



LAKE LEVEL MANAGEMENT PLAN



Revision: 6 September 2011

City of Lake Stevens Lake Level Management Plan Revision 2011

Purpose

This lake level management plan consists of the policies, intent, and procedures of the City of Lake Stevens for managing the water surface level of Lake Stevens. The plan serves as a guide document and is considered a living document subject to changes and revisions. The plan reflects the expectations of City management and maintains flexibility for modifications.

Background

Lake Stevens is the largest and deepest lake in Snohomish County with a surface area of 1,040 acres, an average depth of 62 feet, and a maximum depth of 150 feet. The Lake Stevens' watershed area is approximately 3,500 acres. A map of the watershed is included at the end of this document. The watershed area is relatively small compared to the size of the lake. Stevens, Lundeen, and Kokanee, and Stitch creeks are the main tributaries that convey flows to Lake Stevens along with some smaller un-named tributaries and localized drainage conveyance systems. The lake has a single outfall that drains to the channel adjacent to Hartford Drive that discharges to Catherine Creek. Lake Stevens provides benefits to aquatic life, storm water management, and recreation.

Lake Stevens is a water of the State of Washington and it is regulated by multiple Federal, State, County and Local agencies. The City of Lake Stevens and Snohomish County share the management responsibilities for the lake's operations. The primary reason for regulating the lake levels is to maintain a summer and fall flow in the lake's outfall channel for fish habitat.

Lake Level Management

The lake level is managed by the City's Public Works Department. This is performed using a weir board system that is installed and maintained from April through October, depending on



Figure 1 - Weir system

the weather. The remainder of the year the weir boards are completely removed and the lake level is controlled naturally by the weather conditions and the capacity of the outfall channel.

Weir Structure

The weir provides a fish passage opening in the bottom board. This allows for continuous flow for the outfall channel when the lake level is below the weir. As the water level rises above the top of the weir, the overflow spills over into the outfall channel. The weir is comprised of five wood boards that adjust the height of the crest. These are placed manually and secured with a pin and locked. The adjustments elevation of the weir boards are shown in Table 1.

Weir Board	Base	1	2	3	4	5
Total Height	0	12"	4"	4"	4"	4"
Top Elevation	209.3	210.3	210.6	210.9	211.3	211.6

Table 1 - Weir Elevations

Lake Level Monitoring

The lake level is monitored by reading a staff gauge mounted in the North Cove area of the lake. The City monitors the lake levels several times each week throughout the year. This information is recorded along with the current elevation setting of the weir. This information is critical during the early spring and late fall months when the weir will often need to be adjusted to lower the lake levels to handle anticipated rainfall events. It also is a valuable guide used to predict how much water needs to be held back in the lake to attempt to achieve the desired lake levels during the drier summer months. This information is updated periodically on the City's web-page for public viewing. The elevation of the lake level monitoring gauge and the elevation of the weir had been calibrated to be on the same datum. The gauge measures to 1/100 of a foot and is shown in figure 2.

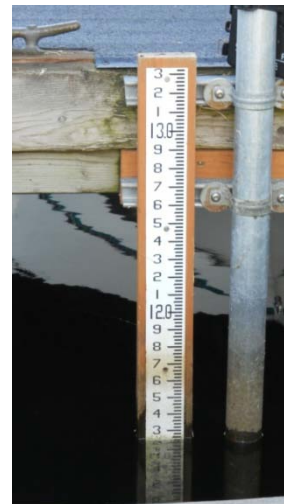


Figure 2 - Visual monitoring gauge

Snohomish County maintains a data collector that monitors the lake level and is downloaded each month. This data can be reviewed on the County's Surface Water Online Data website.

Target Lake Levels

Table 2 shows the target lake levels that are sought throughout the year. These elevations were determined based on the ideal elevation to achieve a continuous flow in the outfall channel during the summer and fall months when water flows in streams are typically at their lowest. For Lake Stevens the target level has been set at 211.7 for the summer months of the year, which is 0.1 feet above the top of the weir when at its maximum height (211.6). This will ensure sufficient flows in the outfall channel to sustain fish passage. It has been observed that during the dry summer months the lake level is typically lower than the weir height. The decrease in lake level will provide available storage volume during the wet seasons.

Month	Target Lake Level	Typical Weir El.
January	209.3	None
February	209.3	None
March	209.3	None
April	211.0	210.9
May	211.7	211.3
June	211.7	211.6
July	211.7	211.6
August	211.7	211.6
September	211.0	210.6
October	209.3	None
November	209.3	None
December	209.3	None

Table 2 - Target lake levels

Those timeframes shaded in Table 2 are the periods when the levels of the lake are not controlled by the City. During the months the weir is operational, a typical weir elevation is shown as a guideline only. The actual weir elevation is determined by the City

based on expected weather patterns, estimated ground water effects, and future seasonal forecasts. For example, if the prediction is for a drier than normal summer, the target lake level and weir placement might be set higher in the early spring months to produce more stored water in an effort to compensate for the lower inflow of surface water from the watershed.

Uncontrolled Flows

The lake level is affected by inflow and outflow. Inflow is difficult to predict and can be very difficult to control. There are wetlands and constructed stormwater facilities that help to buffer the intensity of the inflow, but a large volume of this surface water will enter the lake eventually through surface channels or groundwater.

During the operational period of the weir, the top (crest) of the weir typically is the controlling factor for the outflow. However, during a high flow event, it is common that all the weir boards are removed and the outflow of the lake is unrestricted. In the non-operational period of the weir, this is always the case. In both of these situations the outfall channel naturally will control the flow. It is not uncommon that the downstream channel will approach its natural capacity and result in not being able to release at the rate of the inflow of water to the lake. This results in the lake raising.

