

A. B. Larson Resurvey

Mr. A. B. Larson made a survey to re-establish "compromise level" in 1939 under the general direction of Mr. W. D. Beers, City Engineer.

Mr. Larson's survey is described in his report, given in full in our "papers and Documents" file on pages 121 to 136.

A comparison of results between Larson's survey and the original Doremus survey is given as follows (Papers and Documents, page 136):

COMPARISON OF U.S.G.S. ELEVATIONS OF 1922 & 1923
WITH PRESENT ELEVATIONS JUST COMPLETED
MAY 1939

"In 1922 and 1923 the U.S.G.S. established the bench mark at Lehi located about 600 feet south of the D. & R.G.W. Station with an elevation of 4551.025.

"At this time they also determined the elevation of the white sandstone monument at the pumping plant at the head of the Jordan River, the elevation being 4494.973. The difference in elevation of these two monuments at that time was therefore 56.052 feet.

"In our elevations just completed, based on the original Doremus datum, our elevation of the Lehi monument H-1, 1922 was found to be 161.961 and our elevation of the white sandstone monument at the pumping plant was found to be 105.611 showing a difference in elevation of 56.350 feet.

"The white sandstone monument has therefore settled 0.298 feet since 1922.

"At the same time that the above work was done, the U.S.G.S. determined the elevation of the Knight monument at the pumping plant to have an elevation of 4491.996 which is 59.029 feet lower than the Lehi monument H-1, 1922.

"Our elevations just completed show that the Knight monument at the pumping plant is 59.147 feet lower than the Lehi monument H-1 - 1922. The Knight monument has therefore settled 0.118 feet since 1923.

"The U.S.G.S. at this time also determined the elevation of the U.S.G.S. Gaging Station monument located 100 feet west of the gate leading to the pumping plant and 60 feet east of the bridge over the Jordan River and found this elevation to be 4492.336. This bench mark was therefore 58.689 feet lower than the Lehi monument H-1, 1922.

"Our elevations just completed show that this monument is 38.742

feet lower than the Lehi monument H-1, 1922 which indicates a settlement of the Gaging Station monument since 1923 of 0.033 feet.

"In April 1935, C. V. Gardner took elevations on the Gaging Station monument located 100 feet west of the gate leading to the pumping plant and also on the white sandstone monument at the pumping plant and found that the white sandstone monument was 2.429 feet higher than the Gaging Station monument. Our elevations just completed, show that the white sandstone monument is 2.392 feet higher than the Gaging Station monument which indicates a settlement of the white sandstone monument since April 1935 of 0.037 feet.

"In 1914 Collier took an elevation on a U.S.G.S. monument set on a point of a ridge about 1100 feet east of the pumping plant; he also took an elevation on the white sandstone monument at the pumping plant. These elevations show that the white sandstone monument at the pumping plant was 0.755 feet lower than the U.S.G.S. monument at the point of the ridge.

"In 1935, C. V. Gardner took elevations on these same two monuments and found that the white sandstone monument at the pumping plant was 1.179 feet lower than the U.S.G.S. monument on the point of the ridge which indicates a settlement of the white sandstone monument between 1914 and 1935 of 0.424 feet.

"The following is a copy of a letter written by A. B. Purton to W. A. Knight, January 19, 1939:

'I have been comparing the level notes attached to your letter of August 4 with the results of previous levelling from 1916 to date.

'The elevation of the Lake monument bench mark (copper bolt on the stone obelisk) tied into the 1914 adjustment of the Coast & Geodetic Survey precise level not by primary levelling in 1923 was 4494.973 feet above mean sea level. The elevation of the gaging station bench mark as determined at the same time was 4492.336 feet above M.S.L.

'Using this elevation for the Lake Monument bench mark Jordan & Knight on April 14, 1916 (apparently before the station B.M. was installed) determined the elevation of the zero of the river gage to be 4484.54 feet.

'Later levelling using the elevation of the station B.M. as 4492.336 feet has given the following results for the elevation of the zero of the river gage:

Dickson	Dickson	Knight	Wilson	Bev. & Cottrell
11-12-20	5-15-22	9-20-28	10-15-28	8-3-35
4484.546	4484.546	4484.546	4484.536	4484.571

'The 1933 leveling if we assume the elevation of the Lake Monument 4494.973 gives the elevation of O. of gage 4484.75 (In other words, I think the lake monument had sunk about 0.2 feet between 1923 and 1933).

'Comparing these results with Jordan's determination on April 14, 1916 leads me to the conclusion that the river gage has not moved and that it is safe to call the elevation of the zero of this gage 4484.54 above M.S.L.

'No one since Jordan in 1916 has been able to run between the Lake Monument and the river gage and check this elevation but all have been able to check the river gage from the station B.M. with differences ranging from -0.004 plus .031 of a foot from the elevation 4484.54 feet.

