

APPENDIX I

REVIEW OF SELECTED HISTORICAL LITERATURE PRE-GAGED FLOOD EVENTS ON THE SKAGIT RIVER

SYNOPSIS BY CHAL MARTIN

Mr. Larry Kunzler has been accumulating a significant library of historical documents for years, and has posted most of them on his web page at www.skagitriverhistory.com. His document repository contains a wealth of information and can be easily accessed.

With regard to research on the historic floods of 1921, 1917, 1909, and 1897 (and even further back to approximately 1856 and 1815), authors of numerous technical reports produced over the years have accessed available historical documentation to add context and perspective to the results obtained by various technical analyses. This appendix will list the documents often cited and provide some discussion of each. This is not a complete discussion but we believe it is important to include a synopsis of the historical documents as an appendix to the main report to provide a point of departure for the user to conduct additional review of the written historical record.

To begin, it is important to note that any Skagit river flood with a peak discharge in the range of 150,000 cubic feet per second and an average 24-hour flow in the range of 130,000 cubic feet per second puts today's downstream levee system at risk of failure. Since the levee system has been continually strengthened, past floods of this general magnitude were considerably more likely to cause levee failures than at present. An average river flow of 130,000 cubic feet per second generates three acre-feet per second (there are 43,560 cubic feet of water in one acre-foot); 180 acre-feet per minute; 10,800 acre-feet per hour; and 259,200 acre-feet per 24 hour period. Since there are 640 acres in a square mile, 260,000 acre-feet is enough water to cover 40 square miles (about the size of the entire Skagit river flood plain) over 10 feet deep. Therefore, even these "smaller" floods can cause significant and widespread flooding if the levees fail.

The following photograph shows the effect of levee failures during the 1951 flood event. This flood had a peak discharge at the Mount Vernon gage of 144,000 cubic feet per second, and a one-day average discharge of 123,000 cfs. Still, it flooded the South Mount Vernon area to a considerable depth. This was a function of the location of the levee failures, and the topography in that area.



Photo 1. Conway, Washington, during February 1951 Flood. View is northerly, with the South Fork shown to the left.

The U.S. Army Corps of Engineers, Seattle District Draft Flood Insurance Study Hydraulics Summary (1 May 2008), cites the photograph above and states, “On February 11, 1951, the Skagit River near Mount Vernon gage reached 144,000 cfs, which is roughly a 25-year flood event. The levee system in this reach failed and the flooding in this area can be seen in Figure 31. The Mount Vernon Argus dated 2/15/51 states that “Conway residents declared the 1951 flood was two feet, ten inches below the 1921 inundation in their community.” This would make the 1921 flood similar in depth to the 100-year modeled flood estimate.” Work products provided by the U.S. Army Corps of Engineers, Seattle District, pursuant to ongoing flood insurance studies indicate an equivalent peak discharge for the 100-year regulated flood event at Mount Vernon to be about 208,000 cfs. Would a flood of this magnitude, or even larger (current USGS estimate of the 1921 flood is 228,000 cfs) in 1921 have resulted in flood depths in Conway about three feet higher than in 1951? That certainly is a distinct possibility. But it is also a reasonable possibility that a much smaller flood in 1921 could have caused higher flooding the same area than in 1951, depending on a number of circumstances. Were the levee failures in the same area? Where, specifically, was the newspaper account referring to – was it referring to the east side of the South Fork of the river, or the west side of the South Fork? This is important and intriguing documentation, but it is anecdotal and not specific enough to use as a reasonable basis for verifying the nature and extent of the 1921 flood, or compare the 1921 event to 1951 in this location. Further, there are significant complexities involved in attempting to reconstruct the overall picture of 1921 levee failures and the particulars of the 1921 levee system. Without information

about the exact location of the differential water surface levels reported by the newspaper, the location of the levee failures in 1921, and the nature of the levee system at the time, this photograph cannot be used to validate the notion that the 1921 peak discharge was 228,000 cfs. This information does not take away from the possibility that the 1921 228,000 cfs peak flow estimate may be correct. Neither does it take away from the possibility that the 1921 peak flow was much less.

The U.S. Army Corps of Engineers, Seattle District Draft Flood Insurance Study Hydraulics Summary (1 May 2008), cites the photograph below and states, “*Figure 27 is a picture of the corner of Fairhaven and Anacortes Streets after the December 1921 flood which had a discharge that is within 10% of the predicted 100-year flood (228,000 cfs versus 210,000 cfs at Concrete). Figure 28 is the same flood looking East down Fairhaven Street. The Concrete Herald reported on 12/17/21 that “The entire city of Burlington was flooded to a depth of from three to five feet” (Concrete Herald, 12/17/21) which looks consistent with the flooding seen in these two pictures. . . . It is for these reasons that 3.5 feet of depth in this area seems reasonable.*”



Photo 2. 1921 flood at Fairhaven and Anacortes Street (Figure 27 from Seattle District, Corps of Engineers Revised Flood Insurance Study – Hydraulics May 2008)



Photo 3. (Figure 28 from Seattle District, Corps of Engineers Revised Flood Insurance Study – Hydraulics May 2008)

However, it can be seen from the photographs above that the depth of water at the time the photographs were taken appears closer to 1.5 feet.

The photograph below indicates it was taken at Fairhaven and Gardner, about $\frac{3}{4}$ mile east of the photographs above, and apparently looking east. While the damage is significant, it is consistent with a levee failure and flows of 10,000 cfs to 20,000 cfs. It is plausible water broke through the upstream levee, thereby causing this damage while a significant amount of water remained in the main channel, causing additional flooding further downstream. Without specific knowledge of the nature of the levee failures, it is very difficult to use this photograph to characterize the 1921 flood event (from Mr. Larry Kunzler's web page, www.skagitriverhistory.com, photo gallery).



Photo 4.

Photo 5 is an aerial of the eastern part of the city during the 1921 flood event. It is not known when this photograph was taken in relationship to the flood peak. It can be seen that although flooding was widespread, water depths appear shallow in most areas.

