The Honorable **Sept. 27, 2010**
Jane Hague and Kathy Lambert
King County Council
Seattle WA

RE: Sammamish River Weir Visit

Dear Council Members Hague and Lambert,

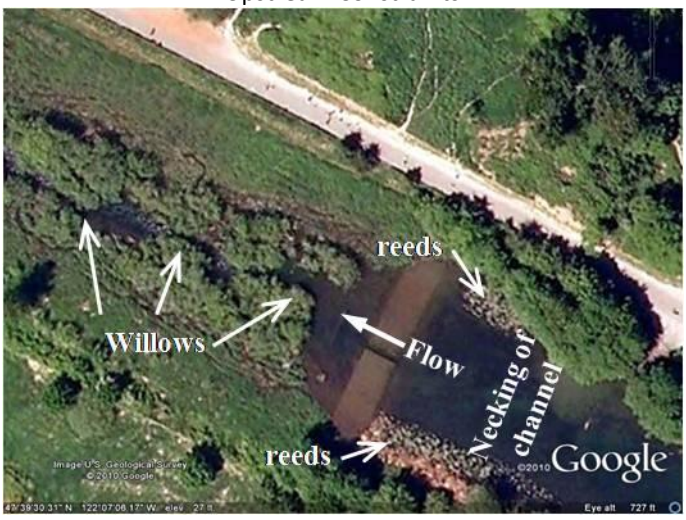
Thank you for arranging the onsite meeting at Marymoor Park in Redmond on Sept. 9th. Everyone had an opportunity to get a firsthand look at the weir and walk the flood channel. I found the experience enlightening and marked by some excellent suggestions for immediate and long term solutions to the high water problems of the recent past.

Following, you will find several topics with photos describing the situation at the weir and in the Transition Zone (TZ) which were of special focus during the site visit and actions to take as a result. In Appendix A, I have included a summary of the first meeting we had on August 19th . Appendix B provides a summary of a subsequent meeting citizens had with the Corps of Engineers.

Center, Low-Flow Channel

Observations - The center channel, which flows throughout the year due to a notch added to the weir in 1998, is lined by willows. Their function is to provide shade, as it has been contended that shade will lower the water temperature in the low-flow channel to levels needed by returning migratory salmon. That assertion, however, is not supported by data or analysis (*Sammamish River Corridor Action Plan*, TetraTech, Inc. 2002). The water temperature flowing through the TZ is the temperature of the upper stratified layer of Lake Sammamish. (Unfortunately, no one had a thermometer to measure the water temperature the day of our visit.)

Recent Aerial Photo at Weir Showing Willow Overgrowth and Upstream Constraints



Low Flow Channel Willow Overgrowth At Weir (Site Visit Photo 9-9-10)

As you'll recall from our field visit, the center (or low-flow channel, as it is known) was heavily overgrown. One individual in the group estimated that the frontage of willows, when looking downstream from the weir, is now over 80 ft wide! Research by our lake residents group has determined that a 1993 transition zone brushing agreement allowed two 10 ft wide willow buffers to border each side of the low-flow center channel. However, this was predicated on the assumption that the remaining transition zone area would be fully effective and sufficiently capable of conveying designed flood flow rates. It was obvious from the site visit - that assumption has been compromised.

The center channel and willow buffer was infiltrated with snags and debris, creating stagnant pooling of water and diverting flow from what seemed to have once been part of the low-flow channel. It was observed that the water flowing at this time of year, through the center channel, passes under low lying willow branches, but that those branches would be in the flow stream at higher water levels. It seemed inconceivable that what is supposed to be a navigable channel for small craft could be navigated at all, under current degraded conditions. The willow branches and debris not only noticeably obstruct flow but are obviously a hazard to boaters attempting to navigate the transition zone, as has already been reported by the County Sheriff's Marine division.

Finally, inspection of the "resting pool" just over the weir on the downstream side revealed one or more submerged, large logs. In addition to obstructing flow, these logs will harbor predator fish, providing excellent habitat for them to "sit-in-wait" for juvenile salmon as they migrate out through the channel in the early spring.

Needed Actions –

1) Remove all snags, debris, logs, etc. as they are obstructing the free flow in the center channel.

2) Trim up the willows 8-12 feet from their base to create an open flow "window". Creating this flow "window" will, in the short term - a) avoid debris accumulating among the willows, b) minimize snag formation, and c) result in a safer passage for small craft which periodically navigate the transition zone.

3) Return the center channel to a navigable waterway. In the interim, post signage upstream (toward the lake) forewarning boaters of possible navigation constraints.

