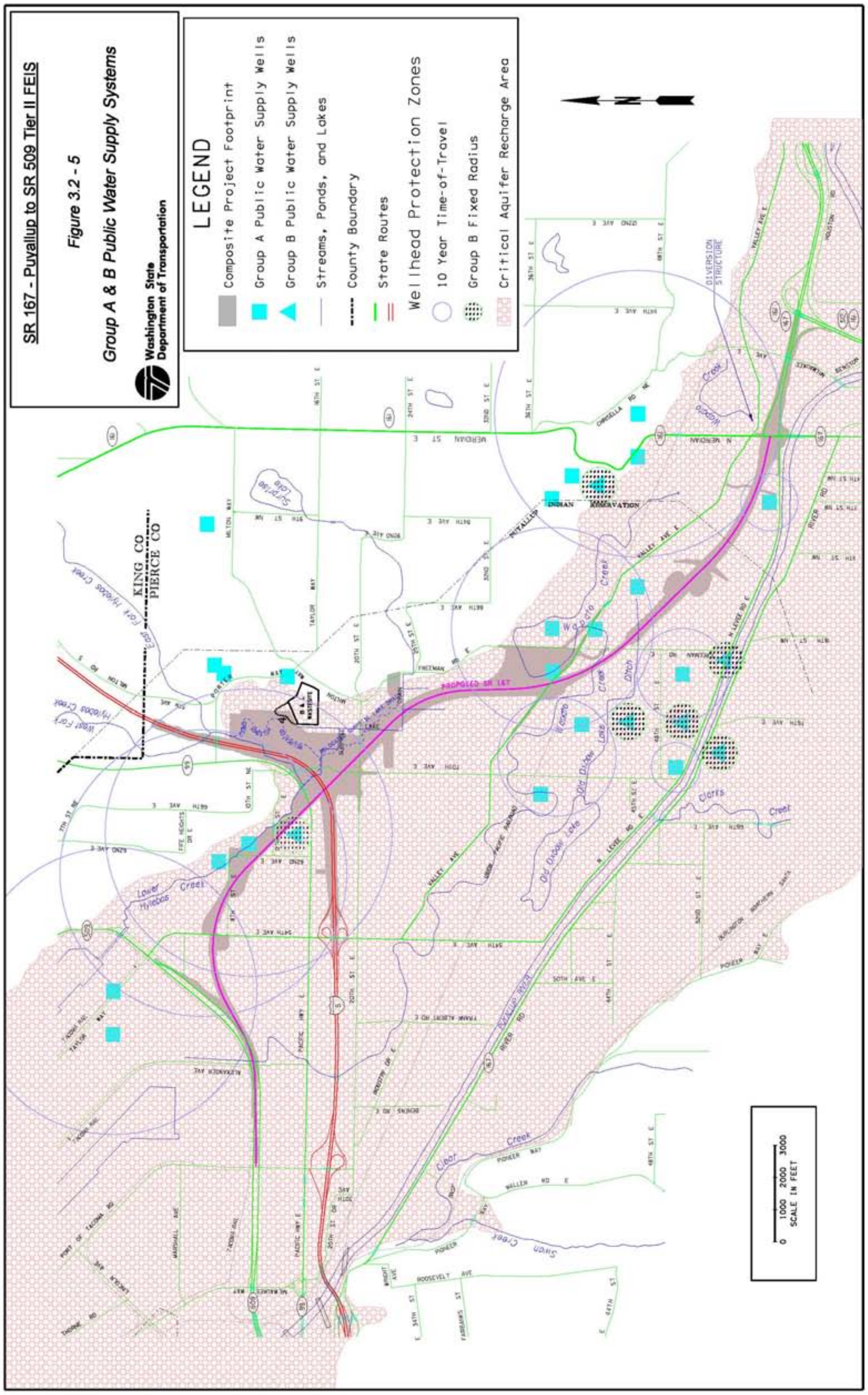
SR 167 - Puyallup to SR 509 Tier II FEIS
Figure 3.2 - 5
Group A & B Public Water Supply Systems
Washington State Department of Transportation
LEGEND
Composite Project Footprint
Group A Public Water Supply Wells
Group B Public Water Supply Wells
Streams, Ponds, and Lakes
County Boundary
State Routes
Wellhead Protection Zones
10 Year Time-of-Travel
Group B Fixed Radius
Critical Aquifer Recharge Area
KING CO
PIERCE CO
PROPOSED SR 167
0 1000 2000 3000
SCALE IN FEET

Shallow groundwater in the project area is susceptible to both excavations that intercept groundwater movements and loads that compress the substrate and retard flows. These shallow groundwater flows are important in maintaining summer flow in area streams.

