



River Contamination & Money Management

(Teacher's Guide)

(With special thanks to E. Denecke, C. Fee, and L. Goldstein of the Queens Multidisciplinary Resource Center, and A. Morawski of Marine Biology Research for editing)

OVERVIEW:

In this activity, groups of students participate in a (fictitious) EPA grant-funded project, whose objective is to locate the source of river bed contamination and identify the industry responsible for the dumping. The activity uses student knowledge of contour maps, lines of latitude and longitude, and environmental contamination resulting from industrial waste. The project culminates with a report of their findings.

MATERIALS:

- topographical map slates of *Oh-Be-Joyful* (1 set of 6 slates per group of students)
- scissors (1 per student)
- scotch tape (1 roll per group)
- Cash box with Monopoly Money, for the banker
- 2 or more buckets to collect discarded sediment and wash out wet, sandy materials
- 70 film canisters, 35 mm, labeled with numbers 1-70
- 2 quarts light sand
- 1 quart dark sand
- 1 quart gravel
- 1 large plastic or aluminum pan, to mix sand and gravel
- 3 quart-size zip-lock freezer bags (or Tupperware containers)
- 1 gallon-size zip-lock freezer bag (or Tupperware container)
- yellow water-soluble dye powder
- blue water-soluble dye powder
- red water-soluble dye powder
- lab gloves
- dropper bottles with "Test Solution" (1 per group of students)
- plastic funnels (1 per group)
- beakers (1 per group)
- plastic spoons (1 per group)
- paper towel
- small-diameter filter paper (brown paper towel cut into circles will work)
- internet-based latitude/longitude coordinate finders:
 - http://en.wikipedia.org/wiki/Category_talk:Lines_of_latitude
 - http://en.wikipedia.org/wiki/Category_talk:Lines_of_longitude

GETTING READY:

- Make the pdf document of the Oh-Be-Joyful map available to students via laptops. Also have ready the six *unassembled* map slates (one set per group), for the preliminary exercise.
- Prepare the 70 canisters with sediment, as follows:
 1. Label the canisters 1-70
 2. In the large pan, mix light and dark colored sand and gravel.
 3. Fill the 3 zip-lock bags with about two cups of sand each. Store the remaining sand in the gallon-sized zip-lock or Tupperware.
 4. Spike the sediment in each of the three zip-lock bags by adding a pinch of orange dye to the first container, a pinch of red dye to the second, and a pinch of blue dye to the third, and mix well to distribute dye throughout the whole bag of sediment.
 5. Fill the film canisters accordingly:
 - RED-spiked sediment: cans #47, 18
 - YELLOW-spiked sediment: cans #48, 50, 52, 20, 21
 - BLUE-spiked sediment: cans #54, 55, 57, 58, 67, 31, 33
 6. Fill remaining canisters with uncolored sediment.
 7. Designate a location in the classroom where canisters of sediment samples will be sold, and place canisters there.
- If using brown paper towel instead of filter paper, cut about 150-200 circles, and place next to canisters. Students will be given one sheet of filter paper with every sample purchased.
- Prepare bottles of Test Solution, filling the dropper bottles with tap water.
- Set aside a place in the classroom where groups will collect the following materials:
 - bottles of Test Solution
 - plastic spoons
 - funnels
 - paper towel
 - beaker
 - gloves
- Set aside another location in the classroom for banking and selling sediment samples. Divide the money into sets of \$9000 for quick distribution, and have sediment samples ready.

LESSON PROCEDURE:

1. Preliminary exercise: assembling the map of *Oh-Be-Joyful* from individual slates. Distribute the unassembled map slates, scissors and tape to each group, and have students figure out how to piece it together.
2. Review how to interpret topographical maps, including contour, elevation, current, lines of latitude and longitude, etc.