4) Re-assess King County's commitment, policies, and actions. The residents find that for decades multiple memorandums and reports between the County and the Corps of Engineers have shown that the transition zone is not functioning at its design level of capacity. King County has demonstrated that this 1993 experiment, allowing the willows to remain and spread, is a failure. The transition zone should be cleared of all vegetation and debris per the Operation and Maintenance Manual established with the Corps of Engineers.

Left Channel Brushing

Observations - The southwest (left) channel of the Transition Zone, which flanks the low-flow center channel, was brushed (i.e., trimmed) in late August. However, during our site visit, one of the County technical staff noted that, in the past, flow data showed no discernable improvement following brushing of the left channel. This seems logical, given the accumulation of 12 to 18 inches of debris and sediment which has built-up above the quarry spall riverbed, raising the left channel elevation to a level well above that of the weir. This build-up of clippings and sediment explains why past brushing of the left channel

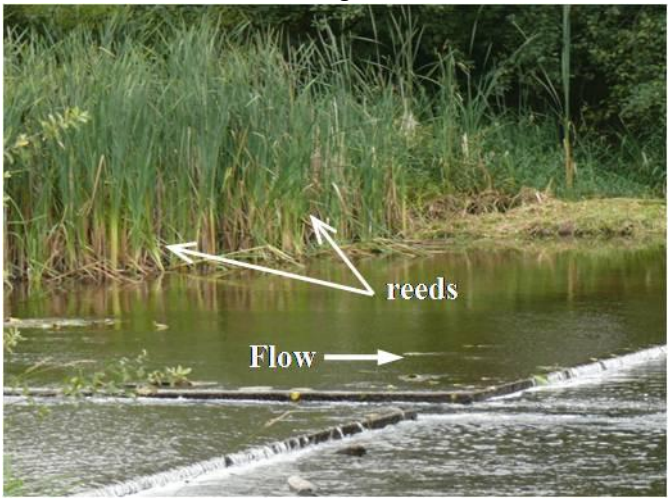
showed no flow improvement; the channel's sediment build-up is acting like a riverbank rather than a riverbed, constricting and funneling the flow towards the center channel rather than allowing water to spread-out over the full width of the left channel.

Southwest Channel Following Trimming (From Atop Weir)

Close Up of Debris & Silt in Southwest Channel

Sediment Build-up In Southwest Channel – 9/2010 (Post Trimming)

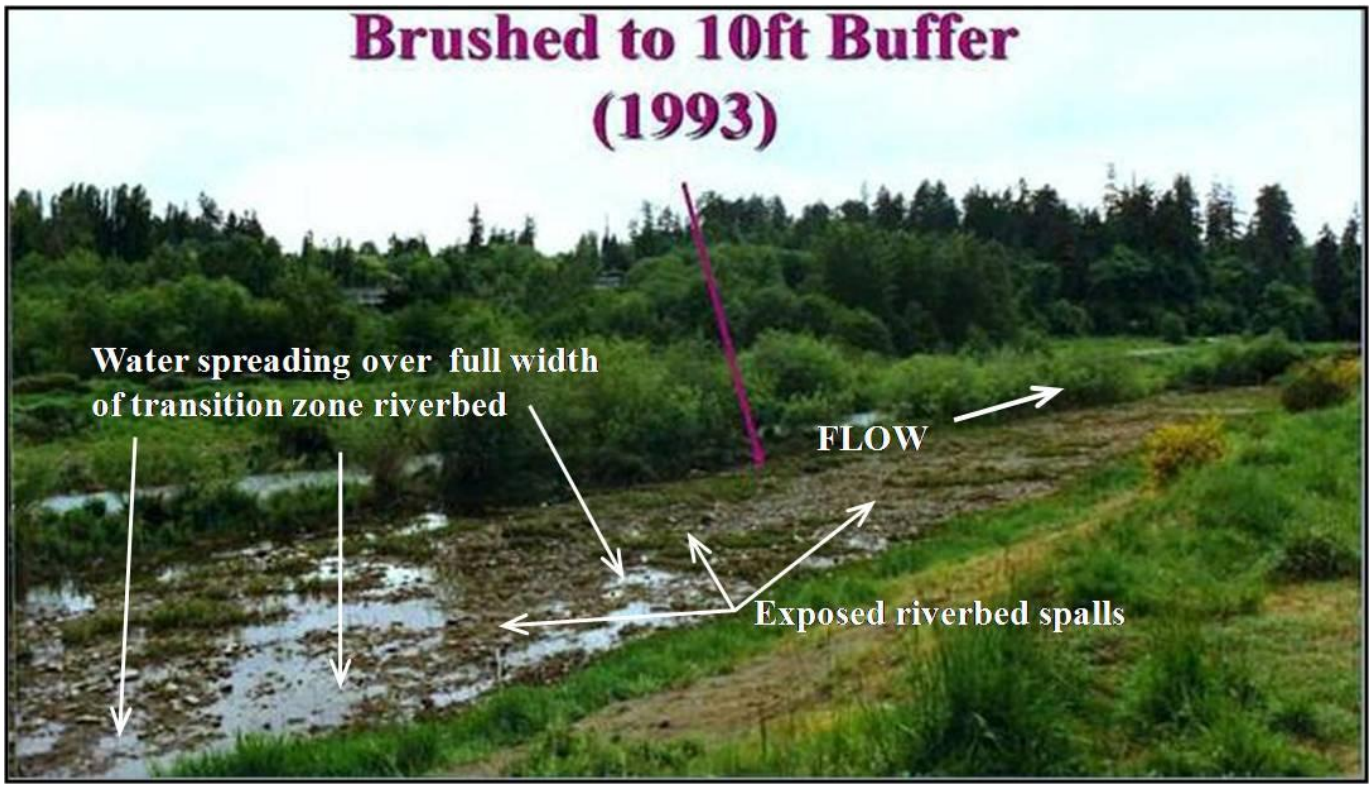
View Across Weir (southerly) Showing Obstructing Reeds Blocking Flow



