4.3 WATER RESOURCES

4.3.1 Impacts of the Proposed Master Plan

Surface Water

Construction

Construction would include excavation and filling during grading activities, construction of stormwater facilities, and the addition of impervious surfaces. Stage 1 construction would occur in the Mallard Lake and Lake Garrett basins of Salmon Creek and a small portion of the Duwamish River basin. Stage 3 construction would occur in the Duwamish River basin.

Construction activities would result in excavation and removal of vegetation and disturb and compact near-surface soils. Cuts and excavations could intersect shallow perched groundwater. Short-term impacts could result in reduced run-off because water would infiltrate more quickly. However, areas of compacted soil may shed water more quickly. Dewatering activities in trenches and other excavations that encounter seeps or groundwater could result in a temporary increase in discharge to storm drainage systems and/or to surface water bodies.

Stage 1 would be developed prior to the diversion of Lake Garrett Basin drainage to the Duwamish River Basin. This would be accomplished with temporary facilities in the Lake Garrett Basin. The proposed water quality vault could be plumbed for flow control capability, or a temporary pond could also be constructed for stormwater flow control. Development within the Lake Garrett Basin could be restricted to a percentage of the proposed total buildout until the Stage 3 diversion is complete. Alternatively, this could be done in a manner that insures no increase in effective impervious area in the basin until the diversion has been implemented. *The Greenbridge Preliminary Plat – Level 2 Downstream Analysis and Preliminary Drainage Control Plan* (Goldsmith, 2003) discusses phasing considerations for developed drainage control.

Operation

In general, an increase in impervious surface area would result in an increased amount of surface water runoff and a decrease in groundwater recharge. However, the proposed design elements include use of roadside biofiltration swales and roof-drain stub-outs where feasible (see Figure 2.6-7). The bioswales and roof-drain stub-outs would likely offset, at least partially, the added impervious area. Additional details of the proposed LID measures are provided in the *Greenbridge Preliminary Drainage Control Plan* (Goldsmith, 2003) (see Page 36, paragraph 1-5).

Storm water runoff from an 11-acre area the Salmon Creek Basin would be diverted to the North Fork of Hamm Creek. This would increase the on-site area in the Hamm Creek Basin from approximately 43 to 54 acres, or from approximately three percent to four percent of the overall basin. This would reduce the on-site portion of the Salmon Creek basin from approximately 47 to 36 acres, or from approximately four percent to three percent of the entire basin. Stormwater control facilities, if needed, would be sized so that developed peak flows and durations for most storm events would be equal to or less than existing conditions. Since peak flows would be

controlled, significant adverse impacts from the planned diversion to Hamm Creek are not likely. However, as stated in *Section 4.5, Fish Resources*, a minor increase in non-peak flow rates during periods of upstream adult migration may facilitate upstream fish passage.

Duwamish River Basin

Design elements proposed in this basin include biofiltration swales, and routing roof run-off to perforated stub-out drains. Approximately 40 percent (11 acres) of the on-site Lake Garrett basin would be routed to the Duwamish River basin. This reroute could potentially increase water surface elevations in the Duwamish River and increase the frequency or extent of flooding. However, the stormwater control structures for the Proposed Master Plan would be designed and constructed so that post-development peak flows and duration will be equal to or less than existing conditions.

Salmon Creek Basin

Design elements proposed in Mallard Lake sub-basin ML-2 include routing roof run-off to perforated stub-out drains. These design elements would not be used in other portions of the Salmon Creek basin. However, a portion of the run-off from the Lake Garrett basin would be diverted to the Duwamish River basin. This would potentially increase flows to the Duwamish River basin. However, post-development peak flows and duration from the Lake Garrett basin would be equal to or less than the existing conditions. Roof-run-off would be routed to perforated stub-out drains in the Mallard Lake (ML-2) sub-basin. The anticipated credit assumes that roof areas can be modeled as 50 percent grass and 50 percent impervious surface. Even if the anticipated credit is not allowed, the increase in effective impervious area is relatively small and other flow controls could be utilized without affecting the Proposed Master Plan layout for this sub-basin.

Wetlands

Wetland impacts are discussed in *Section 4.4, Plants and Animals*.

Groundwater

Perched Groundwater

Construction

Potential impacts to groundwater could occur primarily during construction. It is anticipated that a shallow water table will be encountered in fill soil and ice-contact/recessional deposits in low-lying areas in the vicinity of 8th Avenue SW. Small seeps may be encountered in gravel or sandy layers within the glacial till during mass grading. Seeps may also be encountered in the thin soil horizon above in-situ glacial till during winter season or following periods of extended precipitation.

Mass grading could adversely affect the seasonally perched water table through stripping of the permeable soils or by compacting to reduce pore space and permeability. Recharge to the deeper aquifers could be reduced slightly as the result of mass grading.

