction of mine shafts, tunnels, and ventalation systems, manage drilling and blasting along with other mining operations, and monitor the efficiency, safety and environmental impact of mines. Once the mining engineers formulate a plan to extract the coal, the coal miners begin their job and mine the coal from the site.

There are two major types of coal mines, underground and surface. Underground mining is used when the coal seam is buried several hundred feet below the surface. The process of mining coal underground has changed a lot since it first began. Coal that was once dug by hand is now extracted by a continuous miner. Once the coal is broken off from the face by the miner, it is then moved to a shuttle car. This special designed buggy then transports the coal to a conveyor belt which is used to move the coal from underground to the surface. Another popular method of mining coal is longwall mining. This method involves pulling a cutting machine across a 400 to 600 foot long face of the

coal seam. This machine shears off the coal onto a conveying machine, which once again transports the coal up to the surface to be hauled off, according to www.coaleducation.org. The coal is then transported to the power plant where they will burn the coal and provide energy for the world.

Even though over half of the minable surface coal is located in the western part of the United States, there are some surface mines located in the eastern Kentucky coalfields. Surface mining is used when a coal seam is relatively close to the surface, usually within 200 feet. According to www.coaleducation.org, most surface mines follow the same basic steps to produce coal. First, bulldozers clear and level the mining area where the topsoil is removed and stored for later use in the reclamation process when the coal company restores the land to its natural state. Many small holes are drilled through the overburden (dirt and rock above the coal seam) to the coal seam. Each is loaded with explosives, which are discharged, shattering the rock in the overburden. Giant power shovels or draglines clear away the overburden until the coal is exposed. Smaller shovels then scoop up the coal and load it onto trucks, which carry the coal to the preparation plant.

According to lsa.colorado.edu, after coal comes out of the ground, it typically goes on a conveyor belt to a preparation plant that is located at the mining site. A "prep" plant cleans and processes coal to remove dirt, rock, ash, sulfur, and other impurities. After the coal is mined and processed, it is ready to go to market. Two modes of coal transportation dominate Kentucky. More than three-fourths of mined coal is transported by truck from the mine site to either preparation or loading facilities (www.kltprc.net). The other mode used to transport coal in Kentucky is by railway, which is faster.

However, because of its sub-par infrastructure, Kentucky mostly relies on coal trucks to transport their coal. Once the coal is transported to the power plants, it is used to power the country.

Many industries in Kentucky and throughout the world use coal. While the main use of coal is for electricity, it is used in the iron and steelmaking industries along with the paper, brick, limestone, and cement industries. Because of this, many Kentuckians and Americans are able to attain steady and secure jobs. Not only does coal help the economy by being mined, processed, and transported, but the demand for it by other industries is also a definite plus.

Many people complain about how coal pollutes the environment; however, without it, our economy would be horrendous. While there are other processes being used to provide energy that is cleaner than coal, new coal related technology is being introduced to help and make the extraction of coal cleaner and safer. None of these processes can compete with the amount of jobs that coal provides, and they are more expensive to produce.

Most importantly, coal has a larger resource base than any of the other fossil fuels in the world. With such a supply, the mining industry will continue to boost our economy by providing a variety of mine-related jobs for many years to come. What non-supporters of coal do not realize is that when you interfere with the coal industry, you eliminate jobs, destroy communities, and virtually take food out of the mouths of small children. Without a doubt, coal mining is a vital and important industry throughout eastern Kentucky, and the jobs it provides is the livelihood for families who live in the area. Jobs,

money, food, homes, energy, fuel, and a great economy are provided in eastern Kentucky and throughout the world because of COAL.

Works Cited:

"The Coal Industry and Technology." www.careenergy.com. CARE Energy. 11 Apr. 2008 <http://www.careenergy.com/technology/coal-industry.asp>.

"Kentucky Coal Resources." www.coaleducation.org. 8 Apr. 2008 <http://www.coaleducation.org/Ky_Coal_Facts/coal_resources/ky_resources.htm>.

"Mining Coal." www.coaleducation.org. National Energy Foundation. 9 Apr. 2008 <http://www.coaleducation.org/lessons/twe/mcoal.htm>.

"Mining Engineer." Www.Connexions-Direct.Com. 10 Apr. 2008 <http://www.connexions-direct.com/jobs4u/index.cfm?pid=48&catalogueContentID=216>.

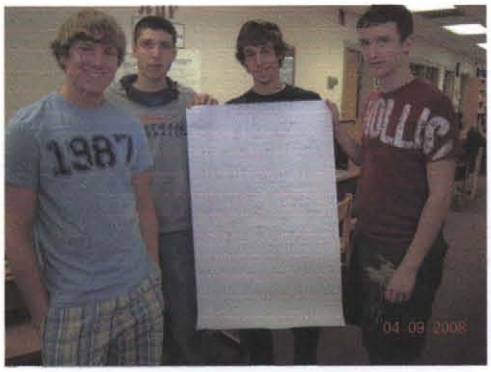
"What is Coal?" Lsa.Colorado.Edu. 10 Apr. 2008 <http://lsa.colorado.edu/essence/texts/coal.htm>.

www.uky.edu. University of Kentucky. 8 Apr. 2008 <http://www.uky.edu/KentuckyAtlas/phys-eastern-coal-field.html>.