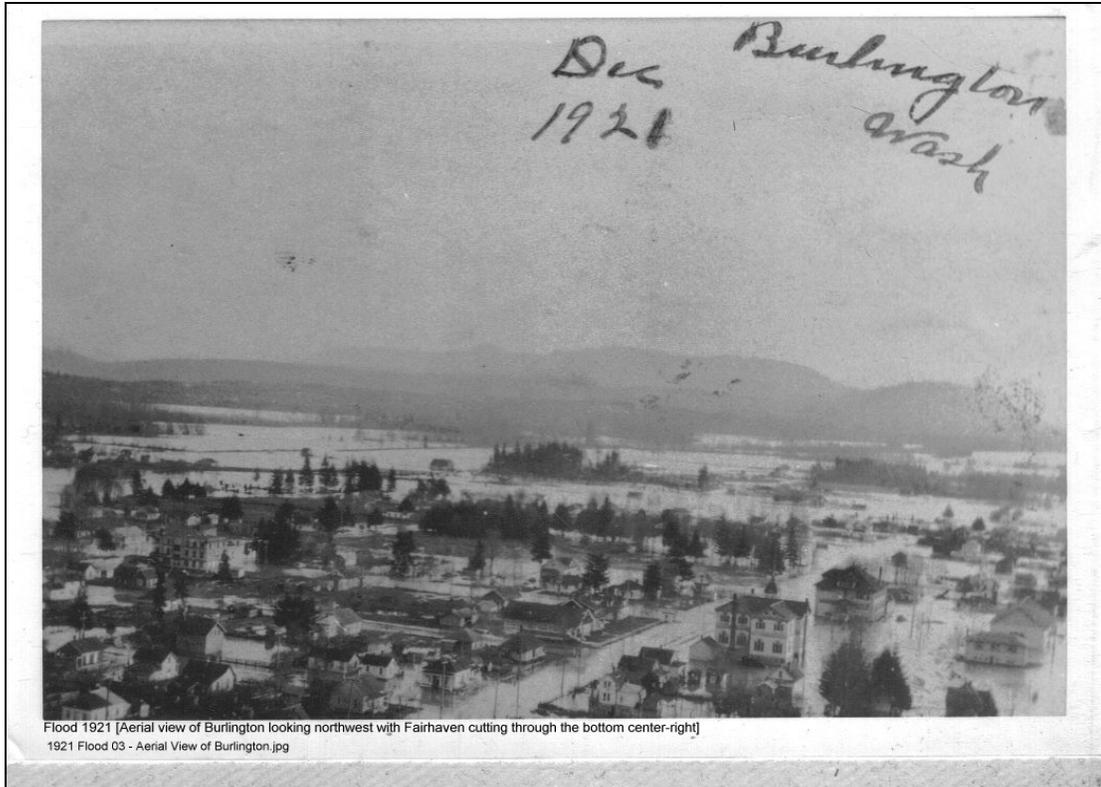


Photo 5. Flood 1921. Aerial view of Burlington looking northwest with Fairhaven cutting through the bottom center-right

It should be noted the newspaper account cited in the Corps' hydraulics summary was from the Concrete Herald, a town 35 miles upriver from Burlington. The local newspaper had this to say (compiled and transcribed by Dan Berentson and Larry Kunzler):

The Burlington Journal

FRIDAY, DECEMBER 16, 1921

BIG FLOOD INUNDATES SKAGIT VALLEY

The Skagit lowland region is passing through another memorable flood period. In consequence of which thousands of dollars of property have been destroyed in the path of the flood. Six weeks of excessive rains, followed last Sunday night till Monday noon by compelling Chinook breezes at the beginning of which the Skagit River was ban full, opened the flood gates in the foothills, and mountains of water poured out to the sea, inundating the greater portion of the valley of the Skagit.

The last crushing flood disaster, which inundated the valley of the Skagit occurred January 1, 1918¹. The widespread destruction wrought then, if estimated in dollar losses, doubtless greater than that caused by the flood of last Tuesday. It is needless, foolishly, to minimize the enormity of the devastation wrought by the recurring floods, as it is a growing menace, of such huge magnitude that efficient engineering methods must be employed to control the river during these flood periods. **The present diking system, so faultily constructed, useless and inadequate, never has nor could control**

flood waters when built on the banks of the river. The river bed and artificial diking basin is inadequate, and the river naturally forces its way through the dikes here and there, inundating the lowlands, causing hundreds of thousands of dollars loss, that could be averted if an artificial channel or channels were provided to carry flood waters from mountains to sea. As to the scientific solution of this disturbing menace, ever present, hundreds of theories are advanced, any one of which might be the right one. Yet it is naturally an engineering problem, and only along correct scientific lines could be successfully solved. If the writer had his way, the Skagit River would be directed from mountain to sea, through a natural channel with sufficient fall for a swift current that would keep the basin free of all accumulations of sand and drift or other arresting material. The present windtag channel of the river with insufficient fall to carry flood water, sand and drift to the sea must be abandoned. A new widened channel should be provided with adequate basin capacity to carry off flood waters. Doubtless a diked in basin a mile wide could function, safeguarding the delta region when flood waters pour to the sea. A bird's eye view of the lowlands from Burlington heights Tuesday noon presented a masterful panorama of the low lands. A subversion of the existing flood conditions of the lowlands from Blanchard to Stanwood and from the foothills west to the sea, evidenced "*honors were even*" in the widespread overflow of the lowland region. Why these flood waters should have been permitted to inundate the lowland region for years when intelligent engineering skill could remove the menace is incomprehensible. The immense loss of property, demoralization of business, prostration of industry, paralysis of transportation, destruction of homes, and sometimes loss of life, because human genius has so conspicuously failed to grasp resourcefully the huge flood problem with the constructive vision of an engineer, those huge flood problems that should have been solved a decade ago.

1921 December Flood

Monday night, December 12, the dikes east and southeast of Burlington broke. Tuesday morning at six o'clock the flood water covered Fairhaven Avenue, and in part the residence districts of the city. At this time the entire

lowlands lying east, west, south and in part northwest of Burlington were inundated. The depth of water is on relative, the lamentable fact being that the area of low lands covered with water was widespread. That certain spots escaped water, neither lessens the flood evil nor removes its threatening menace as the destruction wrought during the last three recurring flood periods of 1909, 1917 and 1921 encompass a wide area of lowlands, some districts suffering greater damages than others, the river in its flood course to the sea, evidently changing or seeking an outlet wherever river dikes could first be swept away.

The flood waters on Fairhaven avenue had disappeared Wednesday morning. The east Fairhaven district suffered loss in property as it was directly in the path of two currents caused when the river dikes gave way east and southeast of Burlington. Could a dike have been built on the slough south of Burlington paralleling the town from east to west the flood waters could have been controlled and the town safe-guarded from flood waters.

Flood Upturns Houses

It is almost marvelous no loss of life resulted during the flood. W.H. Walker, whose residence was situated on the south side of East Fairhaven, (Note: likely this was adjacent to Gages Slough in an area of the Town that was several feet lower than the surrounding area) along the in was one of the heaviest losers in the flooded district. His dwelling was struck by flood waters from the east and southeast at about five o'clock Tuesday morning, the force of the pressure of the water turning the structure on its side, dividing it in two parts. Mt. Walker was in the house at the time. The force of the concussion turned his bed over, throwing him in about three feet of water. Finally he pulled himself into a safe place, and called for help. No boat was available. Finally a boat was gotten from Sedro-Woolley. Three men—Jon Bratton, F.M. and O.B. Elliott, bringing the boat from Sedro-Woolley on a truck to Fairhaven avenue, and pulling the boat from there, wading at times in two feet of water, to the scene of the disaster, when Mr. Walker was rescued, Dr. W.L. Jackson and Luther Jackson,

assisting in taking the old gentleman to a place of safety. The men who brought the boat to the scene of the disaster did not have rubber boots, the ice cool water through which they were compelled to wade be numbing their legs, which required hours to restore them which required hours of constant massage to restore them to normal condition.

Not only was Mr. Walker's dwelling wrecked, but the lots are covered with sand. The Lane dwelling, and the Carlson cottage were partially destroyed. A portion of the Carlson cottage was completely carried away by the flood. In the business district basements were filled with water and here and there business men suffered loss of merchandise. South

of Burlington, the farming district lying between Burlington and the Skagit River was swept by the flood waters when the dike broke on the Varney, now Davis farm. The dwelling, barn, garage and sheds on the Davis farm were almost completely demolished and carried away by the flood. Mr. and Mrs. Davis and family were in the house when it was unmoored by the flood, finally being recovered by a boat by Mr. Shoemaker.