Water quality within the Lower Puyallup River valley aquifers is generally good (Woodward et al. 1995; USGS 1986). The low permeability of alluvial aquifers decreases the risk of groundwater contamination while the high water table acts to prevent filtration of pollutants and thus increases the risk of contamination. The deeper glacial and nonglacial aquifers face little risk of contamination where thick deposits of clays and silts separate them from the upper alluvial aquifers. However, where these deposits do not exist, the lower aquifers' high permeability makes them more vulnerable to contamination.

One known groundwater contamination site is the old B&L Woodwaste Landfill which is located in the Hylebos basin and is now closed. Currently the site includes a closed approximately eight-acre lined cell of consolidated woodwaste, a leachate collection system, and a stormwater runoff control system (Tetra-Tech 2004). The city of Milton has three wells within this area. Two are not in use, but the third is one of two wells that provide a majority of the water supply. This well extends to a depth of approximately 100 feet. There may also be other wells in the vicinity of this contaminant site.

It is not known how much groundwater extraction is occurring within the project area; however, Ecology reports that withdrawals in WRIA 10 "have shown a rapid and steady increase" (Ecology 1995a). Water uses within the project area correspond to similar uses within the larger watershed (WRIA 10) including: commercial/industrial, general domestic, multiple and single domestic, environmental quality, fire protection, fish propagation, heat exchange, irrigation, mining, municipal supply, recreation, and stock watering.

Based on the DOH database, 19 Group A water supply wells have been identified in the project area and 6 Group B wells. Group A wells provide 15 or more connections. Group B systems provide between 2 and 14 connections to the water supply system. During the environmental review process, 7 additional wells were identified by the City of Milton that were not found in the database search. These are wells that are close to or within the project impact area, or whose wellhead protection zones extend into the project area. Four of these are not currently used. Figure 3.2-5 depicts the general location of Group A and B wells in the project area. Some of the wells are located very close to each other and show up as one location. This is why 21 Group A wells are shown instead of 26.

While this information provides a good starting point for identification of potentially impacted wells, it does not include private wells. Group A and B wells can be overlooked if, for example, their location information is not accurate. A more extensive effort to identify impacted wells will be undertaken before this project can be constructed.

Wellhead protection zones have been identified for many Group A water supply systems, based on the distance a pollutant will travel in six months, one year, five years and ten years. Group B wellhead protection zones are represented as a 600-foot radius around the wellhead. The locations of known water supply systems and designated wellhead protection zones within the project area are shown in Figure 3.2-5. The SR 167 project footprint intersects at least eight Group A wellhead protection zones and at least one Group B wellhead zone. Because wellhead protection zones can overlap, and because not all wells have designated protection zones, the number of wellhead protection zones is not equal to the number of water supply wells.

3.2.3 Stormwater Treatment and Riparian Restoration Proposal

Stormwater treatment is necessary because all man-made features, including roadways and other developments, interfere with the natural flow of stormwater by diverting it or causing it to migrate to new locations, create new impervious surfaces that increase the rate and velocity of flow, and reduce or change areas where percolation can occur to replenish groundwater systems.

Due to the potential impacts associated with stormwater, runoff generated by the highway must meet flow control requirements and water quality treatment requirements (known as stormwater Best Management Practices [BMPs]) that have been set to protect in-stream water quality and hydrology. These requirements are defined in the *Stormwater Management Manual for Western Washington* (Ecology 2001) and are reflected in the WSDOT *Highway Runoff Manual* (WSDOT 2004a). Therefore, by design, it is expected that water quality standards will be met and hydrology maintained to the extent defined by the regulations. This does not imply that additional pollutant loading will not occur or that there may not be some modification in hydrology as a result of the project. Stormwater control is a critical component of this project and the initial design phases have led to development of a stormwater control strategy that is both diverse and innovative. The following description of the Riparian Restoration Proposal (RRP) approach to stormwater treatment and rationale is provided due to the innovative nature of the approach, and as background to the impacts discussed under each basin.

The RRP is a more comprehensive stormwater management plan (SWMP) that covers all of the watersheds in the project corridor. Additional information will be developed during final design to further define and clarify the SWMP approach. The RRP approach was selected because it does not change the amount of flooding, but controls it through natural methods. The RRP would create an environment where flooding and channel migration is not detrimental to houses, roads, private property, public infrastructure, etc., because they are removed and new channel migration zones and riparian buffers are established.