3. Distribute laptops with pdf of the *Oh-Be-Joyful* map if students have difficulty making out the details on the paper version.
4. Hand out lab worksheets and the “EPA grant announcement” and review the objectives with the students. Answer any questions they may have.
5. Briefly discuss different ways that industry can lead to contamination.
6. Have groups collect their research materials and the \$9000 allowance.
7. Give students a few minutes to plan their strategy as a team. Remind them of their limited financial resources.
8. Students will now begin to buy and test samples, narrowing down the location of the contamination source. Give them ample time to implement their research strategies, until they come to a determination of the source of contamination
9. Once the exploratory research is complete, students will prepare and present reports to the *Environmental Protection Agency* of their findings, identifying the sources of contamination, types of industrial pollution, and ways to protect the environment.

ANSWERS:

Questions 1-4 on EPA Findings Report:

1. The location of the source of contamination are points #47 and #18.
2. The highest elevation is: 12,958 ft.
The lowest elevation is: 8,871 ft.
The topographic relieve (highest minus lowest) is: 4,087 ft.
3. Latitude: 39° North,
Longitude: 107° West
Oh-Be-Joyful is located in Colorado.
4. The V’s point upstream. Elevation increases in that direction.

Questions 5-8 will vary.



GRANT ANNOUNCEMENT

General Information

Document Type: Grants Notice	Posted Date: Oct 28, 2013
Funding Opportunity Number: MBRP-76543210	Creation Date: Sep 21, 2013
Funding Opportunity Title: <i>Oh-Be-Joyful</i> Riverbed Contamination Source-Finding Mission	Closing Date for Findings: Nov 13, 2013
Category of Funding Activity: Science and Technology and other Research and Development	Estimated Total Program Funding: \$90,000 Monopoly dollars
Expected Number of Awards: Maximum 10	Allowance per Applicant Group: \$9000 Monopoly dollars
Cost Sharing Requirements: None	Successful research outcome indicators: A good grade and sense of accomplishment!

Eligibility

Eligible Applicants: New York Harbor School MBRP students
Additional Information on Eligibility: Must be Level II or III research student; must have completed minimum 1 lesson on Maps and Mapping

Additional Information

Description: It has been determined that there is severe levels of contamination in the *Oh-Be-Joyful* region of the United States, which is the location of numerous industrial enterprises, including hydraulic fracturing, mineral extraction, coal mining, heavy metal refinery, medical technology, mobile communication, nuclear power generation, oil drilling, plastics production, soft-drink manufacturing, and pharmaceutical research. The EPA is awarding \$9000 in Monopoly money to up to ten groups of two students per group, to find the source of contamination and culprit industry. Student groups will purchase riverbed sediment samples, at \$500 a sample, from various points along the *Oh-Be-Joyful* river, to locate the epicenter/s of environmental contamination. Outside or private money sources may not be used in the purchase of samples. Upon completion of the exploratory research, applicants must present their findings along with explanation of cause of contamination, and recommendations for increased protection and conservation of natural lands and resources.

Contact Information: For more information on this grant opportunity, please contact Mauricio Gonzalez, Grant Coordinator, mgonzalez25@schools.nyc.gov

SEDIMENT SAMPLE ORDER FORM

Student: _____

Partner: _____

Group Name: _____

Date: _____

Instructions:

You are allowed to order four batches of sediment samples, five at a time, so you must strategize how you are going to select from among the 70 samples. You must also be careful managing your money, as you have a limited allowance. For each order that you submit, you must explain your rationale for selecting those specific examples, as well as answer the following questions:

- The number of the sample you are requesting
- The sample's latitude coordinate to the nearest degree, minute and second ($x^{\circ} y' z''$)
- The sample's longitude coordinate to the nearest degree, minute and second ($x^{\circ} y' z''$)

Batch #1

What strategy did you use in deciding to purchase these samples? Be specific.

	sample #	latitude coordinate	longitude coordinate
01			
02			
03			
04			
05			

Batch #2

What strategy did you use in deciding to purchase these samples? Be specific.