As you may recall, during the site visit I handed-out a 1993 picture of the post-brushing condition of the northeast (right) channel for attendees to compare against the conditions we were observing that day. Most noticeable from the 1993 picture were: 1) the willows were cut to a to a hedge-like edge, 2) the center channel was open and freely flowing in the background, 3) the northeast channel's quarry spalls were exposed (not covered in sediment), and 4) water is spreading and seeping over the full width of the recently cleared channel. The 1993 picture (included below) showed what the TZ condition ought to have looked like in the cleared, left channel during our visit on September 9. I think everyone who attended would agree, what we saw was not reflective of the 1993 brushed condition.

Several citizens also commented on the narrowing (necking) effect the vegetation appeared to have along the Sammamish River banks upstream of our location. Most noticeable of this physical narrowing of the upstream river channel were the reeds growing immediately ahead of the weir. This obstruction can be seen in the picture above. Upstream constraints will restrict flow during high water conditions.

1993 Brushed Northeast Channel



Needed Actions –

1) The cuttings, which were allowed to remain after brushing, should be removed as soon as possible while water levels are relatively low.

2) Accumulated debris, clippings (duff), and sediment need to be removed down to the quarry spall riverbed base in order to return the channel to its original design condition. Failure to remove this build-up will merely perpetuate the ongoing ineffectiveness of most of the Transition Zone area by restricting water outflow leading to high water levels in the lake, property loss, and unnecessary pollution (see photos in Appendix A).

3) The reeds ahead of the weir, as well as other vegetative restrictions along the river banks, all the way back to the lake, which are reducing the effective width of the upstream river channel, should be planned for removal next season.

4) As observed by WLRD director, Mark Issacson, trimming should be returned to an annual basis, both sides being brushed each and every year. The citizens readily concurred with that suggestion. King

County needs to be held to its obligation of regimented maintenance in accordance with the regulations specified in the 1964 Operations and Maintenance Manual.

Staff Discussion -

Observations - Nancy Faegenburg, of WLRD, and technical staff members present at the weir site visit indicated that hydraulic (computer) modeling showed that Bear Creek, flowing into the Sammamish River to the north, is influencing the transition zone flows during wet weather periods. It was not clear if the intent of their computer modeling is to somehow prove that flooding conditions seen in Lake Sammamish are caused by something less intuitive, like impeded flow of the Sammamish River due to Bear Creek. The Creek is nearly a mile downstream from the weir, and, as I pointed out to the group, there's nearly a 7 foot drop in elevation in that distance. I think it more intuitive that some physical restriction within in the transition zone or near the weir is at issue. Bear Creek and the Sammamish River would need to rise at least 7 feet to cause flooding back into Lake Sammamish. Regardless, two field observations prove that this not occurring.

First, as shown in the photos below, the river stages at the entrance to Marymoor Park don't reflect a 7 ft rise when comparing last spring's rainy high water period to a photo of the same location in late summer.

Marymoor Entrance – 6/2/2010

Marymoor Entrance – 8/27/2010

Note that flow in June was only 2 to 3 feet above elevations witnessed at the summer low.

Second, free flowing water can be seen downstream of the transition zone (see left photo above) and in the middle of the TZ last spring (see photo below). Constricted, "slack" flow would indicate a backup caused by a downstream blockage or impedance, which is not evident at these two locations. There is no evidence that Bear Creek is or was, in anyway, affecting water flow out of Lake Sammamish this past spring. However, slack flow was witnessed at the weir during the late spring high water event, indicating that the immediate downstream conditions (the willows and blocked channels) were indeed restricting the free flow (see photo below).

