Day by Day
Examples

Changing Surface of Salt Lake County

Day #1

CHANGING SURFACE OF SALT LAKE COUTNY AS SEEN FROM FLAT IRON PARK
Story for school teachers. July 12, 2004. By: Genevieve Atwood.

Flat Iron Park is located at about 1700 East and 8600 South in Sandy City, Salt Lake County, Utah, United States, on the North American Continent of the crust of Planet Earth. As its name implies, it is a flat feature, not large, about a half-mile long, east-west, and only 500 – 1000 feet wide north-south. It gets skinnier to the east. It's just the right size of some playing fields and tennis courts. If I were playing soccer here, I'd want my goal to be to the west, because Flat Iron slopes, just slightly, downward, to the west. The sides of this flat feature drop off very steeply on all sides. I wonder how such a flat feature got here, how it stays flat, or perhaps how it stays here at all.

I look around me and see so many places I know, or wish I knew in Salt Lake County. I love this place. I love its view. I like that it is a park. I like that it is a place I can see some obvious land features that give clues to Salt Lake County's changing surface.

I know that every land feature has a story. Here at Flat Iron, I could tell the story of the Wasatch Range. I could tell the story of Salt Lake Valley. I could tell the story of the Oquirrh Mountains. I think I'll tell the story of the Wasatch fault zone, because I can see it running along the base of the mountains east of here… or at least I can see it on a good day. I know that the valley side of the fault drops down with respect to the mountains because Earth's crust is stretching, extending, westward. Yes, California is moving west faster than Colorado, and Ohio, and Massachusetts. And so Earth's crust has to stretch to accommodate the different rates of motion. The Wasatch fault zone is a world class fault that accommodates part of that movement. That explains Salt Lake Valley and the Wasatch Range, too, because the Wastach Range rides high even as the valley drops. It makes sense to me that a block drops down, and the result is a valley. Elsewhere on Earth there are places where the crust is being crunched and thrust movement on faults also causes mountains, but not by the same processes as here. We are in an extensional tectonic environment, not a compressional tectonic environment.. I stand here and think about the amount of time it has taken to drop the valley down this far … assuming that the bedrock under the valley and the bedrock of the mountain were once continuous. That is a lot of change.

Or I could tell the story of Flat Iron Mesa. That is the name of the landform on the official United States Geological Survey topographic map. I just love maps. If a picture is worth a thousand words, I think a map is worth ten thousand words.

What are the clues to the history of this feature? I know it is made of sediments, I can see them on the hill slope below the park, on all sides. I bet it takes a lot of water to keep the grass growing here, and that the water soaks in fast. The materials here appear really sandy. No surprise. I'm in Sandy City, Utah. I look across to the north and see that the broad flat on the north and the broad flat that extends east of here toward the mouths of Big and Little Cottonwood Canyons. I ask myself: is this feature being eroded in today's climate or is running water, wind, glaciers, human beings or landslides making it bigger and bigger? That's easy. This feature, Flat Iron Mesa is being eroded by stream channels, I can see them! Little by little, this feature will be carried to the Great Salt Lake.

Hmmm. That tells me about the changes going on today. But it still doesn't tell me about the past. The big clues are the landscapes around me, and my knowledge Utah's Ice Age and its famous Lake Bonneville. That was about 15,000 years ago, older than my parents but much,

much younger than the dinosaurs. I see the shoreline of that great lake. I see the canyons of the Wasatch Range. I know that those streams carry sediments today toward the Great Salt Lake. I know that in Lake Bonneville time, those stream channels dumped sediments at the mounts of the canyons in features called deltas. I can picture that this flat surface of Flat Iron Mesa is all that remains of this part of the huge delta that was continuous to the flat surface I see to the north and east.

So, during the Ice Age, there was a lake that covered this place. We know from the shorelines along the Wasatch front that the lake elevation was about 5200 ft along the mountain front here. We know another major shoreline was at 4800 ft elevation. My hypothesis is that when the lake was at that 4800 ft elevation, the sediments of the canyons were swept by currents out into the lake and the made the broad, gently sloping surface of a delta. Then climate changed to what we know today, and rivers and streams eroded entire portions of the delta surface. Some parts of the delta are intact. But Flat Iron Mesa is just a small remnant of that big delta.

Wow. What a story of change. The BIG story is the story of earthquakes and the valley and the mountains. That is the story of tectonics and forces from within Earth that gradually change the continents and oceans. But I find the erosion-deposition story just as interesting. During Lake Bonneville time this park was underwater. Sand and gravel was being carried to the west. The source of the sand was from the canyons where Alta and Brighton are today. How mind-boggling. During the Ice Age, there weren't ski resorts there. Although people lived in Africa and Asia, they had not arrived in Utah yet. And even if they had, they would not have found the canyons as we see them. They would have seen glaciers associated with more that a thousand feet thick of ice of the ice fields that covered much of the Wasatch Range at that time. Flat Iron Mesa tells the story of Ice Age conditions here, and modern climate conditions here. Flat Iron Mesa tells the story of climate change of the past 15,000 years. What a wonderful place. It makes me want to figure out more of the story.

EXAMPLE FLAT IRON MESA PARK

~~HOMEWORK #2:~~ **Your Name:** O.A.

CHANGING SURFACE OF SALT LAKE COUNTY

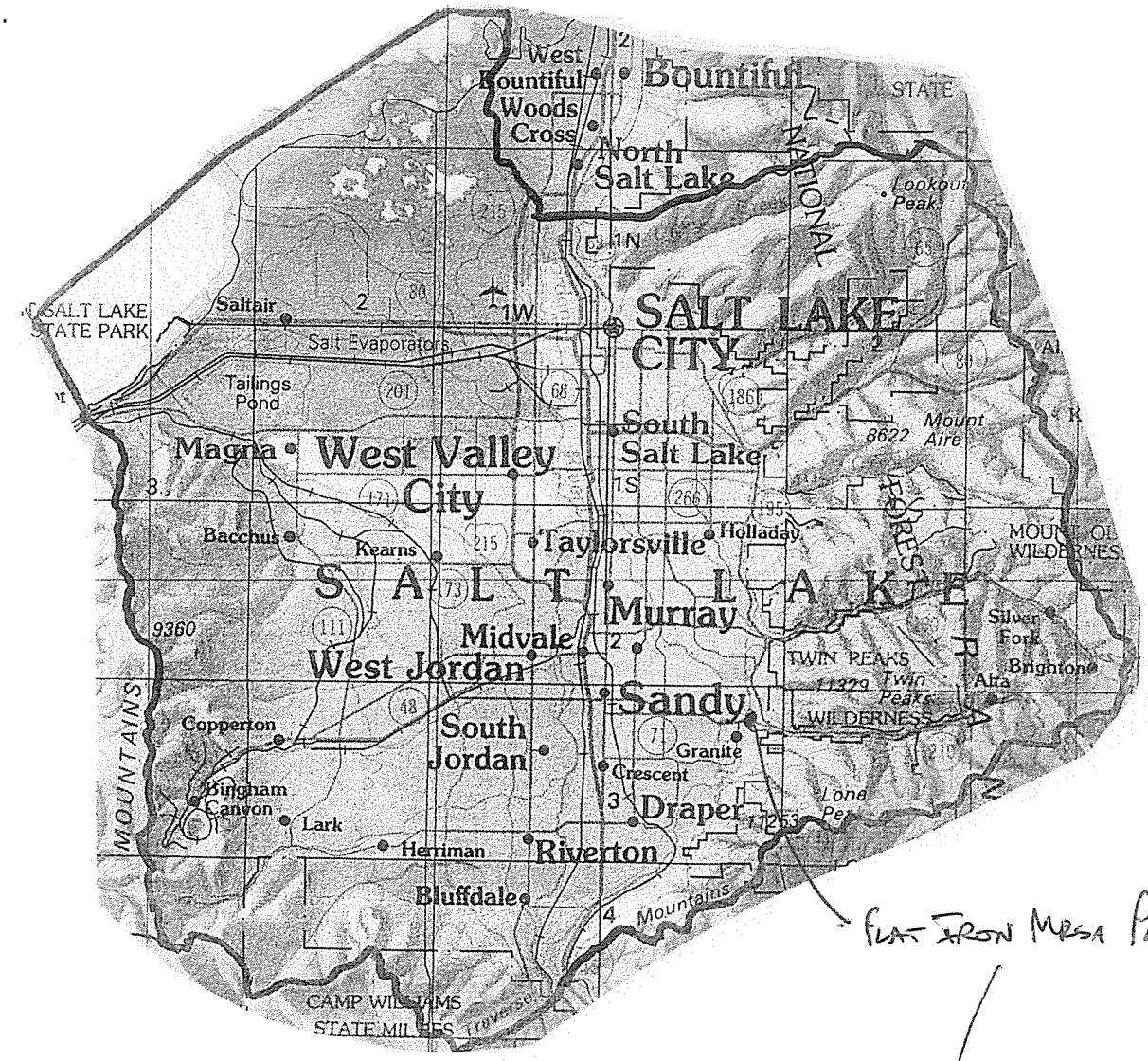
Purpose of this exercise: Your FINAL HOMEWORK is to write a story for your students about the processes that have made Salt Lake County look the way it does today, and the processes that will change the surface of Salt Lake County in the future. Whether you mean to or not, you'll role model observation and interpretation. This exercise is a template for collecting information about your school's location and landforms seen from it.

