

2.1.1.2 HYDRAULIC IMPACTS – VALLEY STORAGE

The maximum allowable valley storage decrease for the 100-year flood and Standard Project Flood are 0.0% and 5.0%, respectively.

General. The computation of valley storage in the CDC Process can be divided into two parts, On-Site and Off-Site. The determination of valley storage impacts consists of the comparison of two conditions: Pre-Project and With-Project. The maximum allowable valley storage decrease, stated as the percent change, is computed with respect to the Pre-Project (existing conditions) amount of valley storage On-Site (within the boundary of the proposed project tract). The intent of the Common Regional Criteria is to identify the specific valley storage impact of an individual proposed project, therefore the impact must be evaluated with respect to the original available On-Site valley storage, not the hydrologic routing reach, the entire river reach, or an area that includes land on the opposite side of the river from the subject tract.

Pre-Project On-Site valley storage. The first step in the determination of valley storage impact is to compute Pre-Project On-Site valley storage. It is suggested that specialized terrain software or other detailed methods be used to compute On-Site valley storage, since the HEC-RAS model may not fully account for valley storage in a specific project tract. The choice of method for valley storage computation is at the discretion of the Applicant's engineer. However, assistance in determining the most appropriate method is available from the CDC/Floodplain Administrator and/or the USACE Water Resources Branch.

With-Project On-Site and Off-Site valley storage. The With-Project conditions model represents the proposed project tract and its resulting impact to water surface profiles and valley storage. Given the restraints of the water surface profile criteria (paragraph 2.1.1.1), the With-Project conditions model could possibly produce a decrease in the 100-year and SPF water surface profiles within, adjacent to, and upstream of, the proposed project (for example, due to additional conveyance on a project tract or a more efficient bridge structure). If the With-Project condition results in a reduction of the water surface profile, this reduction is classified as a valley storage loss. This is a loss in valley storage since the approved 100-year and SPF flows in the river corridor, shown in Appendix B.1 Tables 1A - 1D and incorporated into the CDC Model, were produced from the upper Trinity River watershed runoff model using computed reach-by-reach valley storage values. The 100-year and SPF flows are considered "fixed", therefore the corresponding valley storage values are likewise considered fixed values from which all future proposed projects are evaluated against.

For the With-Project conditions analysis, both On-Site and Off-Site valley storage must be determined. On-Site valley storage can be determined using the same methods as used to compute Pre-Project On-Site valley storage. The On-Site valley storage will represent the proposed changes to the project tract, such as grading and cut/fill. The Off-Site valley storage is determined by computing the impacts to all lands adjacent to, and upstream of, the project tract (see Figure 2-1, Project Site Layout Plan). If the proposed project results in a reduction in water surface profile (as compared to Pre-Project), then the upstream extent to which the impacts of the reduction is computed to is the location in which the With-Project water surface profile converges with the Pre-Project water surface profile. This can be determined using the output table in the HEC-RAS program. The output table will be used to also obtain the Pre-Project valley storage at the convergence point, which will be compared to the With-Project value.

Computational procedure. The engineering efforts required for adherence to the Common Regional Criteria with respect to the water surface elevations and valley storage criteria is a balancing act of trying to satisfy both criteria at the same time. While a reduction in water surface profile may initially be considered as a positive impact, the negative impacts of this reduction to valley storage may be significant. The cumulative impact of a reduction in valley storage is increased peak flows. The challenge for the project design engineer is to achieve the required water surface criteria, while achieving the allowable valley storage reduction. The allowable valley storage reduction is computed as follows (see Figure 2-2, Flow Chart):

- *Determine Pre-Project On-Site valley storage* (this will be the denominator in the equation to compute percent change in valley storage)
- *Determine With-Project On-Site valley storage*
- *Determine With-Project Off-Site valley storage*
- *Determine Pre-Project Off-Site valley storage* (if needed)
- *Sum the With-Project On-Site and Off-Site valley storage values and divide into the Pre-Project On-Site valley storage value.* This will produce the percent change in valley storage (which could be a gain or loss). Note that if the With-Project conditions model produces no change in water surface profile (0.00), then the only valley storage change is confined to the project tract, since there are no Off-Site impacts.