	sample #	latitude coordinate	longitude coordinate
01			
02			
03			
04			
05			

Batch #3

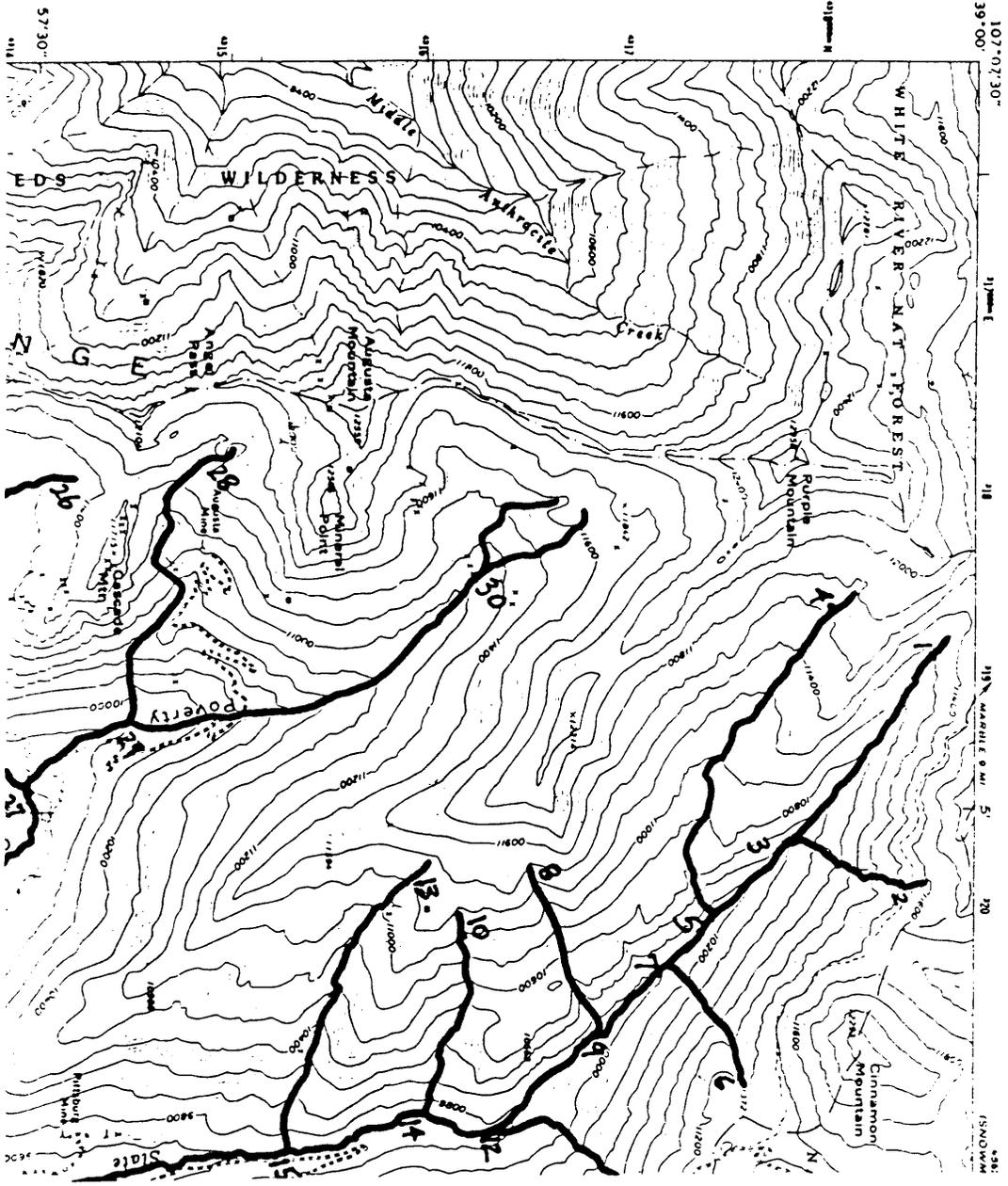
What strategy did you use in deciding to purchase these samples? Be specific.