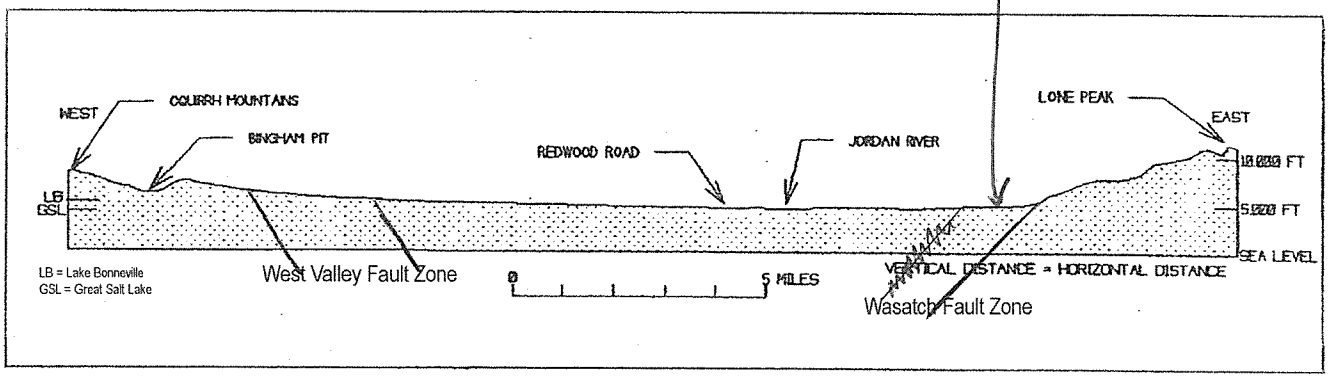
What do you think of ~~your school's~~ my location as a place to teach about Salt Lake County's changing surface? WONDERFUL!! Spectacular vistas! Wherever I look I have "why" questions. How did this feature come to be? What will happen to it?

What landforms can you see from your school? Fill out the following chart.

Feature	Direction from school	Type of feature	Can you see it?	Have you been there?
Oquirrh Mountains	W	Mountain range	✓	Yes
Wasatch Range	E	Mountain range	✓	Y
Salt Lake Valley	W	Valley	✓	Y
Great Salt Lake	NW	Lake	✓	Y
Antelope Island	NNW	Island	✓	Y
Stansbury Island	NW	Island	?	Y
Jordan River	W	River	✓	Y
City Creek - canyon	N	Stream and canyon	✓	Y
Red Butte Creek - canyon	N	Stream and canyon	?	Y
Emigration Creek - canyon	N	Stream and canyon	?	Y
Parley's Creek - canyon	N	Stream and canyon	✓	Y
Mill Creek – canyon	E	Stream and canyon	✓	Y
Big Cottonwood Creek – canyon	E	Stream and canyon	✓	Y
Little Cottonwood Creek – canyon	E	Stream and canyon	✓	Y
Dry Creek – Bell's Canyon	SE	Dry creek and canyon	✓	Y
Willow Creek – canyon	SE	Dry creek and canyon	✓	No
Jordan Narrows	SW	Gap	No	Y
Butterfield Creek – canyon	SW	Stream and canyon	✓	Y
Bingham Creek - canyon	W	Dry creek and canyon	✓	Y
Harkers Creek - canyon	~~NW~~ NW	Dry creek and canyon	✓	Y
Ensign Peak	N	Hill top	✓	Y
Red Butte	N	Ridge	✓	Y
Grandeur Peak	N	Summit	✓	Y
Mount Olympus	N	Mountain	✓	Not on top
Twin Peaks	E	Peaks	?	Not on top
Lone Peak	SSE	Mountain peak	✓	Not on top
Mt Timpanogos	S	Mountain	?	Yes
Lewiston Peak	W	Summit	?	No
Flat Top Mountain (the highest)	W	Summit	?	No
Bingham Canyon Copper Mine	W	Human made feature	✓	Yes
Farnsworth Peak (KSL towers)	NW	Summit, ridge	sort of	No

LOCATION within Salt Lake County.
(1) Show your school on this map. (2) Draw the valley – mountains boundary; (3) Label: Great Salt Lake, Wasatch Range, Oquirrh Mountains. (4) Highlight: the Jordan River





LOCATION on a profile across the County.
Show general location of your school and your landmark.

YOUR ~~SCHOOL~~ location's NAME... Flat Iron Mesa Park

What county? Salt Lake County. **What State?** UT. **What continent?** North America of Planet Earth

Describe its location: East bench - Salt Lake County - on shelf of bench between mountains & valley. "Mesa" not descriptive but a bit old. 86th South 17th East.

GENERAL CHARACTERISTICS... some OBSERVATIONS and interpretations.

In your own words, write three phrases or sentences that describe the shape of your landmark:

1. Shaped like an iron ... a flat iron to iron clothes. Why so flat?
2. It's higher than its immediate surroundings.
3. It's similar to other features such as to the north & east of it - many flat, sloping slightly to the west, and higher than valley.

Does your school's name or name of the city it is in give clues to what kind of landform it is? Yes __; No __. If so... how? FLAT and like a flat iron

Mesa meaning like a table. Sandy, UT - Sandy soils.

Remind me... what is RELIEF?

Differ in elevation between two locations.

Is local relief at your location: steep ___; moderate ___; gentle ___?

gentle on top; steep on sides.

What landform(s) lie at the base of your school's neighborhood? For example, a stream channel, or... nothing, it is the lake bottom. Stream channel; valley floor.

Is your school on the west ___; or east ✓; side of the Jordan River?

Is it on: the valley floor ___; the foothills ___; the mountainous areas ___.

boundary - on bench.

Regional relief:

The highest point of the Wasatch Range in Salt Lake County is 11,489 ft a.s.l. near Snowbird.

The highest point of the Oquirrh Mountains is Flat Top Mountain, 10,620 ft a.s.l.

The low point of the lake bottom of Great Salt Lake is 4170 ft a.s.l.

Therefore regional relief is pretty great across the county... over 5000 ft across 10 miles or so.

Is regional relief higher ___; or lower ___ on the east than the west side of the valley?

CLUES TO CHANGE... some OBSERVATIONS and interpretations.

Is your school mostly loose material/sediment ✓; or bedrock/firm coherent Earth's crust __?

Could you dig a basement there, Yes ✓; No __? Or would you need to blast it? Yes __; No __.

How resistant is this site to erosion? Difficult to erode __; moderately easy __; easy to erode ✓.