FEMA Flood Plan Level

FEMA's 2011 Flood Hazard Area Elevation for Lake Stevens is 213.00 (NGVD 29).

Setting Lake Level

Only during the operation period of the weir does the City control the lake level. Setting the lake level when the weir is operational is a judgment process based on past historical data, carefully monitoring the lake levels, and reviewing upcoming weather forecasts. This is challenging and often requires daily attention, particularly during extended rainy periods.

The initial determination for setting the weir height will use the "Typical Weir Elevation" as shown in Table 2. This is a starting point. Adjustment will be made to increase or decrease the weir height based on recent past and current weather conditions and on a five day weather forecast. If a heavy rain is predicted, the weir may be lowered to decrease the lake level and increase the lake's available storage volume to meter the outflow and to prevent flooding of the surrounding lake front properties and downstream area.

Policy Statement

In developing the lake level management policies , the City considered a number of factors including:

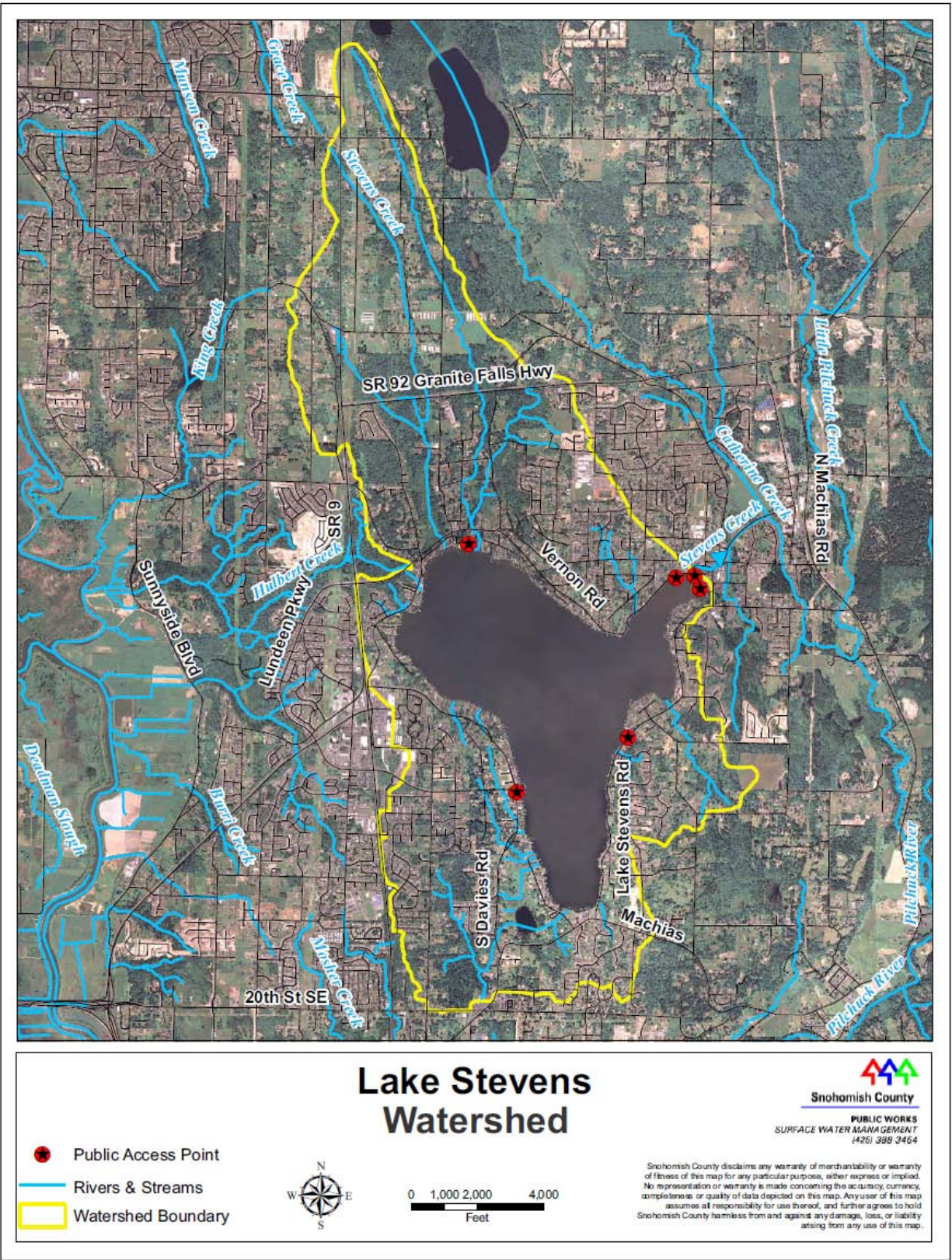
- Public safety, health, and welfare
- Protection of property
- Preserve downstream flows during the summer and early fall
- Protection of water quality

Policy 1 - Adjustments to the weir height will be performed to maintain the target lake level elevations, provide storage capacity for storm events, perform maintenance associated with the weir, and for City approved special activities.

Policy 2 - Preparation for pending storm events shall take priority over maintaining the target lake level elevation.

Policy 3 - Adjustments to the weir height will not be performed for the purpose of private property maintenance.

Lake Stevens' Watershed Map



X:\Lakes\Arc View\Projects\Lake_Watershed_Update\Maps\Stevens_Photo RP 11/30/2009