'If anything has moved the evidence seems to point to the Lake Monument as the 'guilty party'. While a movement of that monument may not be impossible there is also the possibility of errors in running the levels between the Lake and gaging station bench marks due to the longer line and more set ups.

'The Lake Monument B.M. has always been considered as 5.985 feet above 'Compromise'. Subtracting this amount from Harris' (1923) elevation of 4494.973 gives 'Compromise' elevation as 4488.988 feet above M.S.L. assuming that the Lake Monument had not moved. With that assumption and using the above figures the zero of the river gage is at $4488.988 - 4484.54 = 4.45$ feet below 'compromise'.

"We have, therefore, evidence from several sources, to prove that all the monuments at the pumping plant have settled since they were built, the only thing remaining is to determine the amount of the settlement.

"Proof that the Smith's Lake and Geneva Monuments are the same elevation now as when set by Doremus in 1895 is as follows:

"C. V. Gardner's levels which have just been completed, May, 1939, show that they are the same relative elevation within 0.006 feet, as reported by Doremus in his original notes of 1895.

"Collier's levels, run in 1914, show that his elevations are 0.488 feet above the Doremus elevations of 1895, but when he gets to the Jordan Narrows his elevations are only 0.124 feet above the C. V. Gardner levels, which are a reproduction of the original Doremus levels, showing that Collier's elevations gradually raise as they approach the narrows, the total raise between Geneva and the Jordan Narrows being 0.364 feet.

"The distance from Geneva to American Fork is approximately 1/3 of the distance from Geneva to the Jordan Narrows, his line would therefore have raised 1/3 of 0.364 feet or 0.121 feet between Geneva and American Fork. If Collier's line had been parallel to the Doremus and C. V. Gardner lines, his elevation of the American Fork monument would have been 177.230 plus 0.121 - 177.351, which gives a difference in elevation between the Geneva Monument and the American Fork monument in 1914 of 177.351 - 115.135 - 62.216 feet.

"In 1939, C. V. Gardner's elevations show a difference of elevation of these two monuments of 176.862 - 114.654 - 62.208 feet which proves definitely that there has been no change in the elevations of the Geneva or Smith's Lake monuments since they were set by Doremus in 1895."

LIST OF BENCH MARKS - SNAIL ISLAND TO JORDAN NARROWS

<u>DESCRIPTION</u>	<u>ELEV. BY</u>	<u>ELEV. BY</u>	<u>ELEV. BY</u>
	<u>DOREMUS</u>	<u>COLLIER</u>	<u>C.V.GARDNER</u>
	<u>1895</u>	<u>1914</u>	<u>1939</u>
Snail Island Monument (1889)	102.322	102.322	wrecked
Smith's Lake, north shore, 8" by 8" red sandstone, top about 3" above surface of ground rod point indicated by a cross out in top of stone, set by Doremus.	101.831	102.285	101.837
Geneva B.M. established by Doremus red sandstone 8" x 8" top 2" above ground surface rod point indicated by a cross cut in top of stone	114.647	115.135	114.654
U.S.Coast & Geodetic, V-17 about 2 feet East of R.W. fence on west side of track east of old Geneva Resort north of old gate.			114.315
U.S.G.S. B.M. 200 feet south of American Fork Station Bldg. set in 1910, no number, 18" west of concrete walk on west side of road.		177.230	176.862
U.S.G.S. B.M. H-1 - 1922 about 600' south of Lehi R.R. Station on east side of track 2 feet east of private fence.			161.961
B.M. on top of capped pipe set in concrete for State Road right-of-way marker on each side of Saratogo road about 90 feet south of intersection with Lehi Fairfield road top of cap about 4 inches above concrete.			115.532