Is it on east side of the Wasatch fault zone ___; or the west side ✓?

Is it on the east side of the West Valley fault zone ✓; or the west side ___?

Therefore... this location is in the Rocky Mountain Physiographic Province ___; or Basin and Range Physiographic Province ✓?

ATTACH THREE MAPS – IMAGES... instructions on next page.

(1) Map from Google Maps ✓ elevation = 4500 ft a.s.l.

(2) Image from Google Earth ✓ elevation = 4780 ft a.s.l.

(3) Map from USGS national atlas web site that shows contours ✓

You may also want to print off areal photo map of your school from USGS national atlas site ✓

INSTRUCTIONS:

(1) Google Map: should be easy. Google "Google Maps." Type in name of school. Print map.

(2) Google Earth: this is a GREAT program to have on your computer. It takes a little bit of time to figure out how to zoom in. If you're lucky, you can "fly" to your school, meaning, on the upperleft of your screen, you can type in your school's name and Google Earth will fly you there. Print image. Label your school if it isn't labeled by Google Earth. *Scroll your cursor across your school and you'll see its elevation.*

(3) ... and this is more frustrating but hopefully you'll use this topo map site again and again. Print off a USGS contour map of your landmark and interpret the elevation of your landmark from the contour map.

Go to: http://nationalatlas.gov/natlas/NatlasStart.asp
Towards the right, upper, press FIND
Then enter your school's name, for example, Wasatch Elementary, 84102
And there it is. You may not be so lucky. If your school is not "found" ... enter Salt Lake City, or Alta, or Herriman, whatever community is near to your landmark.
Then click on... SHOW TOPOGRAHIC MAP
And you are in business!!
Change the detail setting so it's next to the maximum detailed (Do this by recognizing the IN-OUT bar to the left of the screen, choose the next to most "IN" setting)
If you have to... move around the map (use arrows at side and corners) until you like your map
PRINT the map. (This can be tricky). First click on PRINT. Then... make sure you click the "Send to Printer" button above the map. CONGRATULATIONS...
If you feel like it, then, just for fun, click AERIAL PHOTO and find your school. See any gravel pits near by, or see any faint shading that indicates shorelines??
Leave the program.

On this map, TRACE WITH DARK LINE(S) or colored pencils THE logical contour(s) that bracket your landform. Figure out the elevation:

STAPLE YOUR MAPS to this HOMEWORK ASSIGNMENT... and congratulations!

NOTE: this homework exercise is about your school. Your final assignment will be to tell the story of change for a landmark you can see from your school. Notice how you may want to come back to this site and find information about your landmark using these web sites... for maps and images and elevation information.

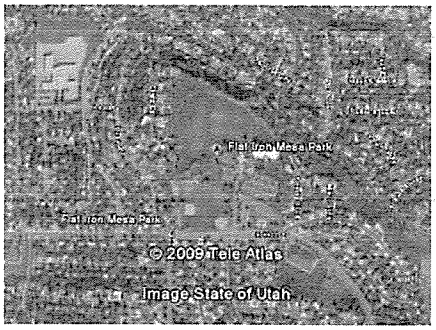
Google maps **Flat Iron Park, near Sandy, UT**

A. **Flat Iron Mesa Park**
1800 E 8600 South, Sandy, UT

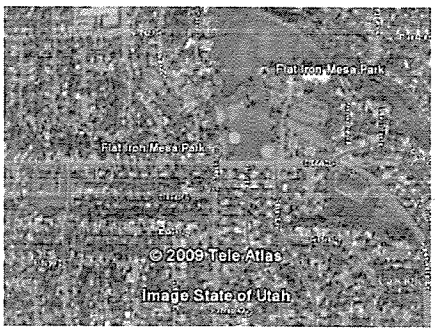
B. **Flat Iron Mesa Park**
1700 E. 8600 South, Sandy, UT -
(801) 568-2900
1 review

Flat Iron Mesa Park, Sandy, Utah (1 - 2)

Flat Iron Mesa Park
A Park with a nice walking/running track, and a great sledding/tubing...



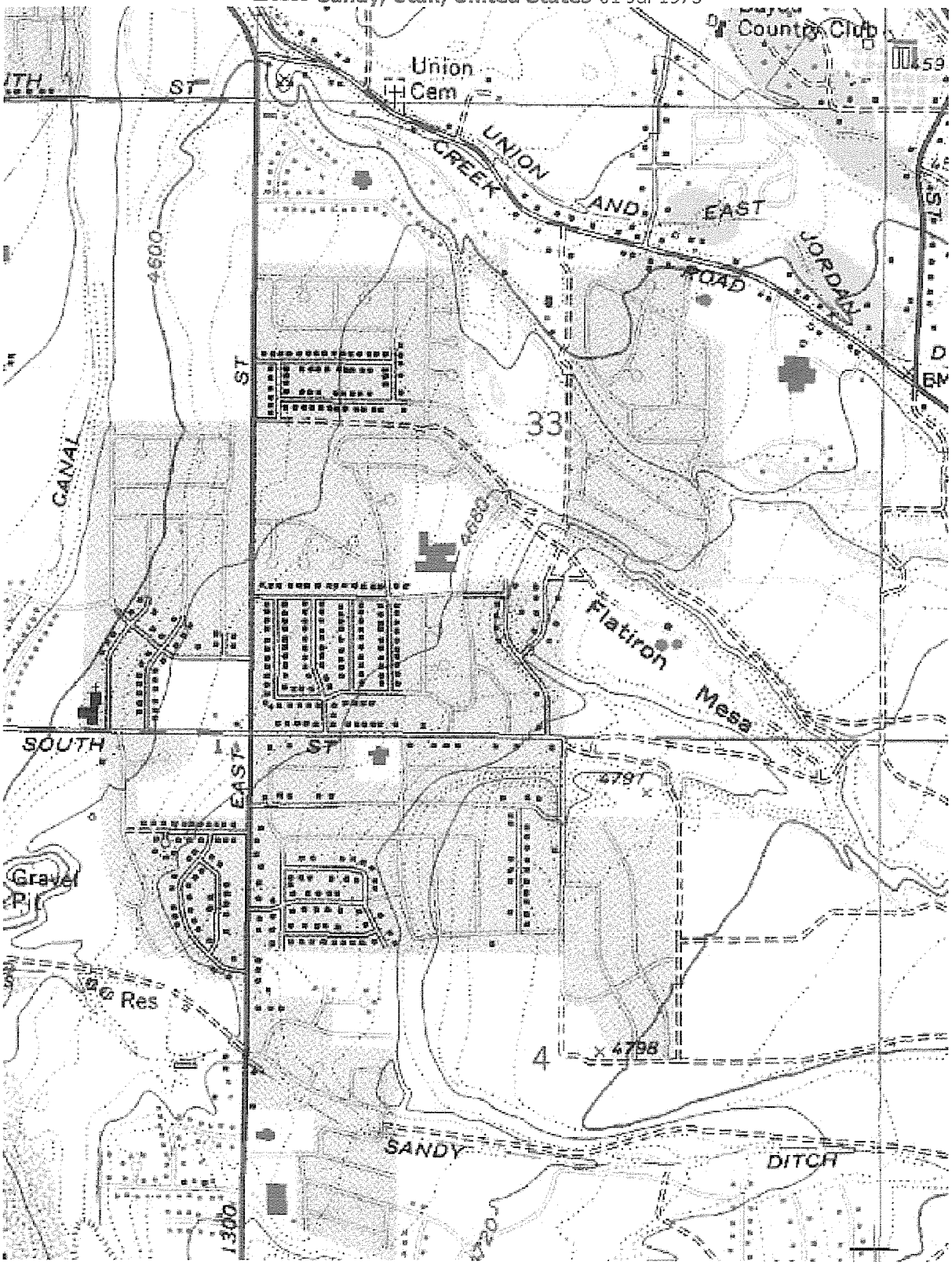
Flat Iron Mesa Park
1700 E. 8600 South, Sandy, UT 84093
(801) 568-2900



Also from Google Earth.