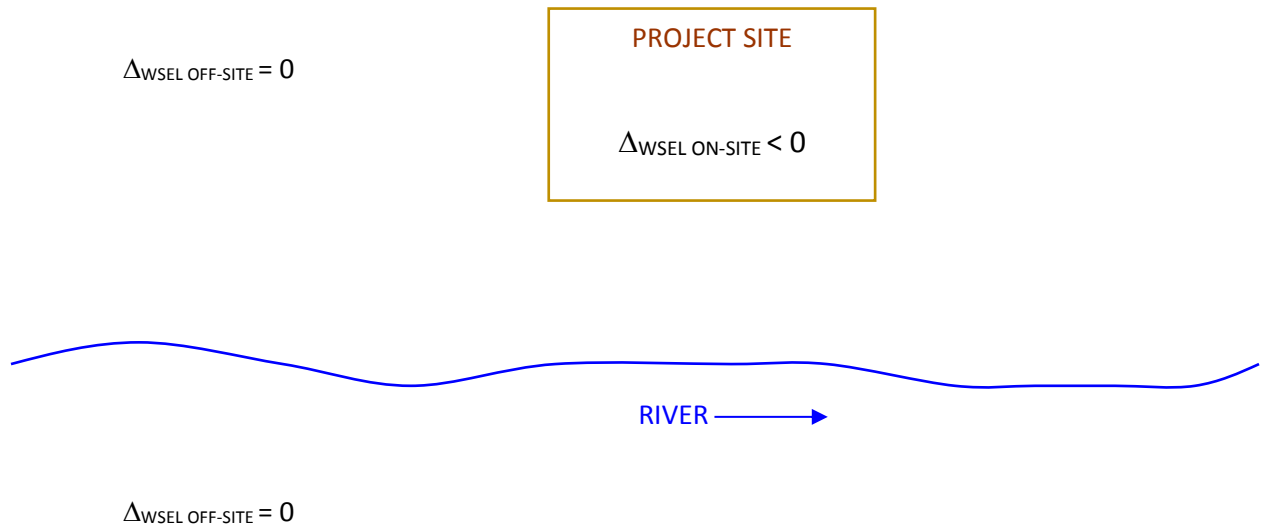
Required valley storage is generally provided within the proposed project site. However, compensatory valley storage may be provided at a separate site, outside of the proposed project site, but preferably in the vicinity of the original project site, subject to approval by the local CDC/Floodplain

Administrator and the USACE. This valley storage compensation area will be evaluated with the same criteria as the original project site such that the valley storage compensation can be maintained in perpetuity. The valley storage site shall be added to the original On-Site tract footprint to compute the percent reduction in valley storage. The valley storage area will be subject to a full hydraulic evaluation in the same manner as the original project site if it is located in the active flow area. If the proposed valley storage area is located within a participating city or county jurisdiction other than the originating jurisdiction, then the CDC/Floodplain Administrator from the affected city or county must be notified and an approval granted by the affected CDC/Floodplain Administrator.

Valley Storage Examples

The following examples on the next three pages are intended to assist the Applicant engineer in computing valley storage impacts of proposed projects. Assistance is available from the CDC/Floodplain Administrator and/or the USACE Water Resources Branch.

Example 1. No decrease in the With-Project 100-year and SPF water surface elevations within project site (On-Site) and outside of project site (Off-Site). All valley storage compensation within the proposed project site.



Pre-Project Conditions

Pre-Project 100-year volume On-Site = 100 acre-feet

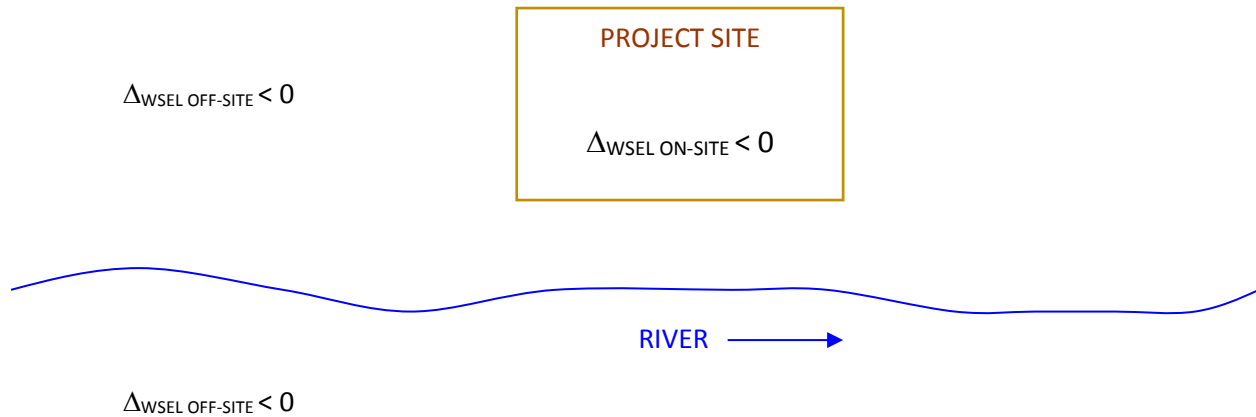
Pre-Project SPF volume On-Site = 200 acre-feet