Grading or excavating so that groundwater is encountered, or even to within a few feet of the water table, could make construction difficult. The on-site soils are moisture sensitive, making them unworkable when wet. Groundwater would most likely be encountered during excavations for foundations, stormwater facilities or for utility trenches that would extend into the recessional outwash deposits in the vicinity of 8th Avenue SW. Excavation into saturated portions of the recessional outwash in the vicinity of 8th Avenue SW could result in the need to dewater, and could also result in difficulty in compacting soil. Crawl spaces below structures in this area could become wet as a result of excavating too close to the water table, or it may become difficult to place liners in detention facilities constructed below the water table.

Intersecting and pumping the shallow water table in the vicinity of 8th Avenue SW could cause localized lowering of the water table, but would likely not have significant adverse effects provided the water is handled appropriately.

Removing vegetation (trees, shrubs, grass, etc.) during construction would result in a decrease in evapotranspiration, and may result in a small, temporary increase in recharge.

Operation

Natural recharge to groundwater is expected to decrease slightly following redevelopment as a result of the increase in effective impervious area, mass grading, and potentially due to drainage of shallow subsurface water along cuts and trenches. This would be partially offset by infiltration that would occur in proposed biofiltration swales and perforated stub-out drains that collect run-off from roofs.

Large scale, long-term dewatering of the recessional outwash aquifer could also result in disruption of ground water flow patterns and lowering of the water table, thus decreasing recharge to downstream wetlands, springs, streams and, if dewatered, could potentially reduce recharge to deeper aquifers. However, dewatering of the recessional outwash is not proposed and is not likely to occur.

Regional Aquifers

King County has mapped and designated critical recharge areas to help protect aquifers used for potable water by mapping areas with a high susceptibility for groundwater contamination or where sole source aquifers exist. A portion of the project site (generally east of 8th Avenue) is identified as highly susceptible to groundwater contamination in the SAO map folio. The mapping of high susceptibility to groundwater contamination appears to rely on published geologic mapping and correlates with areas mapped as recessional outwash. The U.S. EPA does not identify a sole source aquifer beneath the project site. The nearest sole source aquifer is southeast of the project site, on the eastside of the Duwamish River. The following discussion provides a discussion of potential impacts.

The project site is already developed for urban uses and densities; the potential for impacts from redevelopment to regional aquifers is considered low. The Proposed Master Plan includes elements such as biofiltration swales, water quality vaults and ponds, and detention ponds that will likely allow some recharge to occur (see Figure 2.6-7). Run-off water from roadways would be treated; therefore, waters that would infiltrate would likely be cleaner than under existing conditions.

Based on recent studies, glacial till underlies the ground surface at shallow depths across more of the site than is shown in published maps (GeoEngineers, 2003). The till soils will not allow rapid infiltration of subsurface water and contaminants. The artificial fill and the recessional outwash/ice-contact deposits also contain a relatively high percentage of fines. Therefore, flow of water through these soils will be low and the fines will help to filter potential contaminants. The extent of any "Areas Highly Susceptible to Ground Water Contamination" should be smaller than that shown by the King County maps.

There are no water supply wells completed in the recessional outwash aquifer within at least a two-mile radius of the project site. Groundwater encountered in recessional outwash deposits on-site is perched on low permeability soils (interpreted to be glacial till). Therefore, there is a low likelihood that contaminants would migrate from the recessional outwash aquifer to deeper aquifers used for potable water.

Groundwater within the advance outwash deposits is approximately 230 feet below the ground surface in the vicinity of the site. No water supply wells are reported in the advance outwash deposits within one mile of the site. Wells utilized for potable water appear to be located within deeper aquifers that are separated by thick layers of low permeability soils. Because of the depth to deeper aquifers and the thick layers of low permeability strata, it is not likely that the aquifers utilized for potable water would be affected.

Flooding

The project site is located outside of regulated 100-year flood-zones, but a portion of the Lake Garrett basin would be routed to the Duwamish River basin. This diversion could theoretically increase the frequency or extent of flooding upstream and downstream of the discharge point to the Duwamish River. However, the portion of the basin affected by the diversion affected by the discharge is very small (11 acres) and no significant flooding impacts are expected. The project would also implement stormwater control facilities and flow controls to minimize impacts.

Construction

Potential increases during construction would be controlled by temporary stormwater control facilities or other measures.

Operation

Flow control structures will be designed and constructed so that post-development peak flows and durations would be equal to or less than existing conditions. No significant adverse impacts are anticipated.