	sample #	latitude coordinate	longitude coordinate
01			
02			
03			
04			
05			

Batch #4

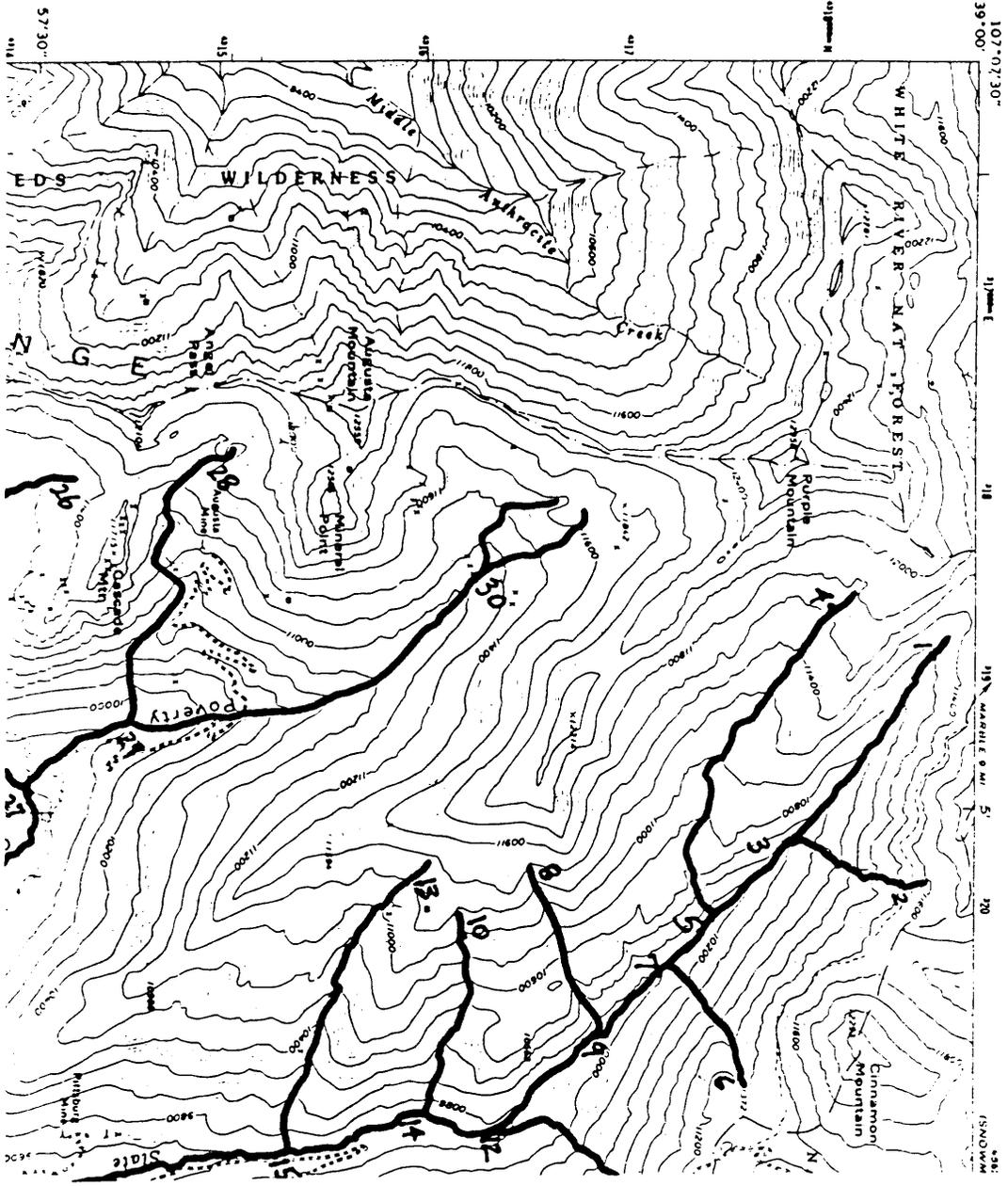
What strategy did you use in deciding to purchase these samples? Be specific.