The damage to the Great Northern and interurban right-of-ways was not nearly as great as that caused by the flood of 1918², yet the main line of the Great Northern will not be repaired until late next week. The main line of the interurban and the Sedro-Woolley branch are in operation and the Great Northern Sedro-Woolley Rockport branch of the Great Northern will be in operation by Saturday.

Mails are arriving and departing via Bellingham and the Northern Pacific railway from Sedro-Woolley. Burlington has not been isolated, insofar as transportation and mails are concerned, the first mail following Tuesday's flood arriving via Bellingham Tuesday evening. Build a slough dike south of Burlington and it could escape river floods.

Individual losses in homes, country and town have been quite serious. The greater flood inconvenience occurred at Conway, Milltown, Stanwood and LaConner. While flood damages in Burlington have been large, the flood waters disappeared from the principal business and residence streets within 12 hours following the overflow. In the Skagit delta flood no human lives were lost, although considerable quantities of hay, grain, and potatoes were lost on the flats and south of Mt. Vernon in the Conway-Stanwood regions.

Flood incidents of human interest in almost countless number could be told if space permitted. A pig in a pen floated from the Pete Moe farm operated by Mr. Parkey, to the Chas. Johnson farm, where the pen lodged in a fence corner, the pig alive and hungry and was fed until rescued. The loft of a barn filled with straw floated from the Varney farm to the interurban trestle, where it lodged in the drift, the straw being dry, and none the worse from its flood cruise. Horses and cattle left in the Davis barn on the Varney farm got themselves safely to a dry plot of ground.

Whenever the water broke through the dike huge quantities of sand were carried by the current and distributed on the land. Back water usually deposits silt which is an excellent fertilizer. The flood is an incident of history. River control methods to avert recurring flood disaster is the acute problem confronting the citizens of the county. Will it be idle, meaningless talk again, while the people are concerned or constructive governmental state and county action to avoid another recurring and perhaps more disastrous flood in a few years?

It is not too late yet to do your Christmas shopping.

¹ This is a misstatement. That was the date of the newspaper article. The flood happened on December 30, 1917.

² Should be flood of 1917.



Photo 6.

The above photograph of the 1921 flood shows a building that still exists today (2-story structure, left part of photo) at 612 Fairhaven. Based on the information in the photograph, the City of Burlington undertook a forensic investigation of flooding in this building. We do not know when this building was constructed, although local estimates are some time around the turn of the last century.



Photo 7. 612 Fairhaven today

The City undertook the investigation with the goal of trying to ascertain the highest flooding the old building had been subjected to. We found that all the lath/plaster had been removed and replaced with newer material about 10 inches up on the base of the wall. Additionally, we observed what we believed to be flood marks about 16 inches up the wall, possibly consistent with floating oil or debris on top of the water surface. Could this indicate the maximum flooding the building received was similar to what the photographs show? Probably. But the forensic evidence was not conclusive. Taken together, the old photographs and the forensic investigation in downtown Burlington indicate significant flooding in the town during the 1921 event. But was a Skagit River discharge of 228,000 cfs necessary to produce this amount of flooding? No.



Photo 8. Removal of wall section for forensic investigation. Note bottom lath/plaster has been replaced. Was this due to flooding, or to install electric outlets? Or perhaps both?



Photo 9. 612 Fairhaven, wall panel removed. Note apparent flood mark to the left of the F3" sample.

There are also newspaper accounts of the 1909 flood event, and its impact on Burlington:

THE SKAGIT COUNTY COURIER

December 2, 1909

SKAGIT RIVER BREAKS LOOSE

Heavy Chinook winds send volumes of water down from Cascades into Skagit County towns causing much damage
COUNTY TOWNS ARE FLOODED

Reports which are constantly coming in from the neighboring towns establish the fact that all of them have been more seriously affected by the flood than has Sedro-Woolley.

DISASTER IN BURLINGTON

The water broke the dykes guarding Burlington and almost the entire town was flooded. In the residence districts the water was over eight feet deep in places.

In the southeastern part of the town a family was driven out of their home and forced to seek safety on the roof. A row boat was sent to their rescue and they were conveyed to a place further removed from danger. All the stores, with one exception, were under at least a foot of water. The

main street in Burlington will be in a bad condition for months to come. Before the flood it was not in the best of shape and now it is a veritable sea of mud.

All day Tuesday the water flowed across the main line of the Great Northern and cut ... The water surrounding the G.N. depot was four or five feet deep. Many feet of track were washed out on both sides of the depot.

W. MT. VERNON UNFORTUNATE

... from Mount Vernon indicates that the most serious damage done in that vicinity was in West Mount Vernon. Mount Vernon proper was many feet below the surface of the river but there was little current on that side and the dikes held. On the west side however, the river made up the west it failed to do on the east. Early Tuesday morning the dikes protecting West Mount Vernon were broken in many places and the raging waters poured in, carrying ... fences and buildings before them. Horses, stock and other animals were drowned by the score. There have been many rumors afloat that human lives were lost there, but these reports have not yet received conclusive substantiation.

FLATS ARE FLOODED

On the flats west of Mt. Vernon and Burlington, farm buildings were surrounded by water and people driven from their homes or forced to seek shelter in the second story or on the roof. Over a hundred head of horses and cattle are reported lost. A view of the flats, obtained on Tuesday afternoon from the hill near Clear Lake showed that, from Burlington westward as far as the eye could see, the country was one vast expanse of water.

TRACKS GONE AT STERLING

At Sterling the water was four or five feet deep. The county road was washed out for a distance of 150 yards. At the Jarvis place part of the orchard and front yard was washed into the river. The G.N. track has been moved from its original position for a considerable distance and is all twisted out of shape. Wednesday evening a hand car was sent over the rails from Sedro-Woolley to within a mile of Burlington and the logs and other debris removed from the track. It is expected that traffic can be resumed by Friday evening.

STERLING CUT-OFF

It is now practically certain that the long talked of cut off at the Sterling bend has been put through.

On Tuesday it seemed as though the main body of water was moving directly west from the draw bridge instead of bending to the right and striking off toward Sterling. It is possible though, that when the river has reached its normal stage, that the current will not be strong enough to remain in the new channel, and will again be deflected into its old course.

CLEAR LAKE AND VICINITY

Every house at Clear Lake with the exception of the few located on the hillside west of the track, contained at least two feet of water. North of the depot a half mile of track was washed in the ditch and the same thing was done to a quarter mile of the track on the south side. A box car which stood on the side track whittled to the ground as the rails slipped from beneath it. Bedall's store was undermined and for a time threatened to fall in ruins. The danger was averted by hauling in dirt and throwing it in underneath the foundation.

Many of the farmers in this vicinity drove their stock to the hills. There is hardly a fence left standing within a radius of two miles of Clear Lake and all the roads are in an impassable condition. Water was still standing on the tracks south of Clear Lake Wednesday noon.

The valley of the Nookachamps was flooded by back water from the Skagit and the N.P. bridge at the Little mill, two miles south of Clear Lake, ruined.

Wednesday morning a pile driving outfit was sent up from Arlington on by the N.P. railway company and commenced driving piles at this point. Trains will probably be able to pass over the Nookachamps sometime Thursday.