When I put the hand on the place we're meeting at, I can look at the bottom of the image and it reads the latitude / longitude as "4793 ft"

USGS Sandy, Utah, United States 01 Jul 1975



From National Atlas Web Maps.

Day #2 STORY #1

CHANGING SURFACE OF SALT LAKE COUNTY AS SEEN FROM SILVER HILLS ELEMENTARY SCHOOL. By Genevieve Atwood, Jun 12, 2004

Silver Hills Elementary School is located about 50 blocks west and 50 blocks south of downtown Salt Lake City. There are about 7 blocks to the mile in Salt Lake County, so downtown Salt Lake City is about 7 miles north and 7 miles east of Silver Hills Elementary School. On a good day, it is easy to see the tall buildings of the city center. Silver Hills has a magnificent view of the Wasatch Range and the Oquirrh Mountains. Silver Hills is about the same distance from the Jordan Narrows, at the south end of Salt Lake County. This central position on the west side of the valley gives Silver Hills one of the best views of geology in the United States of America.

This story is not about the rock units that make up the mountains, but I will digress to mention that all three bedrock types can be seen from Silver Hills, and rocks of every major era of geologic time. Even more impressive to me are the array of landforms that can be seen from the school grounds. Utah has three of the major physiographic provinces of the United States. A physiographic province is a region whose landforms and general geology contrast with the regions that surround it. Utah's three physiographic provinces are the big bold red Colorado Plateau, the magnificent high rugged country of the Rocky Mountain province, and the subtle barren beauty of the Basin and Range province. Two of those provinces and their landforms are seen in their contrasting character from Silver Hills Elementary School.

The Wasatch Range lies along the western boundary of the Rocky Mountain Physiographic Province. Its mountains are massive with name like Mount Olympus, Grandeur Peak, and Lone Peak. Rivers drain the mountain watersheds and flow year-round, except where they are diverted for human use. The mountain front is abrupt.

The boundary between the Rocky Mountain Physiographic Province and the Basin and Range Physiographic Province in Salt Lake County is defined as the Wasatch fault. The Wasatch fault is a significant feature of Earth's crust, a world-class fault with the tall, handsome Wasatch Range to the east and the broad Salt Lake Valley and Great Salt Lake to the west. The Oquirrh Mountains, Stansbury Island, and Antelope Island are mountain ranges typical of the Basin and Range. Unlike the massive, broad mountains of the Rocky Mountains, the Oquirrh Mountains, Antelope Island and Stansbury Island are long north-south and thin east-west. They look non-descript in comparison to the handsome Wasatch. They are not as tall. Their rocks are gray and tan. They do not have major streams that flow into the valleys. The valleys are much broader than the ranges. The region is dominated by erosion and sediments fill in the valleys. It is as though the mountain ranges of the Basin and Ranges are being drowned by sediments eroded from the ranges.

Some of those sediments are associated with Lake Bonneville, the Ice Age lake that occupied most of western Utah about 15,000 years ago. At its highest lake levels is was about the same size as today's Lake Michigan. Silver Hills would have been underwater when the lake was at its deepest, and would have been lake shore property at one of the most important levels when the lake was at about 4700 – 4800 ft a.s.l. The highest lake level can be seen as a natural bathtub ring along the Oquirrh Mountains and can be seen all the way around Salt Lake Valley, along the Wasatch Range and even on Antelope Island.

CHANGING SURFACE OF SALT LAKE COUNTY as told by an imaginary brick of Silver Hills Elementary School and a piece of sand on the hill slope north of the school parking lot.
By Genevieve Atwood

Brick: Hello. I'm kind of new around here. Any way you can fill me in on what goes on around here, long term. I don't mean the day to day activities of the school. I mean the really long story, the story of change.

Sand. I can try, but I don't know all the story myself. I'm really not that old myself if you count the time since I've been this size and this shape and been in this place. You know for the really long story you need to talk to the bedrock. It's been here a long long time, even before the valley and the mountains. That sounds weird at first because you might think that the mountains and what they are made of would be the same age, but it isn't that way. The bedrock has to be here and then the mountain. I kind of know the story because many many years ago, like about 100,000 years ago, I was part of that bedrock. It's been downhill ever since. Ho ho ho… did you get the joke. Ho ho ho.

Brick. Hey come on. I really want to know the story of what goes on here. I know you've had an interesting journey on the rock cycle, and sure, I want to hear about that some time. But I want to hear about what happens here. Frankly, I want to know what may happen to me.

Sand. Ok. I'll tell you what I know. But it won't be everything you want to know because you sound really really curious and I only know a part of the story.

I'll divide the story into two kinds of events… earthquakes and climate change. Earthquakes really crack me up ho ho ho ho.

Brick. Give me a break, ho ho ho…. They don't crack you up you're too small.

Sand. That's true… they just give me a good jolt with the rest of the scene. You'll feel it, and you should do just fine, too, because you're built right. We have a good look at the rest of the valley. I'd like to know just what will happen, but scientists haven't been able to answer my questions. Perhaps some of the kids in the school will grow up to be geologists and work it out. I know the really big jolts don't happen often, like they happen only hundreds of years apart and they involve how this valley is formed over time. Like big time. I know that's how the valley gets a little wider and drops down little by little. Pretty amazing.

But I want to change the subject. I want to talk about climate change. It's really cool ho ho ho ho.

Brick. Good grief.

Sand. The story of climate change I really know about. I used to be a part of bedrock of the Oquirrh Mountains. Then, as I said, I got nicked off by some traveling wild horse and began my journey to where I am now. I was about three miles up hill and was carried by flash floods. It was a climate like this and I hung out in the channel except those few times when I was carried, whoosh a mile or so down hill by a flash flood. I was pretty sure I was going to be part of an alluvial fan, but surprise!!

About 30,000 years ago, climate got colder and wetter. The lake out there got higher and higher. There was lots of snow. I could see the glaciers in the canyons. It was really cool to see

the glacier come out of Little Cottonwood Canyon, right to the mouth, can you see where it was and what fed it?

I was higher on the hill and, wow, I was in the wave zone. That is the neatest time of my entire career. I was swept along by waves and currents and moved again and again. At one time a lot of us were swept down here and got reworked into this shoreline. It was beach front property. I liked that. I could see nothing but lake all the way to the east side. When we have a weather inversion and fog I think about those times.

Brick. Hey quit dreaming. Tell me about change today.

Sand. Well I won't be your neighbor for long. This gully is going to take me out!! Bye Bye. Been great knowing you.