	sample #	latitude coordinate	longitude coordinate
01			
02			
03			
04			
05			



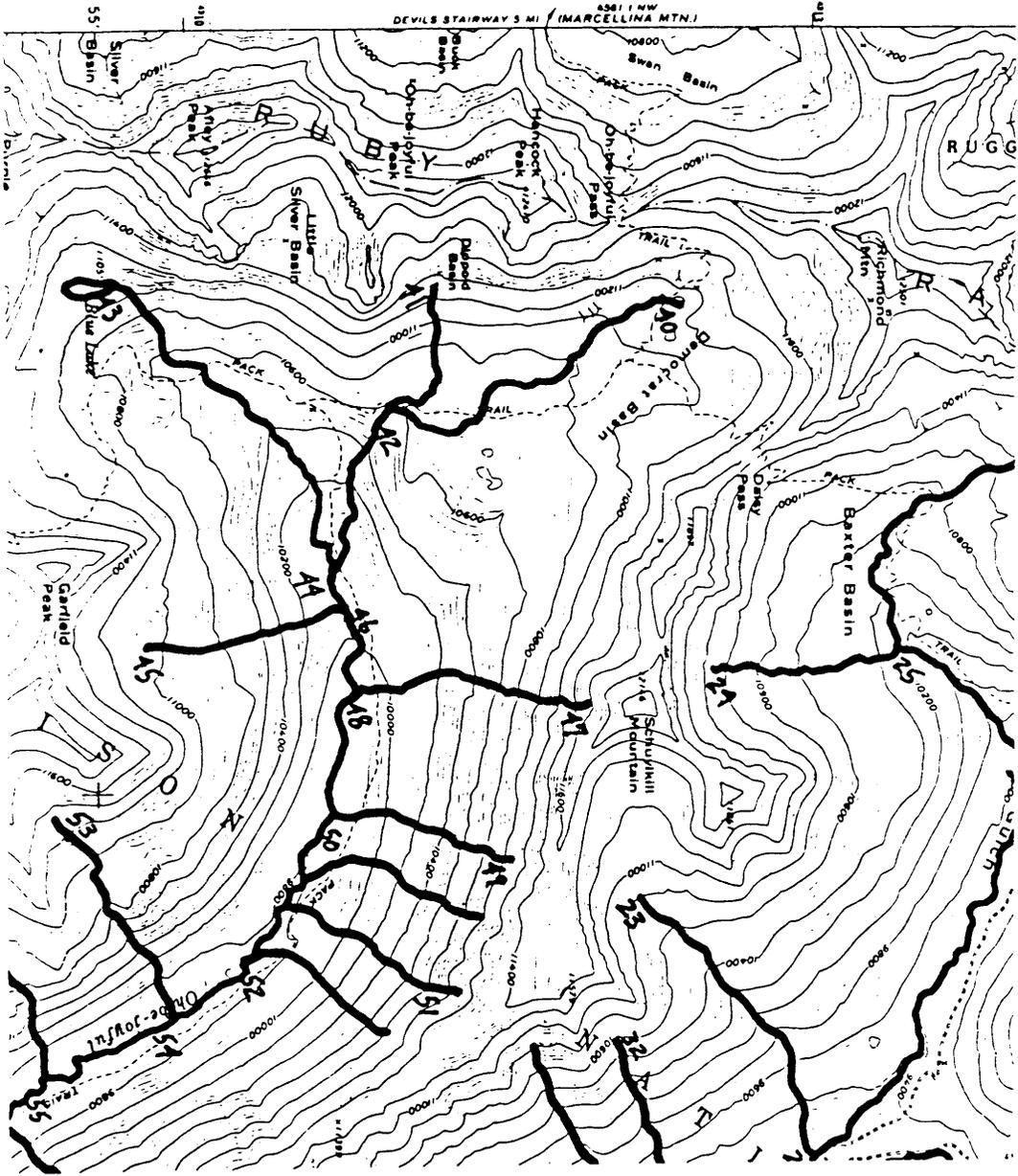
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Map Legend