THE UP RIVER COUNTRY

Details received from the up-river country are so far very meager. It is known that the depot at Hamilton stood in five feet of water and that the whole town was in dire straits. At Lyman conditions were not quite so bad, although there was some water in the main streets and in the business houses. The track between Lyman and Minkler is in very bad shape, most of it being in the ditch.

The bridge at Wilson's creek above Skiyou, was washed out and the one at Hanson's creek, on this side, displaced. The water was so deep along the Skiyou road that a man on horseback coming down had to swim his steed for almost two miles. Much stock has been drowned, particularly on the island.

From the Burlington Journal:

THE JOURNAL

DECEMBER 3, 1909

HIGH WATER ON SKAGIT RIVER BREAK ALL PAST RECORDS

Fairhaven Avenue Flooded With a Foot and a Half of Water
River Raises Twenty-four Feet Above Low Water Mark
Mark—Above all Past Records

¹ Some among the oldest settlers of Skagit County are found to make the statement that never before have they seen the river rise to the marks reached during the flood, which came during the first part of the present week.

Monday noon marked a . . . in the . . . Southeast grid which had continued unchangingly strong and hard for forty eight hours.

The Skagit was overflowing its banks, all of which gave the notice to those of premium experience that for at least eighteen hours the water would continue to rise rapidly, and that there would . . . along the barriers of the famous old river.

At about 10 o'clock Monday night, W.H. Joyce who lives just east of town, gave the alarm by phone, announcing that the water had broken over the county road east of the Jewell place and was running down the big slough towards the east part of town which is quite timely settled. In a short time the . . . and the railroad trestles were swarming with people who were moving to the low lands to warn the people there of their danger. However, notwithstanding this early alarm many were caught like rats in a trap.

When the alarm came the writers who among the first to go down to the trestle bridge south of town and spread the alarm . . . Arriving at the bridge we found Messrs. Badley, Hannain and Stone who were yelling and warning their neighbors to get out.

(Article readability deteriorates here and several paragraphs were omitted.)

Down at the east end of Fairhaven avenue the current was very swift and the bridge went out . . . leaving some forty people shut out in this lowest land and in a swift current of water.

Next morning a boat was built at the Hurpet (sic) mill by W. T. Choucaflatt (sic) and others after a car load of boats came from Anacortes shortly after daylight.

This was a swift current in the big Skagit but with the heroic effort of good men the following families were brought to safety: . . . this was not until after daylight Tuesday morning.

(Article readability deteriorates here and several paragraphs were omitted.)

This is the only article located on this flood event. Due to the condition of this article its transcription cannot be relied on to be absolutely accurate. Thursday was a great day in Burlington and many talked of camping on the heights Tuesday night, but the change came about noon, the water went down rapidly and Burlington has perhaps received less damage then any other town on the Skagit.

. . .

While the East Mt. Vernon dyke held good, a snapshot from the auction building on the hill at Mt. Vernon shows a sea of water from Mt. Vernon to LaConner. Much damage was done in West Mt. Vernon and the hundreds shut in. LaConner was underwater as well as the entire flats from LaConner to Bayview and Mt. Vernon.

¹ Portions of this article were unreadable and those portions are represented by . . . inserts.

(The rest of the article was unreadable.)

And another article from the Journal:

The Burlington Journal

FRIDAY, DECEMBER 3, 1909

Revielle Exaggerates High Water

(Dead in flood Skagit waters collect their toll of human life.) The above headlines, printed in red, were the attractive features of the front page of Wednesday morning Reveille, and is perhaps of the most disgraceful lies that that paper ever published. Following those headlines the reporter says that no dead have been reported. He also says that Burlington is buried under from five to ten feet of water. This is also untrue. They also say that Burlington is sadly in need of relief and mercy work. We hope that the Reveille will be generous enough to correct these false statements. In the first place there is no dead in the flood, so far we have not received the report of one dead from any place along the Skagit. Burlington had about one foot of water in some of the streets, and there were many buildings over the town that were not even surrounded by water. Neither the railroad bridge south of town, or the steel bridge at Mt. Vernon is washed away. The amount published in the Revielle on Wednesday was simply a piece of Yellow Journalism.

These articles clearly indicate the 1909 flood event was very serious. But was it a flood with a peak discharge of 245,000 cfs? The photograph below is believed to be of the 1909 flood event at Sedro-Woolley, at the current location of the old abandoned railroad bridge. Note that the bridge was later modified and put on concrete piers – this bridge in the photograph is still on wood pilings. Notice the old house on the south side of the bridge. That house still exists today, although it has been modified. Real property records indicate it was built in 1908.



Photo 10. Compare the photograph above, to this picture of the 2003 flood event, looking south (approximately 157,000 cfs here):



Photo 11.

This water surface level is within about three feet of overtopping the South Skagit Highway, and then flooding the house.

What have we learned with regard to utilizing information obtained from the historic literature review of downstream flooding? Primarily, that it is difficult to obtain specific information from photographs and newspaper articles about the historic flood events from the downriver areas. That is because of the uncertainty of the levee system configuration at the time; where the levee breaks occurred, the difficulty of using anecdotal information about flooding once the river discharges into the flood plain, and the lack of adequate modeling techniques available today to use the accounts of downriver flooding (i.e., in the Skagit floodplain) to corroborate the historic discharges with any useful degree of certainty. But it is important to note that all of the flooding characterized in the historic downriver accounts, is consistent with peak discharges of 160,000 – 180,000 cfs, Pacific International Engineering’s current estimates of the peak flows of the floods of 1909, 1917, and 1921.

Upstream of Sedro-Woolley, we believe the historic literature contains specific information which, when combined with modern hydraulic modeling methods, can be used much more effectively to corroborate the results of recent studies. The following is a page from James Stewart’s field notes, 1922, Town of Hamilton:

At Hamilton

Nov 27 1922

TP 12.33 12.73 00.00 WS 10 AM

1065 19.05 436 8.84

2.77 16.78 RP

Nov 28

TP 2.94 96.84 93.90 GN rail in front of Hamilton Dept. S. Elev from USGS Bulletin 670?

4.21 98.65 2.70 94.44

3.00 95.62 1917 HW

TP 3.40 97.10 7.95 93.70

TP 5.87 98.98 7.79 92.61

1.59 96.89 RP described above

96.89
16.78
80.11 Elev of WS Nov 27

95.62
80.11 = 1917 HW
15.51 stage 44

96.17
80.11 = 1909 HW
16.06 stage 44

96.46
80.11 = 1921 HW above 44

96.19 = 1909 HW above 44

95.62 = 1917 HW

96.46 = 1921 HW

96.19 = 1909 HW

95.62 = 1917 HW

96.89
16.78
80.11 Elev of WS Nov 27

Magnus Miller says 1897 flood came to door knob of James Smith's drug store (the drug store raised since then) High across from Hamilton may have 1897 mark

Photo 12.

There is a lot of information on these notes. 93.90 feet is the "Top of GN (Great Northern) rail, Elev from USGS Bulletin 670?" Surveyed from that point, the 1917 high water mark "At A J Jacobin Cigar store" was 95.62 feet. The 1921 high water mark in Hamilton was 96.46 feet, and the 1909 high water mark was 96.19 feet, again at the AJ Jacobin Cigar store. The Skagit water surface elevation on November 27, 1922 was 80.11 feet.