Aerial Photo Showing May 2010 Flow Conditions

Computer model analysis of the system is needed. However, without consistent vegetation control in the transition zone, surface roughness variables (Manning's n-values) used in the computer modeling will vary too greatly from one year to the next to accurately predict the transition zone flow characteristics.

Needed Actions –

1) Computer Analysis Precision - Accurately identifying the variables and assumptions in the computer model(s) will lead to more accurate results. If the models did not predict this spring's high waters, they need to be recalibrated. Second, wide ranging patterns of plant growth and debris accumulation will impact these models. Consistency of channel maintenance is key, as intended by the Operation and Maintenance Manual. This would allow staff hydrologists to employ realistic, but limited roughness coefficients in the model, resulting in much more accurate computer modeling of flow conveyance and flood potential. With variables reduced, the computer models then can readily be calibrated against actual stream gage data.

2) Modeling efforts should be coordinated with the Corps' technical staff. The Corps has indicated for many years dissatisfaction with maintenance of the transition zone and has been excluded from technical analyses efforts. Coordination is needed. (See attached meeting summary)

Monitoring –

As this recap is being written, residents are again being reminded of the issues they face due to poor maintenance of the transition zone. We've already had 3 times the average rainfall for the month of September and Lake Sammamish has risen 6 inches. (See Times article – Click Here).

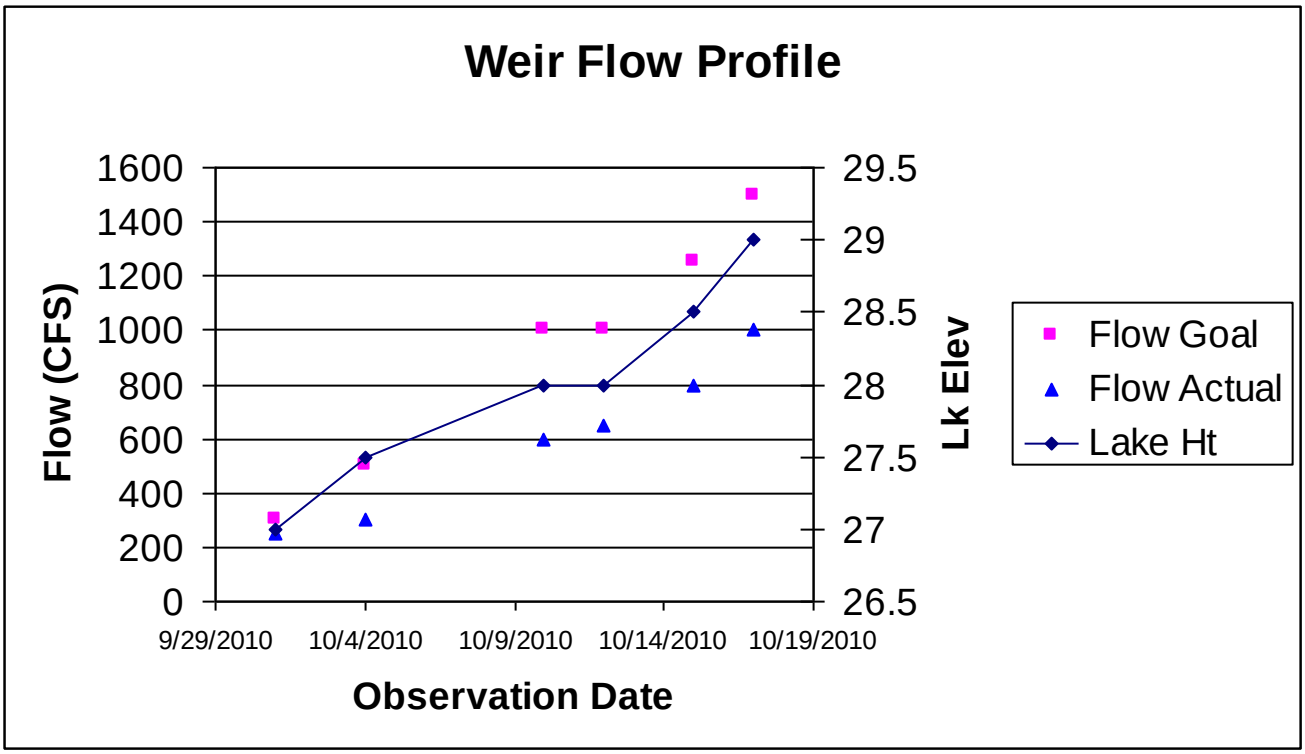
The importance of monitoring the situation cannot be overemphasized. With a host of online data sources published by the County, it should be easy to add a feature that makes effective use of County and other agency information, providing valuable forewarning of possible flooding. (See County Hydrology Information – Click Here).