Water Quality

Construction

Construction activities could cause a significant increase in erosion potential and could impair the quality of off-site surface water bodies such as Duwamish River and Salmon Creek. Preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) is required to meet National Pollutant Discharge Elimination System (NPDES) permitting administered by

Washington State Department of Ecology. The plan would primarily consist of a temporary erosion and sedimentation plan (as required by King County), which may include temporary stormwater control facilities. Other impacts to surface water quality could occur from a spill of fuels or other fluids used for construction equipment. An SWPPP could also include a spill response plan would be developed to address accidental releases.

Operation

If untreated, surface water run-off could affect downstream receiving waters. Potential impacts to water quality could occur from discharge of stormwater onto erosion hazard areas, steep slopes or landslide hazard areas. Overflow from stormwater facilities could also result in erosion if not managed properly. Infiltration from stormwater facilities located near steep slopes or landslide hazard areas would result in seeps emerging on or near potentially sensitive slopes.

The Proposed Master Plan includes design and construction of stormwater quality facilities that would be sized to accommodate post-development flows anticipated from each sub-basin. In some cases, clean run-off (e.g., from roofs) would be maintained and routed separately from run-off water needing treatment (e.g., from roadways) to reduce the size of stormwater control facilities, allowing for a more efficient use of the project site, and design of infrastructure. The Proposed Master Plan would also incorporate roadside biofiltration swales to achieve water quality treatment and some flow control. Some infiltration would occur from the biofiltration swales. This would not only augment shallow groundwater flow (interflow), but would also assist with the filtering and treatment of the roadway run-off water. The Mallard Lake ML-2 sub-basin would utilize a wetpond to achieve treatment prior to discharge to Salmon Creek 1 wetland (White Center Pond). A water quality vault is proposed for a portion of the Lake Garrett LG-1 sub-basin that would flow to Lake Garrett. The portion of Lake Garrett LG-1 sub-basin diverted to the Duwamish Basin and Duwamish River sub-basin DR-2 would maintain separate “clean” (e.g., roof run-off) and “dirty” (e.g., road run-off) conveyance systems and would incorporate biofiltration swales in the design. BMPs include both diversion of drainage away from Lake Garrett and use of basic water quality treatment facilities. As a result of the diversion of about 10 acres or 37 percent of the LG-1 Sub-basin to the Duwamish sub-basin, the pollution generating area, compared to the current site would be reduced even without allowances for proposed LID measures. Therefore, implementation of the proposed BMPs would likely improve the Lake Garret water quality. Additional water quality treatment would not be required to prevent adverse impacts to Lake Garrett. A water quality vault is proposed in Duwamish River sub-basin DR-3, since the proposed high-density units are not amenable to biofiltration swales or perforated stub-outs for roof run-off. In general, runoff would be treated and would be cleaner than under existing conditions. This would also result in improved water quality to downstream receiving waters.

4.3.2 Impacts of the Alternatives

Design Alternative Master Plan

Surface Water

Construction

Impacts would be similar to the Proposed Master Plan. However, no diversion of stormwater run-off from Lake Garrett sub-basin DR-2 to the Duwamish River basin would occur. Therefore, no special measures would be needed to address run-off from the Lake Garrett sub-basin developed in Phase 1 since the stormwater facilities would be designed to accommodate all of the Lake Garrett sub-basin DR-2 run-off. The stormwater pond in the Lake Garrett basin could intersect groundwater, depending upon final size and depth of the excavation. If groundwater is intersected, construction would likely be difficult.

Operation

Impacts would be similar to the Proposed Master Plan. Stormwater control facilities would be designed and constructed so that peak flows and durations will be equal to or less than under existing conditions. The stormwater control facilities would use KCSWD standards for design of facilities and would not incorporate principles and design elements allowed under the Demonstration Ordinance. As a result, stormwater control facilities for Lake Garrett and Mallard Lake sub-basins would be 264 percent and 176 percent larger, respectively. If unlined, the Lake Garrett sub-basin LG-1 stormwater facility would be impacted if groundwater elevations rise, decreasing the capacity of the facility to accept and control run-off water. If unlined, water could seep into the ground from stormwater control and water quality ponds located near sensitive slopes or erosion hazard areas.

Groundwater

Perched Groundwater

Construction

Impacts to perched groundwater would be similar to those anticipated under the Proposed Master Plan.

Operation

Impacts to perched groundwater would be similar to those anticipated under the Proposed Master Plan. However, since built green and low impact design principles, such as biofiltration swales and routing of roof-run-off to perforated stub-outs, would not be used, partial recharge to the perched groundwater would not occur and shallow groundwater flow (interflow) could be affected.

Regional Groundwater

Because of the depth to deeper aquifers, it is not likely that groundwater recharge would be significantly impacted.

Flooding

Construction

Impacts would be similar to the Proposed Master Plan. However, since no diversion of a portion of the Lake Garrett sub-basin DR-2 is proposed, all flows would be handled by the stormwater pond for Lake Garrett sub-basin DR-2.