Recently, Dr. Malcolm Leytham of Northwest Hydraulics (nhc) uncovered a USGS publication which described bench marks prior to the establishment of the NGVD 29 vertical datum. That publication listed the bench marks referenced in Stewart's notes for Hamilton and Concrete:

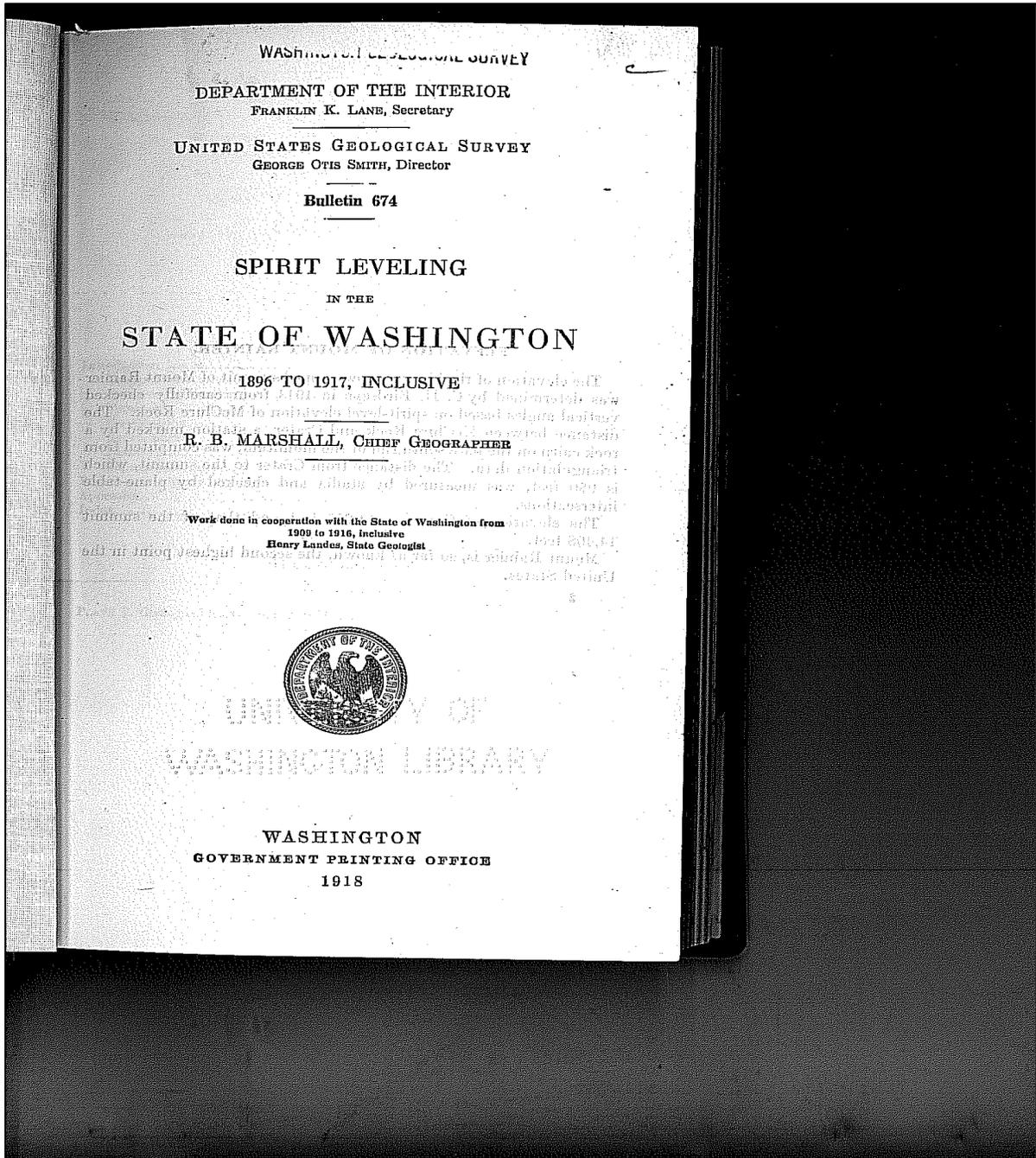


Photo 13.