Unfortunately, information on flows of the Sammamish River at the Marymoor weir comes from a recording stream gage (designated gage# 51m), and that data is not posted real time or even daily but instead typically lags several months. Timely online updates of flow data from stream gage 51m, located at this critical juncture of the river system, is badly needed.

Needed Action –

Following is an example of information that should be monitored by the County with an action plan in place should constrained flow conditions be detected. Early action will avoid losses such as witnessed last spring… or worse.

Proposed Monitoring Graph –



Data shown above is hypothetical. It shows both the lake level on each observation date (increasing from left to right), as well as two flow rates – the observed value (Flow Actual) and what is needed (Flow Goal). As an example, on 10/18 the lake elevation is shown at 29 feet. Actual flow was at only 1000

CFS, but the flow goal, as shown, is 1500. When actual flow is less than the flow goal, remedial action plans (yet to be defined) should be activated, conditions at the weir inspected and corrected, and citizens alerted to flood conditions.

Closure -

Thank you for your attention to this matter. We're also appreciative of staff who came out to assess the situation first hand. That made a difference.

We look forward to working with you further to resolve the issue,

Martin Nizlek, PhD Civil Engineering
312 W Lake Sammamish Parkway NE
Bellevue WA 98008

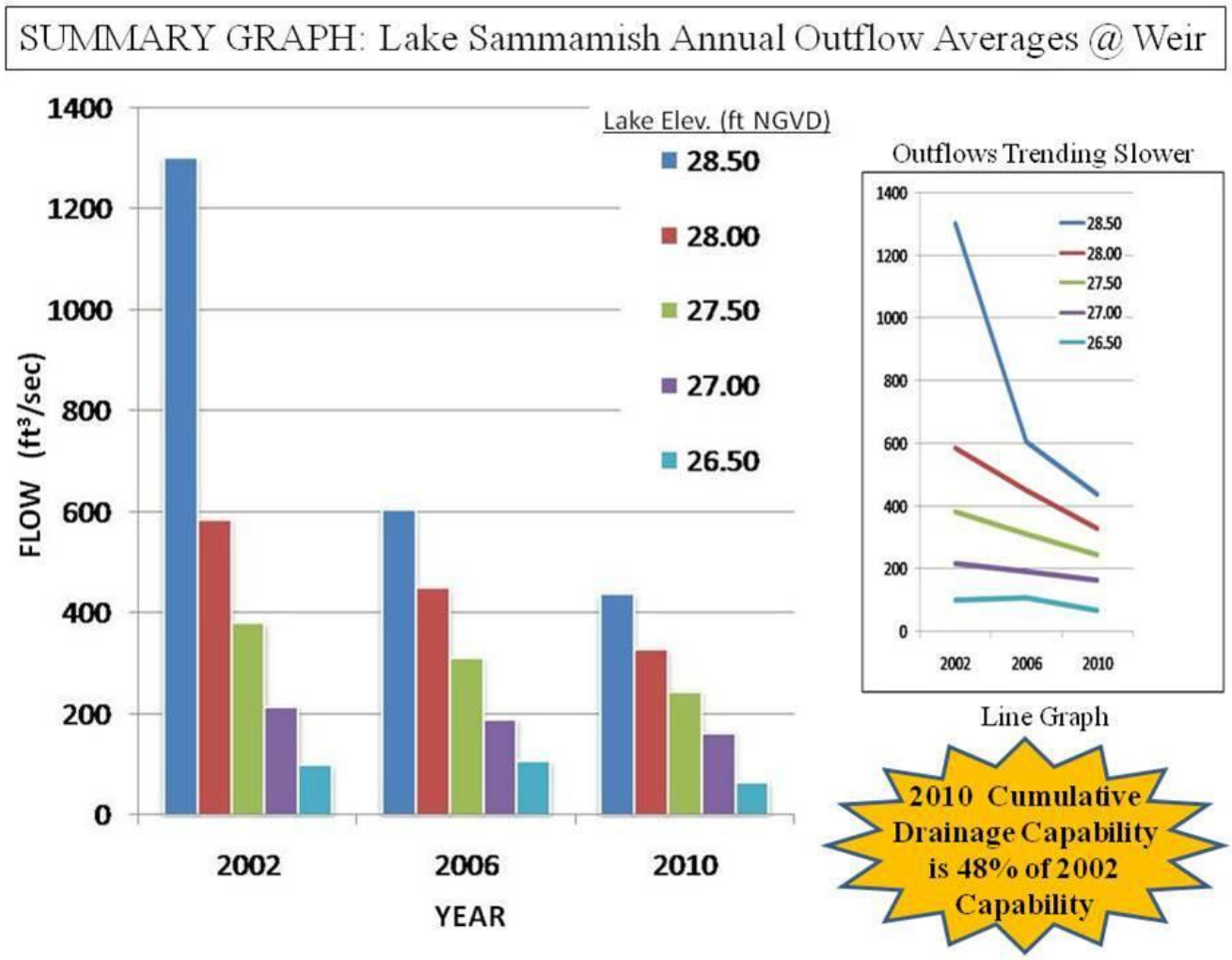
CC: Charles Ifft, Corps of Engineers
Mark Issacson, WLRD Director
John Marchione, Mayor, City of Redmond
Don Gerend, Mayor, City of Sammamish
Tom Young, Office of Representative Dave Reichert
G.Pauley, W.McKenzie, D.Martin, R.Crispin, R.Selset, R.McCallum, G.Heitlauf; Residents