Silver Hills Elementary

USGS **West Valley City, Utah, United States** 01 Oct 1997

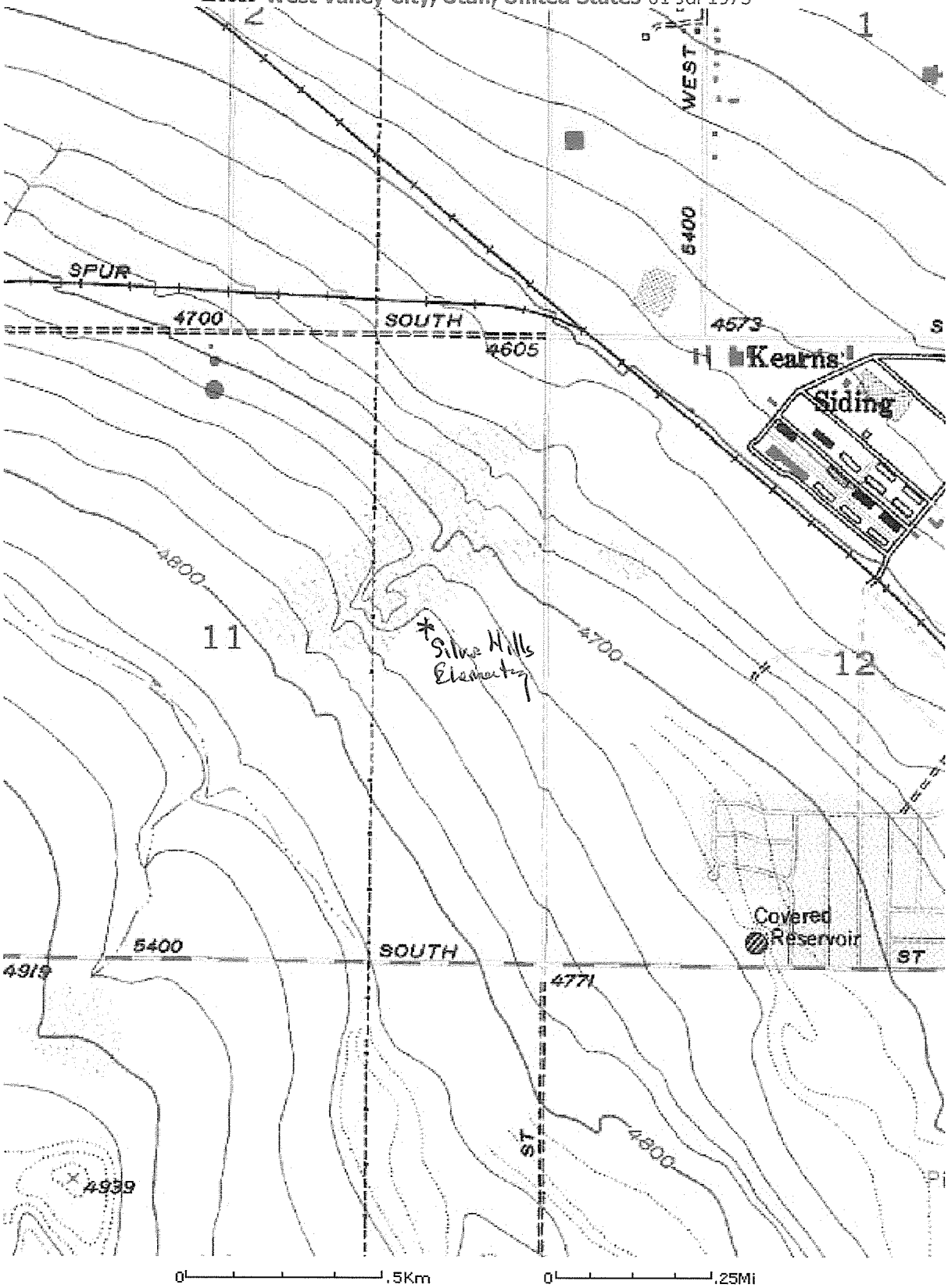
FIND SILVER HILLS

FIND
SILVER HILLS

from Google Earth
(elevation ... 4765 ft a.s.l.)

Silver Hills Elementary

USGS West Valley City, Utah, United States 01 Jul 1975

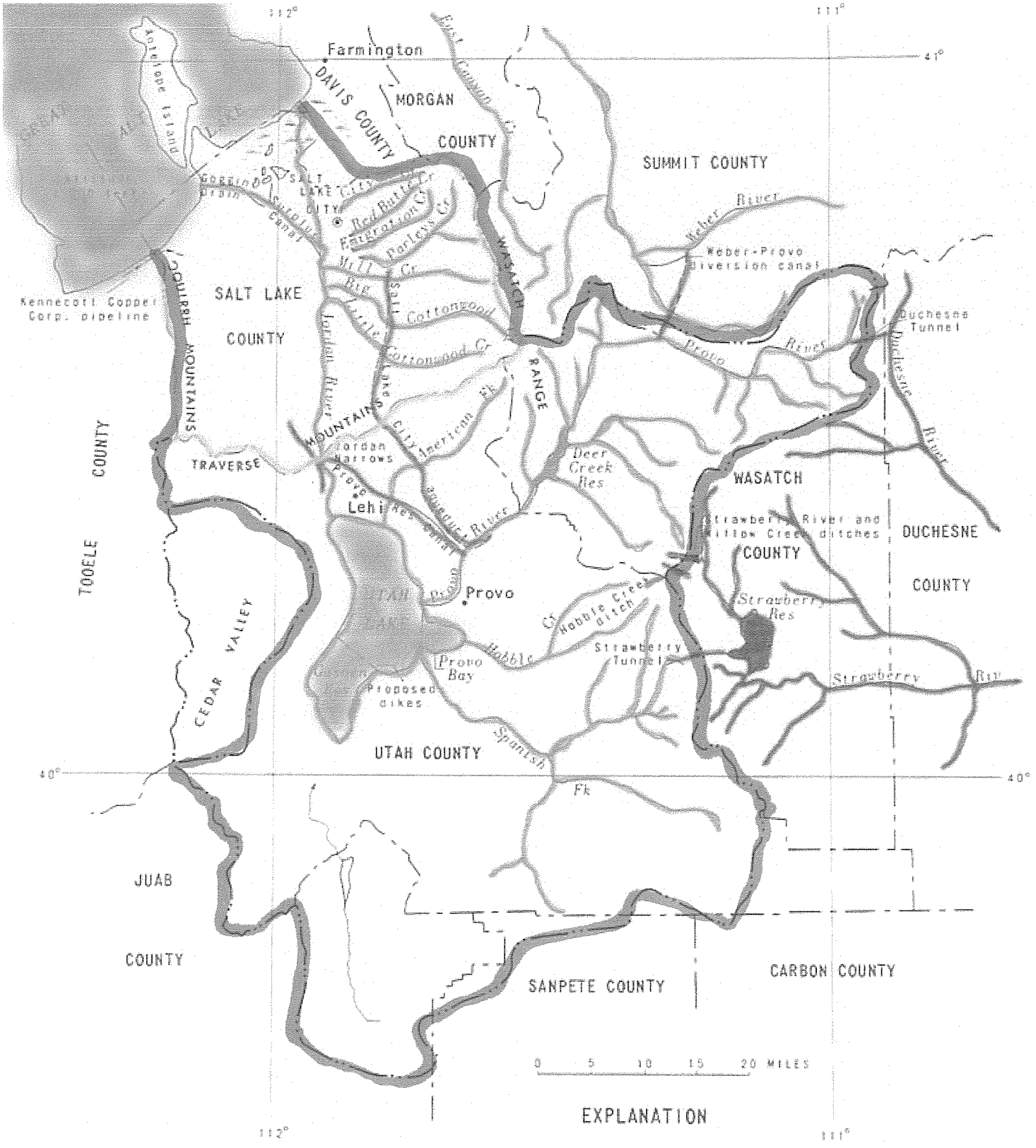


Look Around You
See Landforms

Day #3

Changing surface of Salt Lake County… beginnings of an imaginary interview of the Jordan River by a cub reporter.
By Genevieve Atwood.
Purpose… link landscape change, the water cycle, and social science.

I. Good morning Jordan River, may I call you Jordan?
J. Of course.
I. Thanks for taking the time for this interview. I'm writing a story about the changing surface of Salt Lake County, and Genevieve Atwood said you'd be a good river to talk to. Remind me, what's your job anyway?
J. My job is to carry water and sediment of the entire watershed of the Provo River and drainages of Salt Lake County to the Great Salt Lake. Put another way, my job is to be part of the team that planes down the continent to sea level. But here in the Basin and Range I can only do part of the job because rivers here don't make it to the ocean.
I. I'm not sure I understand. What's the problem?
J. Most places have rivers and streams, called drainages, that are connected to each other and flow to the oceans. Great Salt Lake has no outlet. It's the lowest place I can flow. It's kind of frustrating but that's my job so I do it as well as I can.
I. You do this all by yourself.
J. Oh no. Sorry if I misled you. I'm part of a team. Technically my work starts in Utah County at Utah Lake. The Provo River is in charge of erosion and sediment transport to Utah Lake. There are a couple major rivers into Utah Lake… such as American Fork River that flows from Mount Timpanogos area. I also work with a team of streams in Salt Lake County: you may know some of the larger ones, particularly those that drain the Wasatch Range. Little Cottonwood is my favorite co-worker. It brings some interesting minerals. Years ago, pioneers floated granite blocks downtown from there. I wonder what happened to them. My least favorite colleagues are the storm drains. They carry water from the streets. You'd think it would be clean, but sometimes I get a jolt of oil. That does terrible things to the biology along my banks. Oh, and I try to appreciate the sewage treatment plants but they can be pretty stinky. They've helped the valley clean up its act and they provide good water. They're pretty underappreciated as a source of good water.
I. How about the west side?
J. I don't get much help from there. The Oquirrh Mountains just don't get the precipitation as rain and snow, so they don't send me much water in streams. But they send me some groundwater that has seeped into the land surface and it comes out into my channel as springs. These days there's a big controversy about the chemicals they may send my way via the groundwater. You'll here more about that, I bet.
I. So there's controversy?
J. Yes, there's a controversy about environmental issues and I'm part of the environment. Some folks think I'm an oasis, a place of beauty and quiet. Others think I'm a great place to get rid of sewage and chemicals.
I. What's the favorite part of your job?
J. I love to flood… but that gets me in trouble. They send people to straighten me out and control me…. Do you know how that goes…?