78	SPIRIT LEVELING IN WASHINGTON, 1896 TO 1917.	PRECISE AND PRIMARY LEVELING.	79
	From Mehahey ranch up Naches River and American River to Gold Hill.		
	Gold Creek, 100 feet east of crossing, 9 feet east of center of trail, in large flat rock; bronze tablet stamped "9437 T"	Feet.	570.58
	Bumping River, 800 feet above mouth of, 90 feet northeast from where Bumping River trail crosses Naches River, 10 feet north of trail, 80 feet north of north edge of Naches River; iron post stamped "2557 T"		1,086.653
	American River, 2.5 miles northwest of mouth, 25 feet north of bank, 4 feet north of trail where it turns over hill, in flat rock 4 by 12.5 by 9.5 feet; bronze tablet stamped "2937 T"		1,059.5
	Pleasant Valley, 20 feet north of northeast corner of old cabin, 54 feet north of American River, 8 feet west of flagpole; iron post stamped "3337 T"		1,084.996
	Bear Gap, summit of Cascade Mountains, 10 feet east of Buckley trail; iron post stamped "5832 T"		1,075.41
	Bear Gap, 1.5 miles northwest of, 600 feet northwest of second creek crossing, 100 feet west of trail, in large rock; bronze tablet stamped "4518 T"		443.14
	From mouth of American River to Bumping Lake.		684.22
	Goose Prairie, northeast corner of cabin, 280 feet south of trail, 280 feet north of river, 500 feet east of "Old Man Fife" grave; iron post stamped "3265 T"		743.283
	Bumping Lake, 120 feet northeast of lower northeast end of, at head of Bumping River, 10 feet north of trail, 30 feet north of old fence; iron post stamped "9407 T"		732.86
	MOUNT BAKER QUADRANGLE.		925.91
	[Latitude 48° 30' -49°; longitude 121° 30' -122°.]		742.720
	From Randall east along highway to Glacier.		747.90
	Primary leveling in 1898 by L. D. Ryus and G. C. Jacobs and in 1907 by H. M. Hadley.		761.92
	Glacier, 1,400 feet north of station, 115 feet east of Glacier Creek bridge; iron post stamped "880 B"		831.004
	From Hamilton east along Great Northern Ry.		
	Hamilton, in front of station; top of rail		93.9
	Hamilton, 4 feet south of station and 5 feet east of southwest corner of platform; iron post stamped "96 T. U. L."		94.719
	Birdsview, about 3.0 miles west of, south of road at south end of gravel road, in 36-inch fir tree; nail		130.95
	Birdsview, about 1.0 mile west of, 40 feet west of bridge over Grandy Creek, south of road; iron post stamped "142 T. U. L."		141.856
	Baker, about 4.5 miles west of, on bench opposite orchard on river bank, north of road; in 16-inch fir tree; nail		210.94
	Baker, 0.25 mile west of, at bottom of hill, 40 feet north of fence corner, 50 feet north of road, in granite boulder; copper bolt stamped "231 T. U. L."		230.506
	McKutchens', 0.25 mile east of, northeast side of foothill, 30 feet north on trail, in granite rock west of trail; copper bolt stamped "207 T. U. L."		206.194
	From Baker to Grasmere, thence north on west side of Baker River to Park Creek and to Morovitz ranch.		
	Baker, 0.25 mile west of, at bottom of hill, 40 feet north of fence corner, 50 feet north of road, in granite boulder; copper bolt stamped "231 T. U. L."		230.506
	Baker, 2.5 miles north of, on summit of low ridge, 2 feet east of road, in knuckle of base of cedar tree; nail and aluminum tag stamped "279"		270.33
	Baker, 5 miles north of, at summit of stiff climb and at bend in trail, east of trail, on round granite boulder 12 inches in diameter; highest point marked "772"		772.10
	Grasmere, road crossing, 0.6 mile north of, 2 feet east of road, in base of 18-inch fir tree; nail marked "570"		570.58
	Vogler Lake, 1.2 miles south of, 300 feet north of summit of hill, 150 feet south of old deserted cabin, 5 feet east of road, in 2 by 2 by 2 foot granite boulder; aluminum tablet stamped "1089"		1,086.653
	Vogler Lake; surface of water June 19, 1908		1,059.5
	Frank Edgar ranch, 300 feet north of house, 5 feet west of road, 80 feet south of corner of secs. 14, 15, 21, and 22, at foot of cedar snag, in granite boulder; aluminum tablet stamped "1085"		1,084.996
	Small stream, 150 feet north of, at bend in trail, 2 feet east of trail, in base of 18-inch soft maple tree; nail marked "1075"		1,075.41
	Sulphur Creek, 40 feet south of where creek is crossed by trail, at bend in trail, in base of 36-inch fir tree; nail and aluminum tag stamped "443"		443.14
	Sulphur Creek, 0.3 mile north of, at bend in trail, on top of bench on north side of creek, in base of 36-inch fir tree; nail marked "686" (Tree bears linen sign of south boundary of Washington Forest Reservation)		684.22
	Sulphur Creek, 1.2 miles north of, north of gully, on east edge of trail, in boulder; aluminum tablet stamped "743"		743.283
	Sulphur Creek, 2.6 miles north of, 0.2 mile north of deep draw, 8 feet west of trail, in base of 18-inch fir tree; nail marked "733"		732.86
	Friday Creek, 50 feet north of, at sharp bend in trail, in base of 30-inch tall dead cedar tree; nail marked "626"		925.91
	Boulder Creek bar, south edge of, west of trail, in boulder; aluminum tablet stamped "742"		742.720
	Park Creek, 0.9 mile south of, on south edge of small clearing, 200 feet south of abandoned cabin, 3 feet east of trail, in base of 36-inch fir tree; painted "743," nail and aluminum tag stamped "743"		747.90
	Park Creek, 20 feet south of foot bridge, at junction of trails, solid rock having 1 by 1.5 feet exposed; highest point marked "761"		761.92
	Morovitz ranch, 360 feet north of house, 100 feet north of small stream, 50 feet south of barn, in 6 by 4 by 3 foot boulder of igneous rock; aluminum tablet stamped "831" and rock painted		831.004
	From Morovitz ranch north to point 0.8 mile north of Swift Creek (single-spur line).		
	Morovitz ranch, 0.7 mile north of, on open hillside, 50 feet north of small flat bench, 4 feet east of trail, small pile of rock behind bench mark rock, on embedded boulder; highest point marked erroneously "1101"		1,001.23
	Morovitz ranch, 1.9 miles north of, at place where trail comes out upon Rainbow Creek bar, in root of 48-inch fir tree; nail marked "1207"		1,207.77
	Swift Creek, west side of, foot bridge, 50 feet south of point where trail crosses, in large boulder; aluminum tablet stamped "1615"		1,614.805
	Swift Creek bridge, 0.3 mile north of, east of trail, on 12 by 6 by 5 foot boulder of igneous rock; highest point marked "1694"		1,694.54
	Swift Creek footbridge, 0.8 mile north of, on upper side of where trail after crossing big slide enters grove of trees, on large gray boulder; highest point marked "2000"		1,999.895
	From Baker north by hatchery trail to Baker Lake, thence west to mouth of Park Creek.		
	Baker, 0.2 mile west of, at bottom of hill, 40 feet north of fence corner, 50 feet north of road, in granite boulder; copper bolt stamped "231 T. U. L."		230.506
	Baker, 2.5 miles north of, on summit of low ridge, 2 feet east of road, in knuckle of base of cedar tree; nail and aluminum tag stamped "279"		270.33
	Baker, 5 miles north of, at summit of stiff climb and at bend in trail, east of trail, on round granite boulder 12 inches in diameter; highest point marked "772"		772.10

Photo 14.

It can be seen from the "Hamilton east along Great Northern Ry." entries that this is the source document for the benchmarks Stewart used for his survey work. Note "Hamilton, in front of station; top of rail . . . 93.9; Baker, 0.25 mile west of, at bottom of hill, 40 feet north of fence corner, 50 feet north of road, in granite boulder; copper bolt stamped "231 T.U.L." . . . 230.506." We have not been able to locate either of these old bench marks; however, we have located two others in Burlington and Clear Lake that were noted in USGS Bulletin 674. The old bench mark in Burlington appears to have a current NGVD 29 elevation of about 4 inches higher than that listed in USGS Bulletin 674 (p. 91, 2nd entry). Bulletin 674 indicates 35.753 feet; the benchmark stamp now says 36.086 feet, which is also consistent with the USGS data

sheet for this bench mark. See the Bulletin 674 entry, data sheet and photograph below.

PRECISE AND PRIMARY LEVELING.		91
MOUNT VERNON QUADRANGLE.		
[Latitude 48°-48° 30'; longitude 122°-122° 30']		
From Belleville south along Great Northern Ry. to Marysville.		
Primary leveling in 1898 by L. D. Ryus and W. S. Wheeler, and in 1909 by W. A. Gelbach.		
Burlington, 0.5 mile north of, 30 feet west of railroad, 300 feet north of railroad switch, 1,200 feet south of yard-line signboard for Burlington n. base of 8-foot cedar stump 15 feet high; nail in notch marked '29".....	Feet.	30.008
Burlington at northwest corner of Fairhaven and Regent avenues, southeast corner of school yard, 24 feet north of fence, iron post stamped "35 B".....		35.753
Burlington, south of, bridge over Skagit River.....		48.4
Mount Vernon, 150 feet southwest of station, 50 feet east of Hotel Mount Vernon, 12 feet north of sidewalk, east side of woven-wire fence; iron post stamped "Prim. Trav. Sta. No. 17, 23 Wash 1909".....		23.669
Mount Vernon, 2.4 miles south of, at crossing, 100 feet west of tracks, on south side of road, iron post stamped "9 Wash 1909".....		8 978
Fir, 75 feet southwest of station, southeast corner of crossroad, 3 feet east of telephone pole; iron post stamped "Prim. Trav. Sta. No. 1, 5, Wash. 1909".....		5.466
Milltown, 200 feet north of station sign, 100 feet east of tracks, on east side of road, 3 feet west of Milltown pool room, 5 feet north of telephone pole; iron post stamped "4 Wash 1909".....		4.209
Stanwood, 50 feet west of station, 6 feet north of sidewalk; iron post stamped "Prim. Trav. Sta. No. 2, 5, Wash., 1909".....		5.390
Stanwood station, 2 miles southeast of, 100 feet south of track, on east side of road at crossing; iron post stamped "10 Wash 1909".....		10.039
Norman, in front of platform, top of rail.....		33.6
Silvana, 70 feet south of station, 70 feet east of tracks, on east side of fence, iron post stamped "Prim. Trav. Sta. No. 3, 28, Wash., 1909".....		27.929
English, 300 feet north of platform, 100 feet east of tracks, on east side of road by rail fence; iron post stamped "121 Wash 1909".....		119.795
Stimpson Crossing; top of rail.....		98.7
Marysville, 3.4 miles north of at crossing, 60 feet east of tracks, on north and west side of roads; iron post stamped "70 Wash 1909".....		69.158
From Woolley south along Northern Pacific Ry. to Hartford Junction.		
Northern Pacific Ry. and Great Northern Ry. crossing; top of rail.....		55.38
Clear Lake, 36 feet north of station, 12 feet east of northeast corner of platform; iron post stamped "44 T. U. L.".....		44.050
Clear Lake, in front of station; top of rail.....		43.5
Parker, in front of station; top of rail.....		91.9
Montbom, in front of station; top of rail.....		115.7
McMurray, about 1,000 feet north of station, 25 feet east of track, about 300 feet north of seventieth milepost, in colored rock; copper bolt stamped "246 T. U. L.".....		246.210
McMurray, in front of station; top of rail.....		246.4
Lake Cavanaugh road crossing about 1,080 feet north of sixty-ninth milepost, 480 feet east of, in dark-colored rock, 8 feet north of road; copper bolt stamped "268 T. U. L.".....		259.255
Bryant, 270 feet south of station, 25 feet west of tracks; iron post stamped "171 T. U. L.".....		170.015
Arlington, in front of State bank; hydrant.....		112.408