Weisenfluh, Gerald A., James C. Cobb, John C. Ferm, and Carol L. Ruthven. "Kentucky'S Coal Industry: Historical Trends and Future Opportunities." www.kltprc.net. 1996. University of Kentucky. 9 Apr. 2008 <http://www.kltprc.net/books/exploring/Chpt_19.htm>.

Extra

Pictures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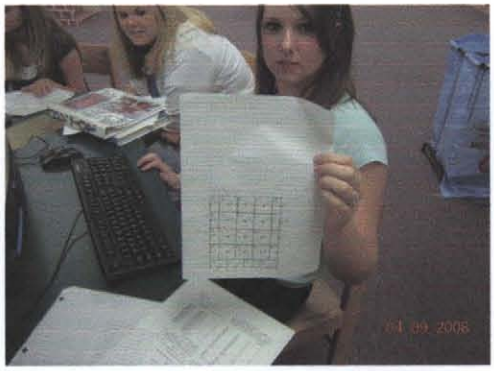
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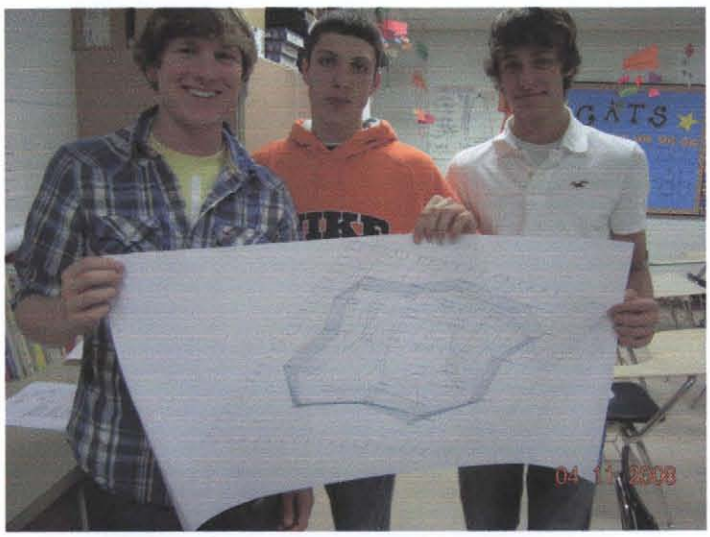
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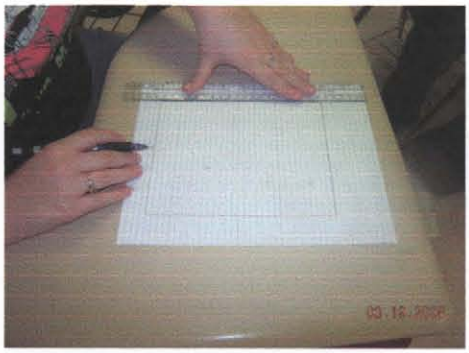

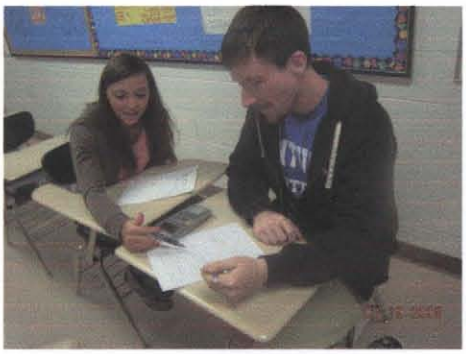

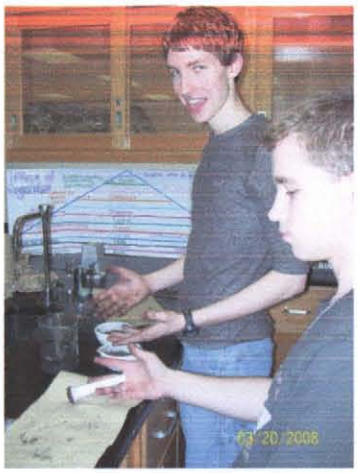
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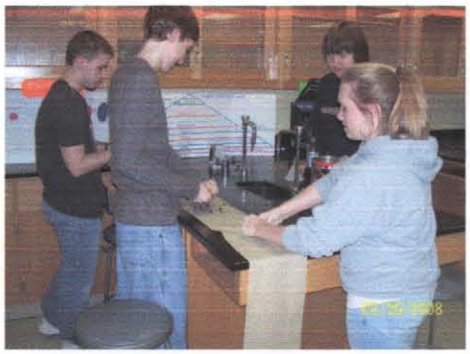

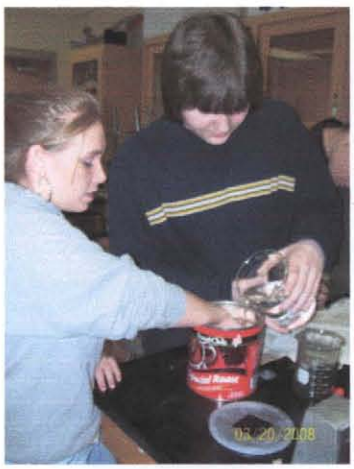


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