With-Project Conditions

With-Project 100-year volume on-site must be ≥ 100 acre-feet

With-Project maximum SPF allowable loss of valley storage = 10 acre-feet ((200 acre-feet \times 0.05) (5%)), therefore, the total With-Project SPF valley storage On-Site must be ≥ 190 acre-feet (200 acre-feet $-$ 10 acre-feet)

Example 2. Decrease in the With-Project 100-year and SPF water surface elevations within project site (On-Site) and outside of project site (Off-Site). All valley storage compensation within the proposed project site.



Pre-Project Conditions

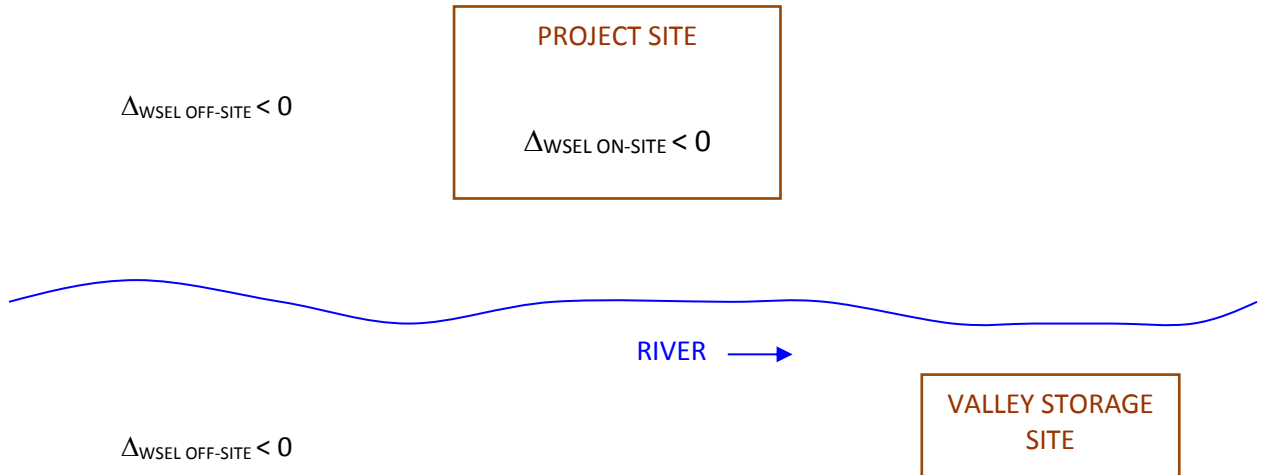
Pre-Project 100-year volume On-Site = 100 acre-feet
Pre-Project SPF volume On-Site = 200 acre-feet

With-Project Conditions

There is a decrease in the 100-year On-Site and Off-Site, therefore, the total With-Project 100-year volume (On-Site and Off-Site) must be ≥ 100 acre-feet

With-Project maximum SPF allowable loss of valley storage = 10 acre-feet $((200 \text{ acre-feet} \times 0.05 (5\%)) = 10 \text{ acre-feet})$, therefore, the total With-Project SPF valley storage On-Site and Off-Site must be ≥ 190 acre-feet $(200 \text{ acre-feet} - 10 \text{ acre-feet})$

Example 3. Decrease in the With-Project 100-year and SPF water surface elevations within project site (On-Site) and outside of project site (Off-Site). Valley storage compensation located in a separate tract from the proposed project site.