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<u>DESCRIPTION</u>	<u>ELEV. BY</u>	<u>ELEV. BY</u>	<u>ELEV. BY</u>
	<u>DOREMUS</u>	<u>COLLIER</u>	<u>C.V.GARDNER</u>
	<u>1895</u>	<u>1914</u>	<u>1939</u>
B.M. top of concrete Sec. corner for sections 24, 25, 19, and 30 between range 1 E. and Range 1 W. T. 5 S. about $\frac{1}{2}$ mile east of pumping plant top of metal disk about 75 feet south of Main Saratoga Highway between new road and old road.			104.229
U.S. C and G. Survey V.M. K-41, 1934 at pumping plant head of Jordan River about 80 feet east of east bank of Jordan River and about 7 feet north of Brick store house building, concrete monument with metal disk in top.			104.992
Lake Monument set by Doremus in 1899 white sandstone set in concrete base, rod point in copper bolt set into the stone near its base $23\frac{1}{2}$ feet S.E. of red sandstone monument set by Utah Lake Commission in 1885.	105.985	106.277	105.611
	<u>ELEV. BY</u> <u>UTAH LAKE</u> <u>COM. 1885</u>	<u>ELEV. BY</u> <u>C.V.GARDNER</u> <u>1939</u>	
B.M.Red sandstone monument set by Utah Lake Commission in 1885 located 23.5 N.W. from white sandstone monument and 77.3 feet S.W. from the S.W. Corner of Shelton's House and 51.7 feet easterly from the N.E. Corner of pumping plant building.	104.500		104.102
B.M.Knight Monument, copper bolt set in concrete base 18" under surface of ground front of Shelton's house 35.5 feet south of south wall of house 50.8 feet Northeasterly of white sandstone monument.			102.814
U.S.G.S. B.M. Marked gaging station metal disc set in top of concrete post 100 feet west of gate leading to pumping plant 60 feet east of bridge over Jordan River about seven feet south of south edge of highway paving Saratoga road.			103.219

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<u>DESCRIPTION</u>	<u>ELEV. BY COLLIER 1914</u>	<u>ELEV. BY C.V.GARDNER 1939</u>
B.M. Yellow sandstone monument 8" x 8" rod point marked by cross on top of stone located 282.6 feet northeasterly from the north east corner of Steel Bridge over the Jordan River and the Lehi Fairfield road 3 feet north of fence on north side of road.	108.390	108.387
B.M. on the west side of old Indian Ford Dam red sandstone 8" x 8" on top found 6 inches underground about 45 feet west of the west bank of the river.	107.535	107.392
U.S.G.S. B.M. 2 inch galvanized pipe with cap marked U.S.G.S. 324-50, 4506.95 on the east bank of the Jordan River about 60 feet S.E. of the east abutment of the old Indian Ford Dam.	120.575	120.475
B.M. 4 inch pipe filled with concrete (concrete about 0.02' below top of pipe) east of old road west side of Jordan River about 300 feet west of Intake to East Jordan Canal elevation taken on top of concrete.	99.600	99.453
B.M. on weir crest of east 24 foot opening of new City Dam at the Jordan Narrows at the intake of the Utah and Salt Lake and the East Jordan Canals.	94.640	
B.M. on weir crest of west 24 foot opening of new City Dam at the Jordan Narrows at the intake of the Utah and Salt Lake and the East Jordan Canals.	94.640	94.543
B.M. Bronze cap on northwest cap of City Dam at Jordan Narrows marked with cross in top of cap.	105.047	104.923
U.S.G.S. B.M. H-3, 1922, metal cap set in top of concrete in S.W. Corner of new City Dam at the Jordan Narrows at intake to Utah and Salt Lake and the East Jordan Canals.		104.923
B.M. on top of coping directly over the rail ice breaker on the upstream end of center pier of twin arch bridge over the Jordan River about 100 feet down stream from the new City Dam.		99.513

CONCLUSIONS

"1 - the evidence heretofore outlined shows that the Snail Island monument had settled 0.69 feet in 1921 as indicated by levels run by Wentz and Knight. It is also shown by the Collier levels run in 1914 that the Snail Island monument had, at that time settled approximately one-half foot. It is also shown that the Snail Island monument is at present entirely disrupted and is lying on one side in the general neighborhood in which it was originally established. The red sandstone monument set by Doremus and DeMoisey in 1895 near the point at which the permanent Snail Island monument was established has also disappeared. There is no evidence as to when these monuments were removed from their original position.

"2 - It is definitely proven in this report that the Geneva and Smith's Lake monuments are at the same elevation as when established by Doremus and DeMoisey in 1895, and these are the only monuments connected with the original establishment of Compromise Level, that we have been able to find and as long as they are in the original position as established, they furnish sufficient information from which to permanently re-establish Compromise Level.

"On the list of bench marks attached, all the elevations shown are referred to the original Doremus and DeMoisey datum, 1895, when the original levels were run from the sandstone monument established by the Utah Lake Commission in 1885 to Snail Island, under orders from the District Court for the purpose of establishing Compromise Level at a point to be selected later. Under the Column headed 'Elevations by C. V. Gardner, 1939', will be found the true elevations of bench marks listed, as referred to the original Compromise Level of 100.0 feet assumed by Doremus and DeMoisey in 1895.

"3 - It is proven by the evidence in this report that the original red sandstone established by the Utah Lake Commission in 1885 and the white sandstone monument established by Doremus in 1899, under authority of the Board of Canal Presidents, both of which are located at the pumping plant near the head of the Jordan River, have settled and it is indicated that this settlement was commenced after 1916. The new levels as described under #2 show the true elevation of these monuments with reference to the original Compromise Level."