Photo 15.

TR0244

 TR0244 DESIGNATION - PTS 16
 TR0244 PID - TR0244
 TR0244 STATE/COUNTY- WA/SKAGIT
 TR0244 USGS QUAD - MOUNT VERNON (1981)
 TR0244
 TR0244 *CURRENT SURVEY CONTROL
 TR0244

TR0244* NAD 83(1986)- 48 28 32. (N) 122 19 18. (W) SCALED
 TR0244* NAVD 88 - 12.158 (meters) 39.89 (feet)
 ADJUSTED
 TR0244

TR0244 GEOID HEIGHT- -21.73 (meters) GEOID99
 TR0244 DYNAMIC HT - 12.161 (meters) 39.90 (feet) COMP
 TR0244 MODELED GRAV- 980,863.7 (mgal) NAVD 88
 TR0244
 TR0244 VERT ORDER - FIRST CLASS II
 TR0244
 TR0244.The horizontal coordinates were scaled from a topographic map and
 have
 TR0244.an estimated accuracy of +/- 6 seconds.
 TR0244
 TR0244.The orthometric height was determined by differential leveling
 TR0244.and adjusted by the National Geodetic Survey in June 1991.
 TR0244.WARNING-Repeat measurements at this control monument indicate
 possible
 TR0244.vertical movement.
 TR0244
 TR0244.The geoid height was determined by GEOID99.
 TR0244
 TR0244.The dynamic height is computed by dividing the NAVD 88
 TR0244.geopotential number by the normal gravity value computed on the
 TR0244.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
 TR0244.degrees latitude (G = 980.6199 gals.).
 TR0244
 TR0244.The modeled gravity was interpolated from observed gravity values.
 TR0244

TR0244;		North	East	Units	Estimated Accuracy
TR0244;SPC WA N	-	165,120.	389,970.	MT	(+/- 180 meters

Scaled)
 TR0244
 TR0244
 TR0244 SUPERSEDED SURVEY CONTROL
 TR0244
 TR0244 NGVD 29 - 10.993 (m) 36.07 (f) ADJ UNCH
 1 2
 TR0244
 TR0244.Superseded values are not recommended for survey control.
 TR0244.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
 TR0244.See file dsdata.txt to determine how the superseded data were
 derived.
 TR0244
 TR0244_MARKER: P = PIPE CAP

Appendix I

TR0244_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
TR0244_STAMPING: PRIM TRAV. STA. NO 16 35 B WASH. 36.086 FT. 1909
TR0244_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
TR0244+STABILITY: SURFACE MOTION

TR0244

TR0244	HISTORY	- Date	Condition	Recov. By
TR0244	HISTORY	- 1909	MONUMENTED	USGS
TR0244	HISTORY	- 1973	GOOD	NGS
TR0244	HISTORY	- 1984	GOOD	USPSQD

TR0244

TR0244 STATION DESCRIPTION

TR0244

TR0244''DESCRIBED BY NATIONAL GEODETIC SURVEY 1973

TR0244''IN BURLINGTON.

TR0244''AT BURLINGTON, AT THE NORTHWEST CORNER OF FAIRHAVEN AVENUE AND NORTH

TR0244''REGENT STREET, AT ROOSEVELT ELEMENTARY SCHOOL, 69 1/2 FEET NORTHWEST

TR0244''OF THE CENTER OF THE JUNCTION, 34.0 FEET NORTH OF THE NORTH CURB OF

TR0244''THE AVENUE, 31 1/2 FEET WEST OF THE CENTER LINE OF THE STREET, 24.6

TR0244''FEET SOUTHEAST OF THE SOUTHEAST CORNER OF THE SCHOOL BUILDING, 3.5

TR0244''FEET WEST OF THE WEST EDGE OF THE WEST SIDEWALK OF THE STREET, ABOUT 1

TR0244''FOOT HIGHER THAN THE STREET, A CAP RIVETED ON THE TOP OF A 3 1/2-INCH

TR0244''IRON PIPE ENCASED IN A CONCRETE POST PROJECTING 0.2 FOOT ABOVE THE TR0244''GROUND. SEC 32, T 35N, R 4E.

TR0244

TR0244 STATION RECOVERY (1984)

TR0244

TR0244''RECOVERY NOTE BY US POWER SQUADRON 1984

TR0244''RECOVERED IN GOOD CONDITION.



Photo 16.



Photo 17.

The old Clear Lake bench mark has also been located. It is listed as 44.050 feet in Bulletin 674. We could not locate a USGS data sheet on this bench mark at the time of publication of this report. However, we expect to have current GPS elevation estimates for both this bench mark and the Burlington bench mark available soon.

Although we have not been able to recover the exact bench marks used by Stewart in the Concrete and Hamilton vicinity, other benchmarks established prior to 1929 indicate reasonable consistency with the current NGVD 29 vertical datum – generally within a few inches.

This photographic evidence below from 1897 in Hamilton shows significant damage adjacent to the old “Water Street” of Hamilton. After this flood event, the town migrated to the north, further away from the main stem of the river. Would it have taken a flood discharge of 265,000 cfs to create this damage, or would a much smaller but still very significant flood event (in the neighborhood of 180,000 cfs) have done it?



Photo 18.

The flood of 1897 in Hamilton was a serious flood and resulted in the town center being relocated to Maple Street. Unlike further downstream, there are several articles about the 1897 flooding in Hamilton, listed and synopsised here from Larry Kunzler’s web page:

<http://www.skagitriverhistory.com/PDF-BIN/Concrete%20Herald/1921-12-24%20Hamilton%20Reports.pdf>

Almost universal housecleaning has been the rule in Hamilton this week. Only a few houses in the main part of town escaped the muddy waters of the flood, which reached its highest point about midnight Monday.