Appendix A –

Summary of August 19, 2010 County Meeting

Eastside residents presented study findings analyzing flow conditions in the Sammamish River Transition Zone in the vicinity of Marymoor Park in Redmond. Present were representatives from Council member offices, staff of WLRD, the Corps of Engineers, and several cities.

The resident engineers' analysis, accompanied by photographs, described the deterioration in flow conditions over a period of 8 years. Key among the findings of the analysis is the following graph showing the reduction in flow at all lake levels.



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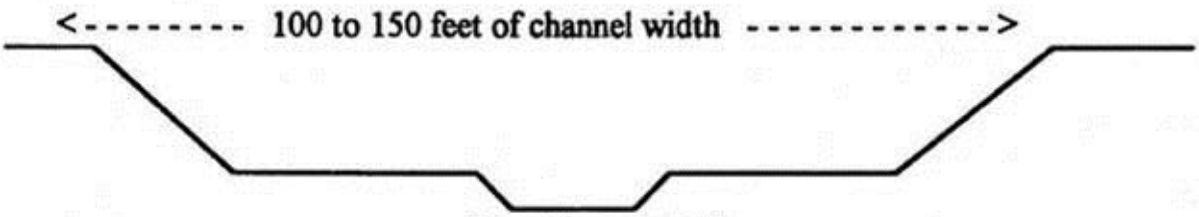
Among historic information cited by residents was the basic conditions and assumptions to which the weir and transition zone were designed. This excerpt from a 1993 Army Corps of Engineers' report indicates that lack of maintenance of the transition zone has been an ongoing problem with King County.

CENPS-EN-HH-HG **9 December 1993**

- **Below is a schematic cross section in elevation view through the transition section. The low-flow conveyance section is in the middle. The low-flow section is lined and stays clear of vegetation. Vegetation immediately adjacent to the low-flow channel has been allowed to accumulate to provide some shade on the channel. The existing condition of the left and right sections is complete cover of vegetation grown to a height of 10 to 15 feet.**



- **Low flow channel**

- - - Designed capacity is to pass 1,500 cfs at a water surface elevation of 29 feet. - - -

- **The existing condition is not expected to persist into the future. The Corps is recommending that the left and right conveyance sections be trimmed to a height no greater than 6 inches every 2 years.**

Failure to maintain the transition zone to these standards has led to artificial and persistently high lake water levels, the consequences of which were presented by residents. Some of their pictures are shown here.

Dislodged Shoreline Polluting Lk Samm 6/2010

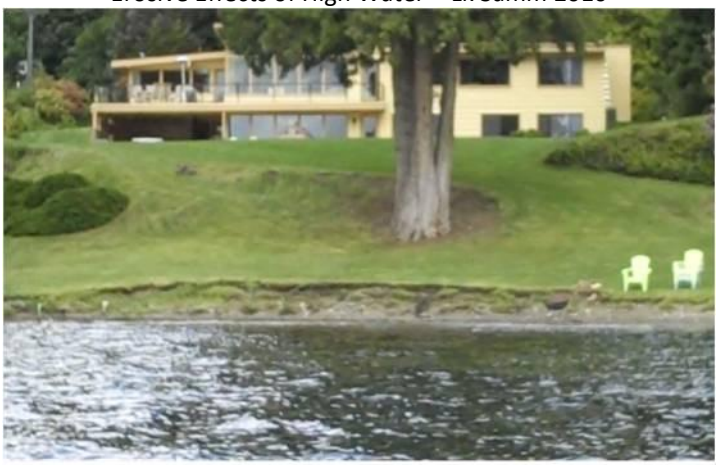
Lk Samm Storm Impacts – Winter 2006

In the second portion of the presentation, fisheries scientist and former University of Washington professor, Dr. Gil Pauley, listed a variety of impacts which lack of maintenance of the transition zone has encouraged. These included:

- **Predators** – flow restraints foster predator fish, which equals reduced salmon survival.
- **Shade** – overgrowth isn't needed for salmon. They're migrating and spend little time here.
- **Returning spawners** – would have easier upstream access without obstructions.
- **Scour** – not a factor for salmon eggs. No record that channel is a salmon breeding ground.
- **Pollution Impacts** - as mentioned, high water will cause sediment to be pulled into the lake. This is a problem for young salmon.