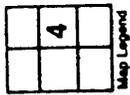
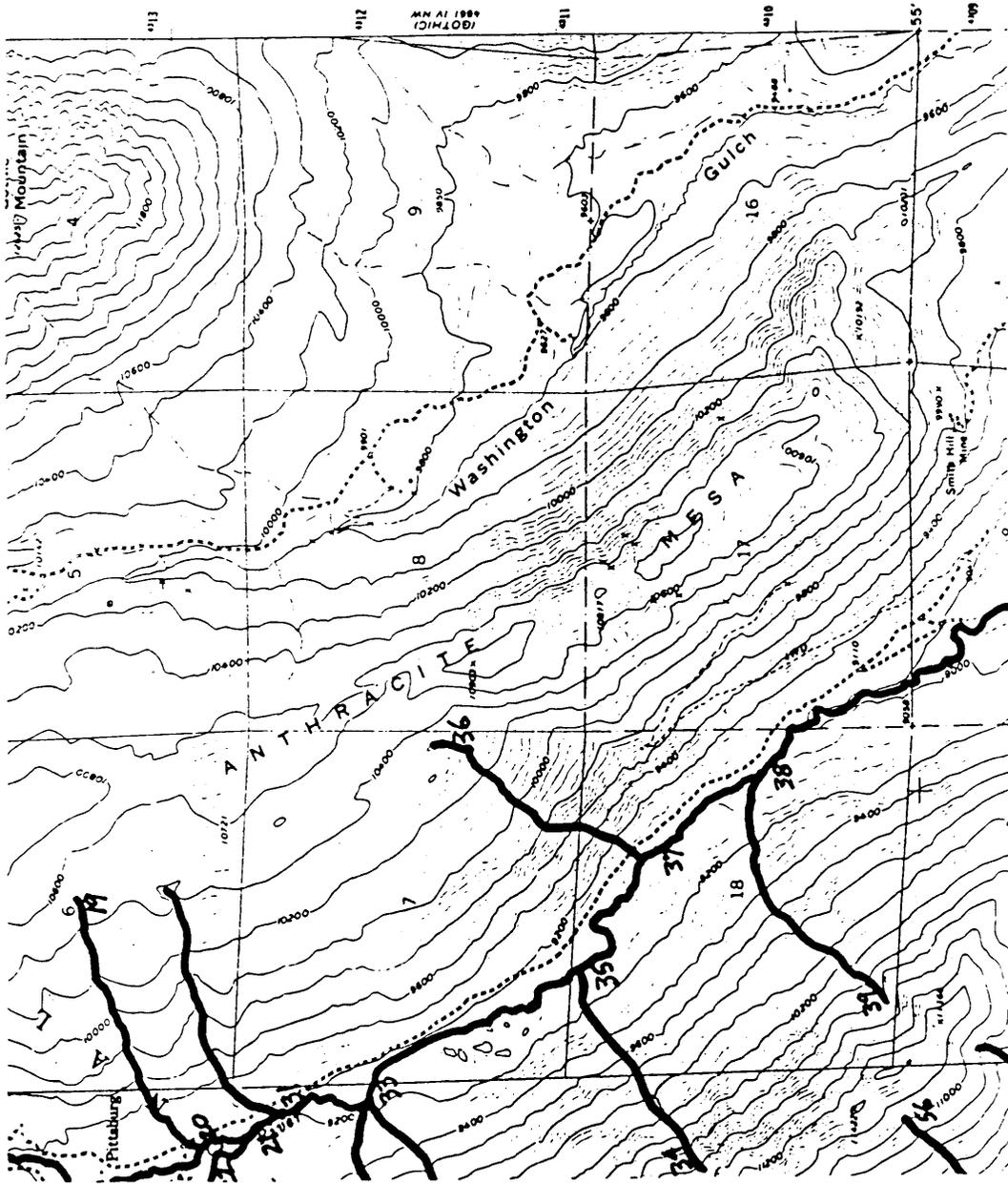


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Map Legend

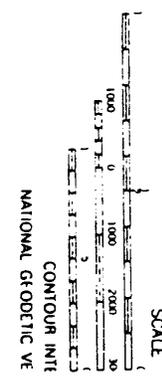
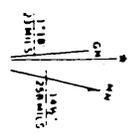