Old residents here tell of three former big floods in the history of the town, in 1897, 1909, and 1917, and it is said that this flood was one of the highest, though probably not quite as high as that of 1897.

<http://www.skagitriverhistory.com/PDF-BIN/Concrete%20Herald/1921-12-17%20Heavy%20Damage.pdf>

At Hamilton the entire town was covered with water to a depth of from three to seven feet, the water entering every business house in town. Sidewalks were washed away

[http://www.skagitriverhistory.com/Clear%20Lake%20Newspaper%20Articles/1909-12-09%20Skagit%20River%20Breaks%20Loose%20\(Skagit%20County%20Courier\).pdf](http://www.skagitriverhistory.com/Clear%20Lake%20Newspaper%20Articles/1909-12-09%20Skagit%20River%20Breaks%20Loose%20(Skagit%20County%20Courier).pdf)

Details received from the up-river country are so far very meager. It is known that the depot at Hamilton stood in five feet of water and that the whole town was in dire straits.

<http://www.skagitriverhistory.com/PDF-BIN/MVDH/1896-11-19%20sct.pdf>

The whole valley east of Sedro was a floating wilderness. Hamilton was totally inundated; one brick building having caved in and several frame ones torn from their foundations. The county bridges recently constructed were destroyed and the improved roads that had become the pride of the upper valley became an easy prey to the devastating waters.

Of note, there has been little uncovered in the written record upriver about the 1909 flood event, which the photo evidence from further downstream (i.e., Sedro-Woolley railroad bridge) would seem to indicate was a flood of at least the magnitude of the 2003 event. Does that mean it was not a serious event for Hamilton? That is uncertain. It has been a matter of speculation that the flood of 1897 cleared the river channel in the Hamilton vicinity and created more river capacity for the subsequent floods. But following this line of reasoning, it would seem that the 1909, 1917 and 1921 floods would have maintained the river channel capacity, assuming discharges of 245,000 cfs, 210,000 cfs, and 228,000 cfs respectively. However, the 1932 flood event, with a peak discharge at Concrete of 147,000 cfs (the river gage had been installed by then) resulted in this newspaper story in the Concrete Herald (from Larry Kunzler's web page):

FLOOD IN SKAGIT DOES NO DAMAGE IN THE COMMUNITY

With the heaviest snowfall in the mountains that has been known in twenty years, a raging Chinook wind accompanied by heavy rains, found conditions just right to bring on a flood and do it quickly. The rains started last Thursday and continued steadily until Saturday afternoon, and during most of that time

the rain was heavy as well as steady. The Chinook continued through the greater part of the day. It was exceptionally warm for this season, raising the temperature almost to summer level during the afternoon.

Flood Comes Quickly

All the streams in the Skagit valley began rising Thursday afternoon, and had already reached about the highest stage of the winter by the time the Chinook struck Friday. Then the smaller streams became raging torrents and the Skagit began a steady climb that did not reach its peak until late Saturday night. When the river began to drop Saturday night, it still lacked six to eight feet of being up to the record level of 1921, but it was high enough to cause some worry among the residents of Crofoot's addition and East Concrete. Low-lying gardens on the east side were covered but Crofoot was not even dampened. The Baker River dam held back the flood waters of the Baker for over 24 hours, and then only a comparatively small amount of the stream came over the dam. Had this stream been added to the water already in the Skagit, Crofoot would have been flooded by Friday night and the communities of the lower valley suffered much damage. ... Birdsvie the greatest damage was to the Great Northern railroad, with the Grandy creek bridge and considerable track washed out, and at the fish hatchery, where grounds and buildings were flooded. Hamilton and Lyman suffered only the usual damage from high water, with no buildings washed away. **Nearly the whole of Hamilton was covered at the height of the flood.** In the lower valley the most damage was done Saturday by breaking dikes along the lower river. The approach to the Skagit river bridge at Sedro-Woolley and a considerable portion of railway track between Sedro-Woolley and Lyman were washed out.

As can be seen from this aerial photograph, there is a several-foot elevation drop in Hamilton from east to west:



Photo 19.

When “nearly the whole of Hamilton was covered,” water would be between zero feet deep on the east end of town by the “Smith” house (ground elevation about 98 feet), to about 6 feet of depth on the west side of town (ground elevation about 92 feet). If a flood discharge of only 147,000 cfs put that amount of water in town, it would indicate the channel capacity in 1932 was much the same as it is today. Could the river capacity in this reach have decreased so substantially over the 11 years since the 1921 flood event, that a “small” flood with a peak discharge nearly 80,000 cfs less than 1921 have flooded the town to a level only a little lower than in 1921?

The following are additional excerpts from the Courier-Times and Concrete herald, taken from Larry Kunzler’s web page:

[12/22/21](#)
[CT](#)

Biggest flood in skagit history say old-timers

The flood of 1921 is the biggest flood in the history of the Skagit, according to old timers, who recall the floods of 1879, 1888, 1897 and on up to the big flood of 1909 and the 1917 freshet. Mrs. Dreyer, who lives west of town, tells of the big

BIGGEST FLOOD IN HISTORY

DALLES TWO FEET HIGHER THAN 1909.

	<p>flood of 1888, when in some places the river backed up higher than this year. She says that not so much damage was done then because there were practically no dikes and the water spread over the lowlands more gradually.</p> <p>Measurements at the Dalles, near Concrete, show that the flood water this year reached a point two feet higher than at any previous time in the memory of the oldest settler. Charley Moses says that it was the biggest flood, with the biggest volume of water ever carried in the Skagit. At Van Horn the water was 14½ inches higher than it had ever been. In 1909 the river in the upper valley was only about two-thirds as wide as it is now. Hundreds of acres of land are being washed away every year, by both Skagit and Sauk rivers. W. A. Ellison says he has been on the upper river for 21 years and this is the biggest flood he has seen or heard old timers tell about.</p>	<p>Charley Moses lived in valley through 1906, 1911, 1917 and 1921 events. He observed the height of the river in The Dalles in 1921.</p>
<p>12/31/21 C.H.</p>	<p>flood was highest in skagit county history Old timers in the Skagit valley, who have seen all the floods in the Skagit valley since the early 80's say that the recent flood carried a greater volume of water than any previous flood since the county was settled, surpassing even the famous high water of 1897. The fact that the river did not reach marks set in former years at some points in the upper valley is accounted for by the widening of the river since that time. In all places where the banks of the river have remained unchanged the 1921 mark is considerably above that of any previous flood known to settlers.</p>	<p>December 12, 1921 Flood Event</p> <p>Highest flood in the history of the county. See 12/22/21 CT article.</p>

James Stewart also performed a significant amount of work in Concrete and in the Dalles vicinity. Here is a page of his notes for Concrete:

the store and residences, and the total loss is heavy. ... There is some argument as to whether this flood was higher than that of 1909, but the general opinion seems to be that it was just as high or a few inches higher than the mark reached that year.



Photo 21. “Crofoot’s Addition” to Concrete, 2007



Photo 22. “Crofoot’s Addition, 1937 with location of L.E. Wolfe residence annotated.

The outcome of the forensic investigation in the Crowfoot’s Addition to Concrete, and the information provided from the hydraulic model extension between the Dalles gage and Concrete, is addressed in the main body of the report.