Bass Fishermen atop Weir May 2009

Erosive Effects of High Water – Lk Samm 2010



Following the citizen presentation, a question and answer period followed. A series of action items were delineated by Councilmember Lambert, including agreement that there be field visit to the weir and transition zone on Sept. 9, 2010.

Appendix B –

Letter Recapping Citizen – Corps of Engineers Meeting
Sept 8, 2010

US Army Corps of Engineers **Sept. 10, 2010**
ATTN: Charles Ifft
4735 E. Marginal Way S
Seattle WA 98124-3755

Charles – Thanks for meeting with us the other day and answering the variety of questions we posed. As a means to assure we understood your feedback, following is a summary. We're interested in assuring that other concerned residents and our elected officials understand some of these points. This information may pertain to causes of increasingly high water levels on Lake Sammamish over the last decade.

Hydraulic Modeling –

Since these models form the basis of answers to many questions, we were concerned with their use and coordination. Among the questions we posed were the following. Following each I've paraphrased what I heard.

How are hydraulic models pertaining to Lake Sammamish coordinated? There are numerous models; the Corps has theirs, the County theirs, area consultants have theirs, and even FEMA, via consultants, builds their own models.

Are the models coordinated, say, for consistency? No. Different factors are entered for differing scenarios and conditions.

So, the Corps does not do either the County modeling or FEMA's for their flood maps? No. They have their own, usually done under agreements with one of several area consultants.

What are the key factors and inputs to the models? Relative to the weir area (Transition Zone), a key variable is the "roughness" factors chosen. These indicate the relative resistance to flow presented by physical conditions in the channel; each segment of the channel needing factors entered reflecting the "roughness" along it. There are other factors for a given modeling situation such as the amount of rainfall and how rapidly it's assumed to arrive at the weir from the lake's drainage basin.

What were the presumptions for the design of the current weir? Bottom line: the conditions assumed a 40 year storm and that the transition zone would handle sufficient flow (specifically 1500 CFS) when the lake reached an elevation of 29 feet (NGVD). Other presumptions: there would only be 10 feet of shrubs on either side of the low flow (center) channel and both of the wider outside channels would be cleared of brush (growth) each year.

Maintenance of Design Conditions –

How did maintenance change? There was discussion in the late '90's that the County would sponsor a project for a channel widening below the weir, and that would allow the County to work towards limited or even no maintenance of the channel (removing brush from them each year). County staff suggested

that a new channel would allow reduction in frequency of maintenance below the original design assumptions, and proceeded to do so. Annual brushing of both sides has gradually slipped to one side every year, to one side every other year resulting in the current four year cycle. There has been no progress towards constructing the project since the original proposal.

Has the Corps concurred with such an infrequent maintenance program? The Corps staff agreed to a change in the maintenance regime in 1993 from the original maintenance program allowing for more vegetation to be present in the transition zone. The "agreement" was not officially adopted by the District Commander or the King County Executive. It also noted that the maintenance practices were adaptable if there were problems noted in functioning of the project.

What does the proposed new channel look like and what's its status? No plans have been provided, but the concept was to create a wide area just beyond the weir, kind of a wide swoop, parallel to the existing channel, narrowing back at the end of the transition zone. It would not be a smooth channel, say of concrete, to carry storm level flows, but more of a natural area with courser woods and native vegetation, not unlike the center low flow channel.

Would this meet approvals from the Corps? If the proposal to modify the transition zone was demonstrated to show full functionality in a modified state, the Corps may approve of the change given a thorough review of the proposal. Additional work must be done on the entire project before the Corps could consider making the project active in the PL 84-99 program again.

What has been the County reaction to your stance? County staff has inquired about the process to de-authorize the project so that no further 408 permits would be required for environmental enhancement projects. The process for de-authorization would literally take an act of Congress since the Federal Government is averse to abandoning taxpayer investment. The contention is that the project was to protect farm lands from flooding and those conditions have changed; simply de-authorize the project. Of course, such action on our part would fail to recognize that even more development is now involved, since those farms disappeared, not to mention the needs of lake residents.