Pre-Project Conditions

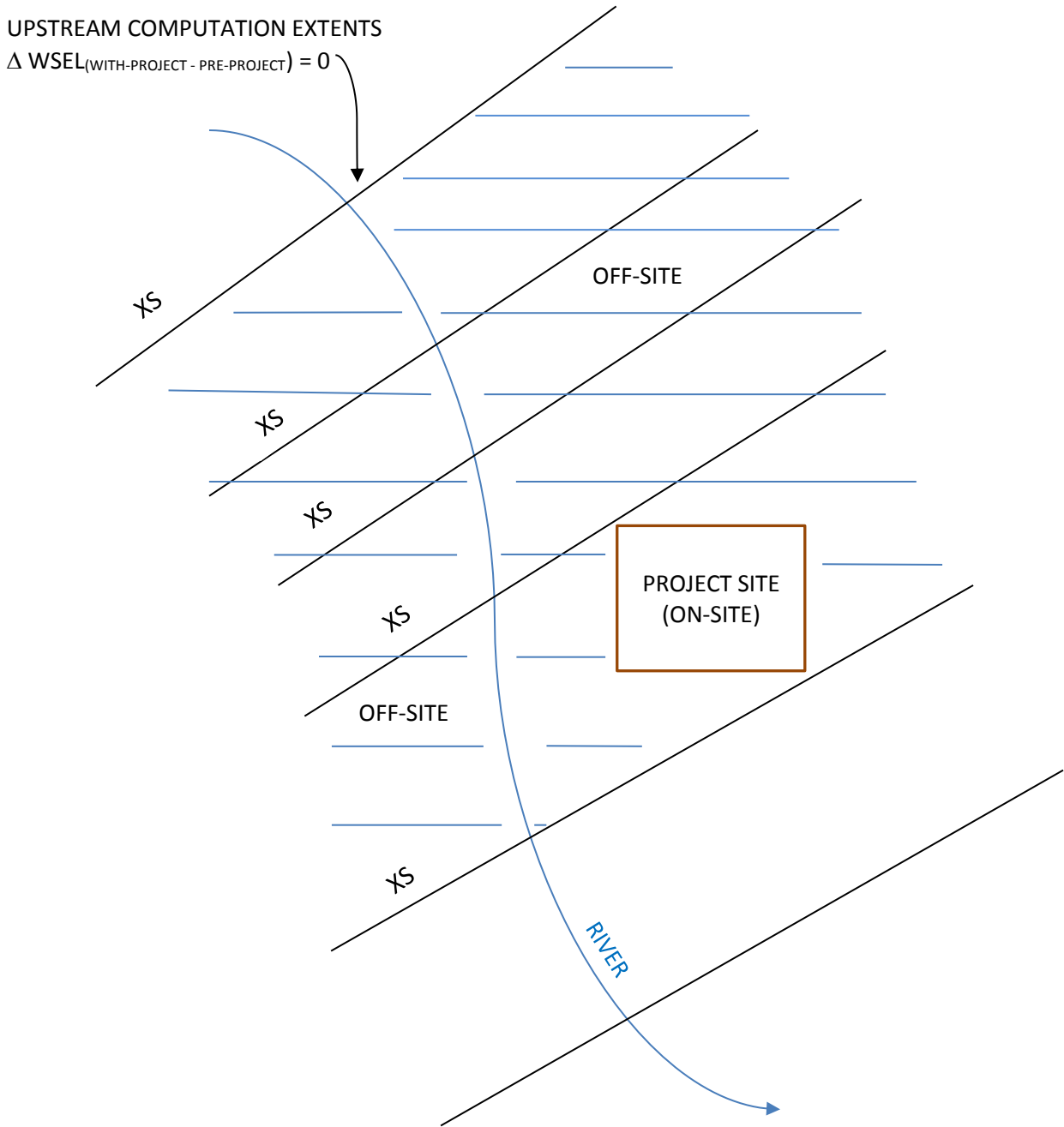
Pre-Project 100-year volume On-Site = 100 acre-feet
 Pre-Project SPF volume On-Site = 200 acre-feet \Rightarrow Equals total of Project Site + Valley Storage site

With-Project Conditions

There is a decrease in the 100-year and SPF water surface elevations On-Site and Off-Site, therefore, the total With-Project 100-year volume (On-Site and Off-Site) must be ≥ 100 acre-feet

With-Project maximum SPF allowable loss of valley storage = 10 acre-feet $((200 \text{ acre-feet} \times 0.05 (5\%)) = 10 \text{ acre-feet})$, therefore, the total With-Project SPF valley storage On-Site and Off-Site must be ≥ 190 acre-feet $(200 \text{ acre-feet} - 10 \text{ acre-feet})$

**FIGURE 2-1
PROJECT SITE LAYOUT PLAN**



Note: For bridge/roadway projects, the On-Site footprint is the right-of-way limits within the floodplain.

FIGURE 2-2
FLOW CHART - CDC VALLEY STORAGE COMPUTATION PROCESS