Operation

Impacts would be similar to the Proposed Master Plan. All stormwater control facilities would be designed and constructed so that peak flows and durations are equal to or less than under existing conditions.

Water Quality

Construction

Impacts would be similar to the Proposed Master Plan. Measures such as a SWPPP that includes a TESCP would be implemented during construction. An SWPPP could also include a spill response plan would be developed to address accidental releases.

Operation

Impacts would be similar to the Proposed Master Plan. Water quality facilities would be designed for the anticipated flows. The water quality facilities will use KCSWD standards for design of facilities and will not incorporate built green and low impact design principles and design elements. As a result, water quality facilities would be larger.

No Action Alternative

Under the No Action Alternative, no redevelopment would occur. Existing buildings and infrastructure would remain. No new impacts to surface water or groundwater would result. There would be no additional downstream impacts. Poor drainage would continue to occur in the central portion of the site that reportedly results in water ponding in the vicinity of the community center. Under the No Action Alternative, stormwater run-off would continue to be untreated prior to discharge to local drainage systems and waterbodies. Erosion would continue to occur where stormwater run-off flows onto erosion hazard areas (see *Section 4.8, Environmental Health,* of this Draft EIS for a discussion of potential groundwater impacts associated with historical conditions).

4.3.3 Mitigation Measures

Proposed Master Plan

The following mitigation measures would be implemented during construction of the Proposed Master Plan to satisfy requirements of a SWPPP:

- A temporary erosion and sedimentation control plan (TESCP), which may include a combination of interceptor swales, straw bale barriers, silt fences, and straw mulch for temporary protection of exposed soils and receiving surface water bodies,
- Construction of the diversion, including temporary stormwater ponds, if needed
- A spill prevention plan would be adopted to reduce any accident-related water quality impacts.

Several design elements of the Proposed Master Plan are intended to mitigate potential operational impacts. The items listed below, have been discussed in conjunction with description of impacts in the previous section.

- Diversion of a stormwater run-off from a 11 acres (or 40 percent of the on-site portion) of the Lake Garrett sub-basin LG-1 to the Duwamish River sub-basin DR-2 (increasing the on-site portion from 35 acres to approximately 46 acres),
- Built green and low impact design concepts to enhance stormwater control and reduce development-related impacts, including:
    - Biofiltration swales integrated within street rights-of-way in Duwamish River basin and diverted portions of the Lake Garrett basin,
    - Biofiltration swale/linear park along SW 100th Street,
    - Roof runoff will be captured in perforated roof drain downspout systems and provide a source of groundwater recharge,
    - Reduced road widths and slightly less impervious surface area than the Design Alternative Master Plan,
- Two stormwater detention ponds near the eastern site boundary,
- A water quality vault in the vicinity of the proposed community facilities.
- A water quality vault in the northeastern portion of the redevelopment,
- A water quality wetpond along the western site boundary,
- A new storm drain conveyance system would be constructed and a storm drainage plan would be prepared to outline the proposed methods to control and treat stormwater (both quantity and quality).

All stormwater control facilities would be sized so that peak flows and durations are equal to or less than the existing conditions. For the Proposed Master Plan, additional analysis may be needed for the final design of the stormwater and water quality ponds and for design criteria for installation of the vault in the central (Lake Garrett) basin. It may be necessary to line stormwater ponds located in proximity to erosion, steep slope and/or landslide hazard areas.

Design Alternative Master Plan

Construction mitigation activities would generally be the same as for the Proposed Master Plan. Water quality and detention ponds would be larger since built green and low impact design concepts would not be used. Design for the stormwater control pond for the Lake Garrett sub-basin DR-2 would need to consider the depth to groundwater to avoid difficulties during

construction. Construction of proposed stormwater facilities on the east side of the project would require construction of a large embankment within an east-west trending swale. The embankment would also accommodate a road connecting the southeastern and northeastern portions of the redevelopment. Lining of the ponds will likely be required to prevent seepage into embankment soils.

Special studies would be required for design of the embankment downslope of the Duwamish Basin stormwater quality and detention ponds. The height of the embankment would require specific analyses to evaluate constructability, stability and to provide geotechnical design criteria for construction.

A portion of Lake Garrett drainage basin would not be diverted to the Duwamish River basin. In addition, stormwater drainage facilities would be designed and constructed according to typical King County design standards. As a result, the stormwater quality and detention ponds would be larger. Lining of stormwater control and water quality ponds may be required to reduce seepage potentially affecting sensitive slopes and erosion hazard areas and to reduce potential impacts (e.g. Lake Garrett sub-basin LG-1 facility) from increases in groundwater elevation.

4.3.4 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to water resources are anticipated.