Map Legend	3		
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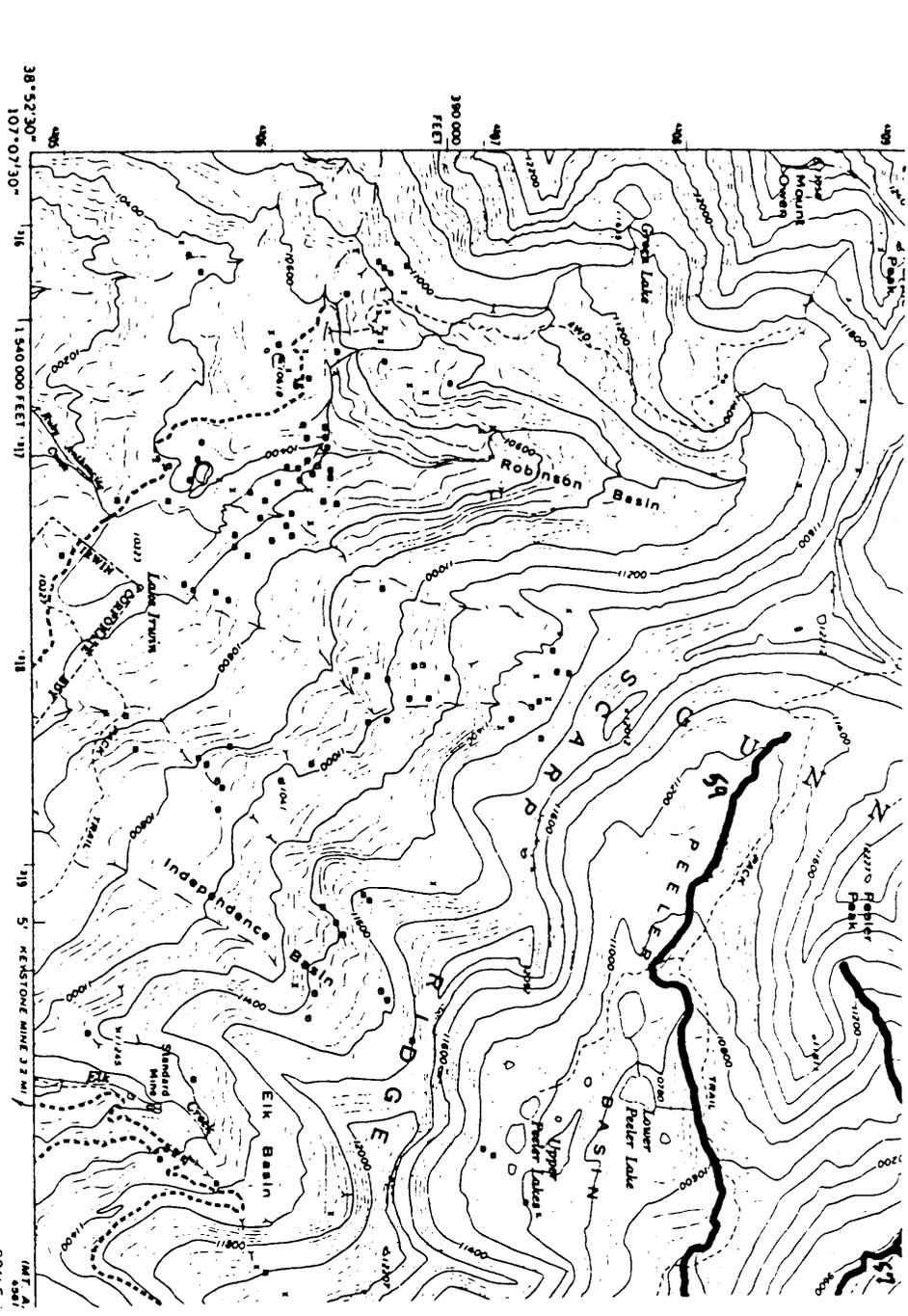


1:250,000
 1:50,000
 1:25,000
 1:12,500
 1:6,250
 1:3,125

Mapped, edited, and published by the Geological Survey
 Control by USGS and NOS/NOAA
 Topography by photogrammetric methods from aerial photographs
 taken 1958 Field checked 1961
 Polyconic projection 1927 North American Datum
 10,000-foot grid based on Colorado coordinate system.
 Contour interval