Base from U.S. Geological Survey State base map, 1959, scale 1:500,000

DNR Tech Pub 31, 1971. Water resources of Salt Lake County

Figure 2.—Jordan River basin.

Send To Printer Back To TerraServer Change to 11x17 Print Size Show Grid Lines Change to Landscape

USGS **Murray, Utah, United States** 04 Oct 1997

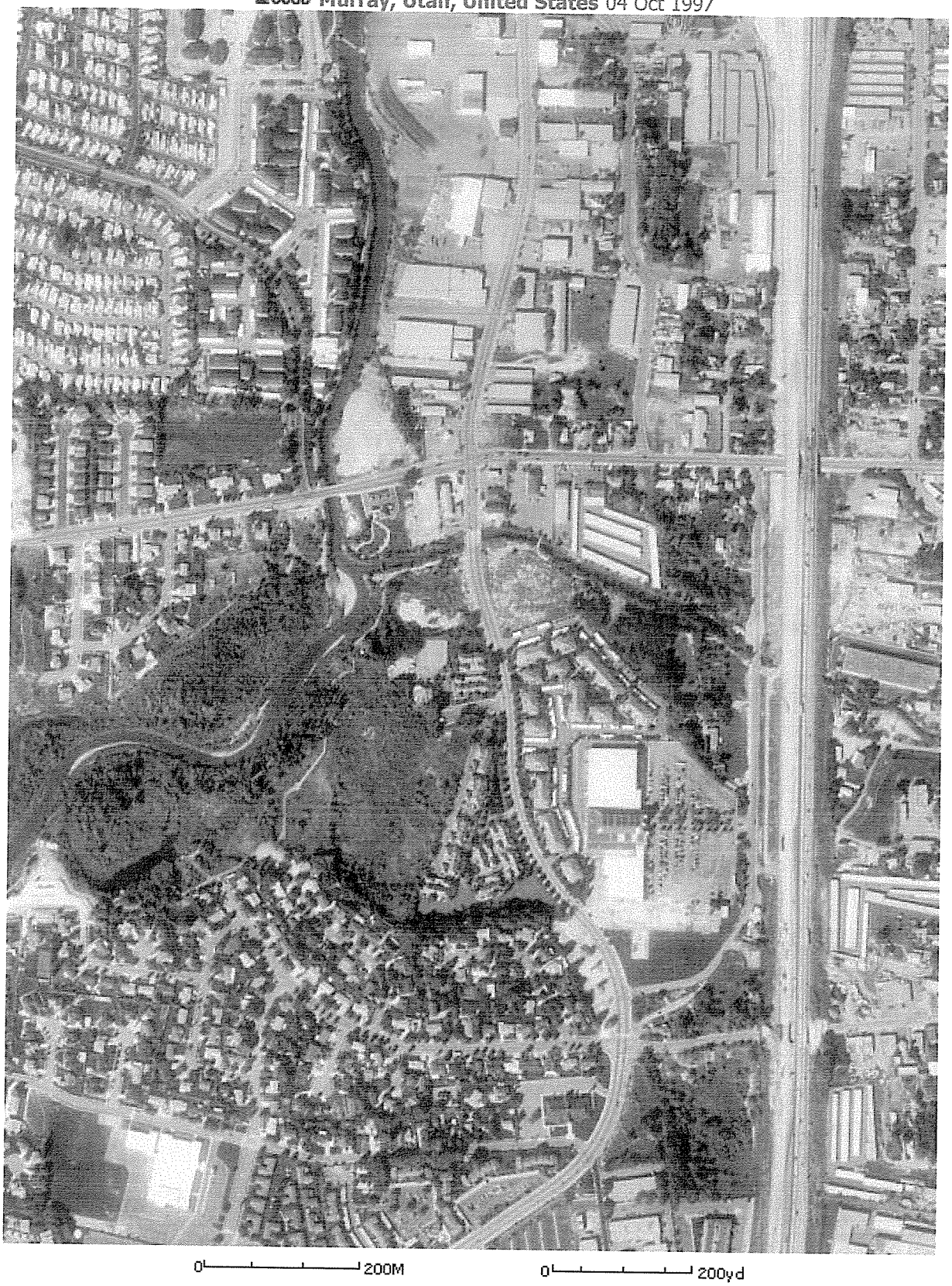
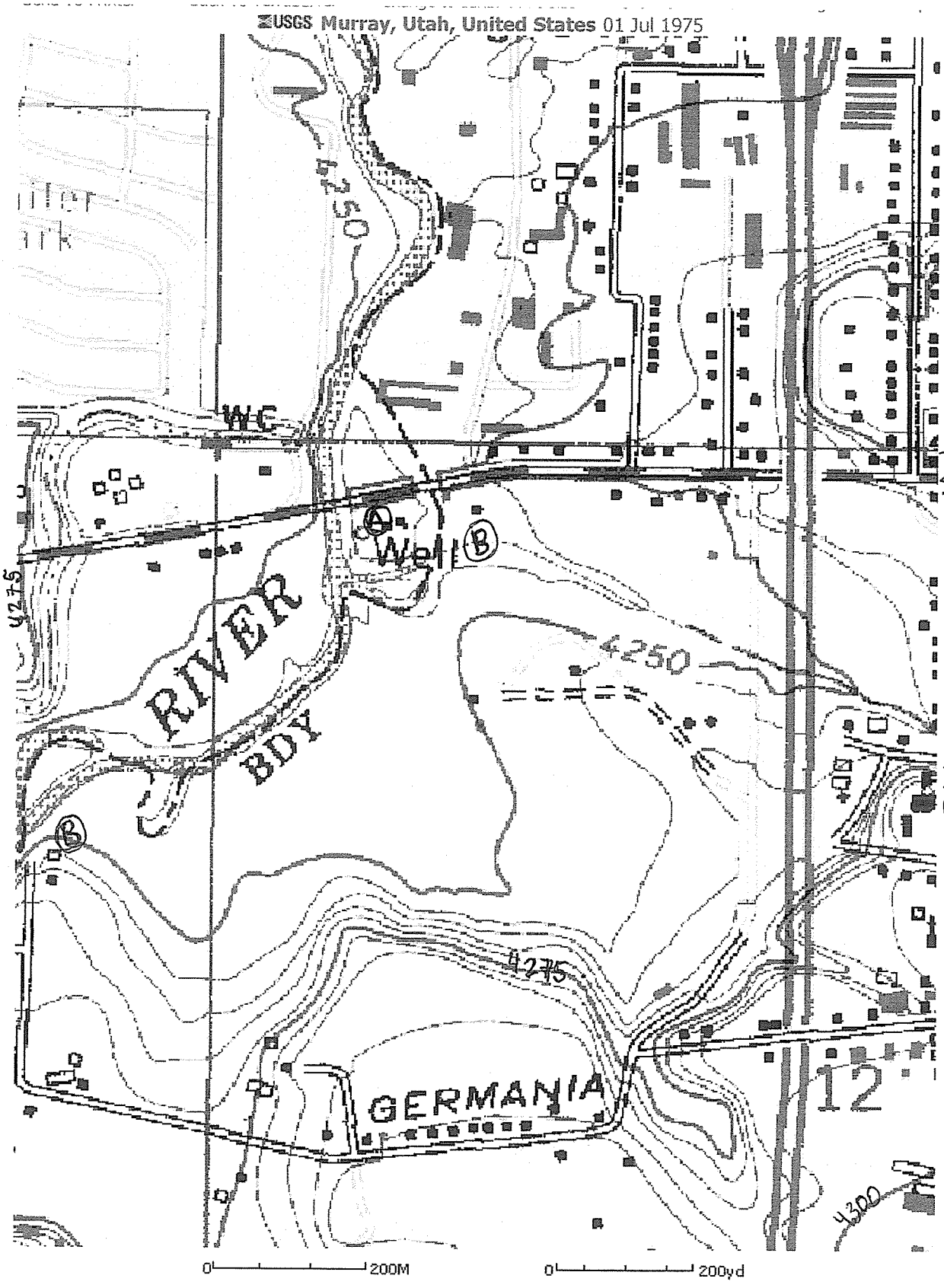