Can you simply step away like they suggest? A study would have to be initiated and it would have to show that the project is no longer in the taxpayers' interest. After public input, Congress would have to act to remove the project from public sponsorship. Also, under 33 USC 408, no major modifications can be made without approval from the Chief Engineer of the Corps, at national level. Second, there are limitations placed on plantings in navigable waterways – which the river still is.

The project is currently inactive in the PL 84-88 rehabilitation program, but is still considered a Federal project. If a 404 permit is needed by a sponsor for modification of the project, then a 408 mod approval is still required even with the "inactive" status.

Analysis of this Year's Situation -

Is there a simple manner to assess whether this river section is adequately handling flow? The citizen group has essentially shown this in their photos. When water is encountering resistance, it will appear to slow and spread. This is called Slack Flow. Conversely, if there is relatively little resistance and there's enough of a drop in, as below the weir in the transition zone, gravity will take over and water will run more freely.

Can the data prepared by our citizens group be used to calculate the flow resistance of the transition zone? In a way, yes, it could provide an overall roughness value, but there's really no need to. You've presented real data which shows, over a substantial period of time, the flows at all levels of lake water have been diminishing. Models aren't needed. Real data provides factual information that removes the need for computer models where assumptions and estimations can be subject to debate.

Do conditions upstream toward the lake impact the flow? Possibly, but if there's Slack Flow from the transition zone back toward the lake, then you know the primary restraint is below (north of) the weir.

Is dredging, to return the channels to the original depth and eliminate "roughness" produced by growth an option? Yes, however it must be done with care as there's a bed of rock spalls that created the channel which should not be disturbed.

Bear Creek has been mentioned as a cause of the backup of waters we've seen in the Lake. Is that likely? That's unlikely. It's about a mile away and, more important, there's a drop of some 6 or 7 feet from the weir to that point. Some model runs produced by the County have shown that the water surface profile is very flat at high flows, but those models need to be calibrated with flood stages and the modifications at the mouth of Bear Creek also need to be incorporated into updated models.

We've seen photos from Google Earth (inserted below) this past May when we had unusually high lake water levels. They show rapidly flowing water at the end of the transition zone. Does that tell us anything? Yes, it does. Water that's running rapidly like that is not being constrained. This tells us that Bear Creek was not causing a back-up at the time. Slackened flow is occurring upstream from the weir, not here.

If there's some possibility that Bear Creek is involved, are there actions which would mitigate that? The major factor with flows from the weir to Bear Creek is the roughness along the banks. Extensive brushing of the channel from the transition zone to Bear Creek along both sides would help to reduce backwater effects if there are any. You can see this is needed in your photo from May. A great deal of brushing could be done at the end of the transition zone toward Bear Creek.

In 2003 there was a mediation process. What was that about? Given the Corps' continuing concern with lack of maintenance and unpermitted activity along the entire project, a conflict resolution meeting was held to seek solutions to the problems involving maintenance. The County agreed to return to the maintenance schedule in the 1993 agreement until a permanent project could be built to modify the transition section for environmental enhancement that would eliminate maintenance requirements. Responsibility was clearly shifted to the County, but we have continued to notify them of maintenance needs. Lack of maintenance and ongoing modifications throughout the project led the Corps to make the project inactive in 2008.

Is the current maintenance program sustaining flows needed to handle the original storm conditions? No. The data obtained by the citizens group clearly shows that the project flow vs. lake stage is lower than what was authorized in the original feasibility study.

As upstream property owners, we're greatly concerned about flooding. You seem to be our only protection from catastrophe. Are there other sanctions within the purview of the Corps to protect us? There are. The most stringent action would be for the Corps to decide not to partner with King County on planned future projects due to failure of the County to maintain its existing projects. That may impact hundreds of millions of dollars which come from the federal level to the region.

Closing –

Charles, thanks again for your clarifications, especially in light of the field visit yesterday (9/9/10).

One other observation we'd like to note, to see if you concur. In the photo inserted below, from May 2010, when we know high flows were occurring, it appears that conditions have changed over time in another way. All flows seem to funnel toward the low flow channel, even at the north end of the of the transition zone heading toward Bear Creek. Is it not also important to assure the side channels are cleared all the way to that point, or is that what you were suggesting the clearing was for, toward Bear Creek, above?

Respectfully yours,

Martin C (Marty) Nizlek, PhD CE
312 W Lake Sammamish Pkwy NE
Bellevue WA 98008

CC: R.Crispin

May 2006 Aerial Photo Showing Transition Zone and Weir

Shrub & Tree Overgrowth Below TZ Affecting Downstream Flow **Weir**