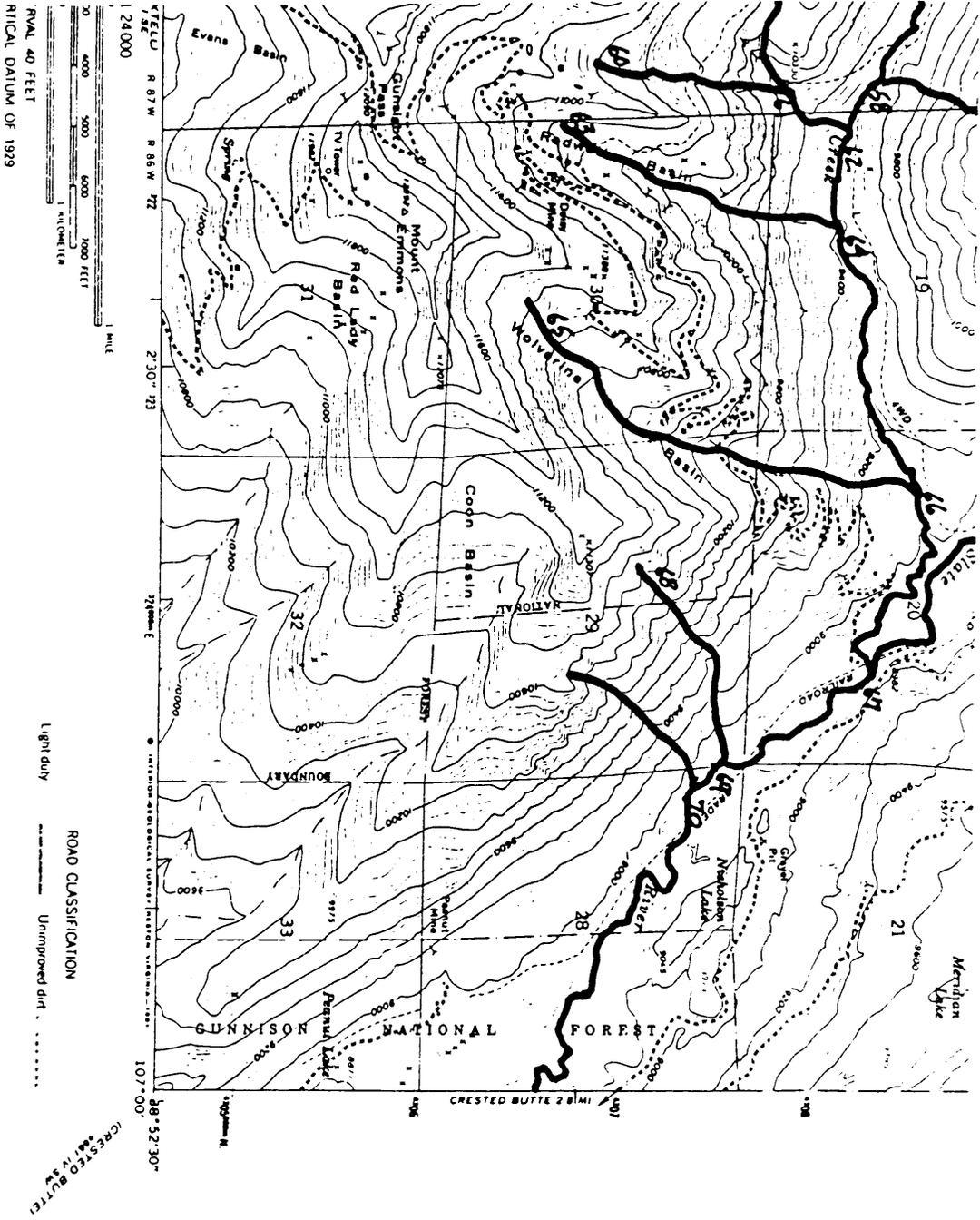
SCALE
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 FEET
 0 1000 2000 3000
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 CONTOUR INT
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5		
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Map Legend

Map Legend	6
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VERTICAL DATUM OF 1929

SCALE 40 FEET

ROAD CLASSIFICATION

CRESTED BUTTE