Image courtesy of the U.S. Geological Survey

Google Earth ... find Arrowhead Park.



① LABEL Arrowhead Park

② HIGHLIGHT in blue the Jordan River - note there are 2 channels!!

← 4800 S

Ask yourselves why 2 channels?

BDY = boundary. MURRAY is east of the Jordan River.

Is Arrowhead Park in Murray? Why??

③ Highlight the 4250 ft contour

④ Highlight the 4275 ft contour

⑤ Give elevations for:

Image courtesy of the U.S. Geological Survey

(A) ____ ft a.s.l.

(B) ____ ft a.s.l.

(C) ____ ft a.s.l.

Day #5

CHANGING SURFACE OF SALT LAKE COUNTY witnessed at Silver Lake, Brighton, UT

Brighton, Utah is located in the Rocky Mountain physiographic province of the North American plate, on Earth's crust. In this region's geologic past, tectonic forces of long ago, of dinosaur time, caused thickening of the crust and uplifted the land surface. That land surface was eroded long ago. Although those chapters of Utah's geologic past are long over, the region stays elevated due to isostasy and erosion and deposition continue to sculpt the region's surface. The Rocky Mountain physiographic province floats like an iceberg. It generally is a stable region in contrast to the active spreading of the Basin and Range due to extensional tectonics. The Wasatch fault zone runs north south along the Wasatch Front and is only a dozen miles west Brighton. The downdropping of Salt Lake Valley due to extensional tectonics results in extreme topographic relief, about a mile of elevation difference from Salt Lake City to Brighton. Steep relief means aggressive erosion.

Because the Wasatch Range is (a) elevated, (b) on the windward side of the Rockies, and (c) downwind of Great Salt Lake Brighton experiences a montane climate characterized by abundant winter snowfall (over 500 inches of snow) and moderate summer rains (about 15 inches of summer rains). Abundant precipitation and rugged relief due to tectonics assure aggressive erosion. We'd expect exposed bedrock scraped and washed clean of sediments, and we'd look for where the sediments have been deposited.

Two contrasting climate modes characterize northern Utah's climate of the past few million years and these climate modes are characterized by different types and timing of precipitation and drive different processes of erosion and deposition. Glacial climate of glacial oxygen isotope stage #2, called the Ice Age was characterized by climate 5 to 10 degrees colder than interglacial oxygen isotope stage #1 climate characteristic of our climate. Glacial climate during the Ice Age also was wetter, probably 2 to 5 times wetter than today's interglacial climate. During interglacial time such during the 20th Century, (a) water of mountain streams is the major agent of geomorphic change followed in order of importance by (b) ground failure, (c) glacial ice of cold climate excursions during interglacial time, and (d) human activities such as mining. Erosion by wind is negligible. During glacial times of the Ice Age, (a) glacial ice is the major agent of geomorphic change followed by (b) water of mountain streams and (c) ground failure. Sediments eroded in the canyons are carried, deposited, and reworked as they travel toward Salt Lake Valley and the Great Salt Lake.

Almost every landform that can be seen from Silver Lake owes much of its shape to glaciation. Bedrock dominates the landscape where moving glaciers scraped it clean and gouged into it. Some rock debris was carried short distances and deposited as lateral moraines such as those northwest of Silver Lake now covered by aspen groves. Other Ice Age glaciers carried debris to the confluence of the glaciers about a third of the way down the canyon from Brighton to the mouth of Big Cottonwood Canyon. Other glaciers, very small ones of wet cold periods of interglacial time, perhaps as young as 3,000 years ago carried debris less than a mile from the high peaks. One small moraine, less than 20 ft high, is visible on the north side of Silver Lake. During the next major glacial stage, this moraine will be wiped out by a large glacier. Moraines are evidence of glacier fields that advance and retreat. Evidence of small glaciers, for example those in response to cold climate excursions of interglacial time, are eradicated by large glaciers. The largest glaciers of the Ice Age were over 1000 ft thick. These glaciers plucked loose rock from bedrock, gouged out small lakes, scraped rock against rock leaving scratches called striation, leveled off mountains they rode across, and made steep the highest mountain peaks that stuck above the ice level.

Today, Brighton, Utah experiences interglacial climate. Silver Lake and other lakes gradually fill in with sediment carried in by streams and by vegetation that grows thick along shore. During the winter,

the area has some of Utah's Greatest Snow on Earth. Interglacial climate has been the norm for the past 10,000 years. However, from about 30,000 years ago to about 13,500 years ago the wet, cold climate of glacial times that caused the rise of Lake Bonneville also caused the accumulation of snow and ice that became the glaciers of the Wasatch Mountains. The global, glacial, oxygen isotope stage #1 Ice Age was preceded by perhaps as many as 40 alternating interglacial and glacial stages of the past four million years.

In summary: Landforms of the Brighton area owe their steepness and shape to the erosional and depositional activities of glaciers, mountain streams, and ground failures including landslides, rockfalls, debris flows and landslides. These agents of geomorphic change are characteristic of high mountainous terrain of the Rocky Mountain physiographic province of mid-latitude North America. Glacial and interglacial climate of the past few million years alternately brings climate such as today's montane climate and Ice Age glacial climate. The high mountainous terrain of the Rocky Mountain physiographic province stays elevated due to isostatic forces. The region is tectonically stable; the chapter of tectonic compression that raised the region during dinosaur time is long over. Extensional tectonics and spreading of the Basin and Range downdrops the Salt Lake Valley creating the Wasatch Front. Thus the greatest snow on Earth is indirectly a product of the Wasatch fault and its predecessors. The great relief between the mountain tops of the Wasatch Mountains and the valley floor of Salt Lake Valley not only is responsible for the Greatest Snow on Earth but also causes rapid erosion and dramatic deposition of sediments down slope. As for Ice Age Lake Bonneville, that lake and the glaciers of the Wasatch Mountains both resulted from changed climate. It is not true that the melting of the glaciers filled Lake Bonneville. Ice Age Lake Bonneville and the Ice Age glaciers of the Wasatch and Uinta Mountains helped sustain each other. The lake effect of Lake Bonneville fed the glaciers and annual outwash from the glaciers contributed to Lake Bonneville. Won't it be interesting to see effects of future climate change on precipitation and on landforms?

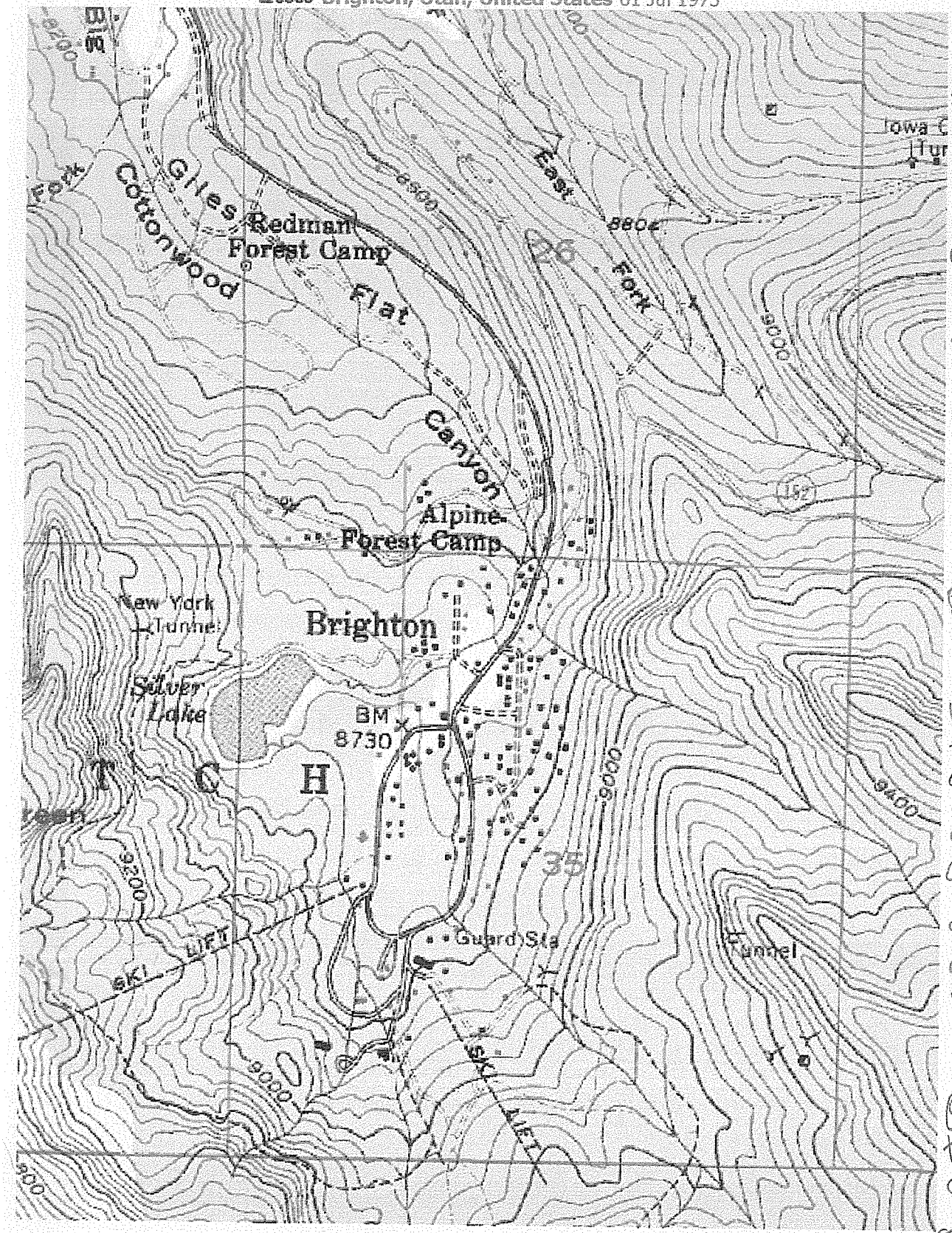


Image courtesy of the U.S. Geological Survey

(1) LOCATE our meeting place on the map.

(2) "B.M." means benchmark - a surveyed elevation

What is the elevation of our meeting place.

(3) How many contours are there between the 9000 contour and the 9200 contour? (Southwest part of map)

So... each contour interval is _____ ft.

(4) HIGHLIGHT the 8600 ft contour.

(5) What is the elevation of Silver Lake?

BRIGHTON – Information Center at Silver Lake

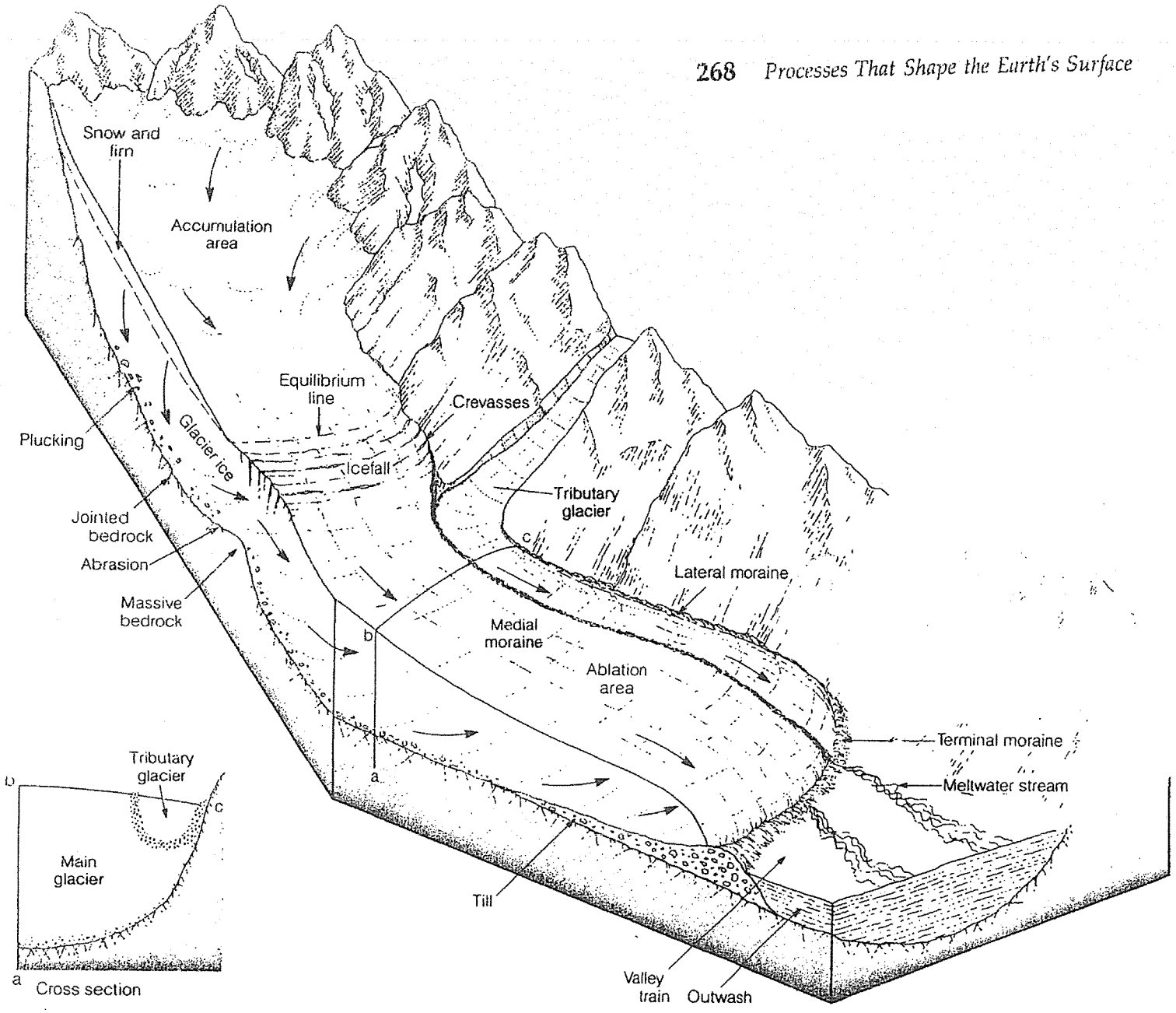


FIGURE 12.6 Main features of a valley glacier and its deposits. The glacier has been cut away along its center line; only half is shown. Crevasses form where the glacier passes over a steeper slope at its bed. Arrows show directions of ice flow.