The advantage of the RRP approach is that it removes existing encroachments and restores the riparian ecosystem and natural course of flooding. The RRP would reduce the amount of stormwater coming onto the project from off-site sources by maintaining natural flooding conditions. Stormwater coming from within the right-of-way would be handled with traditional conventional methods onsite before being released into the RRP system.

Conventional stormwater approaches tend to detain and collect stormwater both coming onto the project from outside and water collected on-site within the right-of-way. Stormwater detention ponds can regulate the amount and flow of water leaving the project and allow for treatment before it percolates into groundwater or is released into the surrounding environment. However, conventional methods often conflict with natural processes by blocking channels, altering direction or rates of flow, and require handling of large amounts of water from off-site sources that would not need to be dealt with under a RRP method.

Stormwater treatment requirements include those associated with pollutant removal (water quality) and those associated with reducing and minimizing runoff volume and speed (water quantity). Runoff generated from the corridor must receive both water quality and water quantity treatment. This is described in more detail in the next section. At this time (i.e., preliminary design) stormwater treatment is expected to occur through the RRP, supplemented with standard stormwater treatment facilities (i.e., biofiltration swales, detention ponds, constructed wetlands, and manufactured treatment vaults), possibly deep fill infiltration, and landscaped fill slopes. The RRP is proposed as an alternative to conventional flow control BMPs, such as stormwater detention facilities.

Deep fill infiltration refers to infiltrating stormwater into the highway median strip and allowing the fill underneath to act as a large sand filter and stormwater detention unit. The surface of the median would include compost amended soils or similar filtration media to provide basic quality treatment prior to infiltration. Landscaped fill slopes refers to fill slopes that are landscaped with native vegetation rather than grass and where soil amendments and compost are added to the planting area. Landscaped fill slopes are included in the WSDOT *Highway Runoff Manual* (WSDOT 2004a). Deep fill infiltration is a stormwater management proposal that would warrant coordination with Ecology for use.

Enhanced treatment for removal of dissolved metals will be provided for those highway surfaces that exceed the traffic volume threshold established in the WSDOT *Highway Runoff Manual* (WSDOT 2004a).

Comparison of RRP to Conventional Treatment Design

Preliminary design of the SR 167 project utilized stormwater detention criteria as defined by Ecology's 2001 stormwater design manual (Ecology 2001) flow duration standard. The intent of the standard is to prevent stream channel erosion and instability over that which occurs under pre-developed conditions. The size of detention facilities resulting from application of the 2001 standard are large; often five times larger than facilities designed to previous standards. In the case of the SR 167 project, this increase in size is exacerbated by the project location in a low-lying area where it encroaches on floodplain and wetlands. This requires that the stormwater ponds be sized to compensate for flood storage loss associated with their placement as well as water storage needs associated only with the roadways contribution to impervious surface.

Due to the size and number of stormwater facilities that would have been required under the new standard, and the potential loss or encroachment on wetlands, riparian areas, and floodplain, FHWA and WSDOT developed an alternative approach. The RRP approach effectively meets the goals of the flow duration standard (i.e., control stream erosion and stability) while also reducing existing flood levels and inundation area, enhancing degraded stream segments, and providing improved stream/riparian corridor habitat that would benefit the entire watershed. The stormwater manual (Ecology 2001) includes a provision whereby alternative stormwater controls may be used if they are supported by a watershed analysis that is tailored to the location of interest, with the goal of providing equal or better protection of stream resources than the standard required by the manual. The analysis performed for the Hylebos RRP has met this provision. The Wapato RRP has not yet been formally submitted for review; however, WSDOT has designed the Wapato RRP with the expectation that it might also meet stormwater flow control requirements. FHWA and WSDOT are currently working with Ecology and resource agencies on this plan.

In those areas where RRP is utilized, stormwater runoff from the highway would receive enhanced water quality treatment as it leaves the highway but then would be dispersed overland through protected riparian areas. All of the RRP area would essentially act to detain and absorb the runoff and allow it to be transported at a more natural pace and volume toward the stream. Because of the slow expected speed of the runoff and the long distance of travel (relative to a typical bioswale) the RRP would also effectively act as a final polishing step for pollutant removal. The RRP also involves removal or replacement of problem stream crossings. Undersized stream crossings can cause flooding as well as stream downcutting and erosion from higher velocity discharges. Project implementation would result in removal of a number of stream crossings and substantial improvements to existing stream crossings; typically involving removal of traditional culverts and replacement with bridges or arches that span the stream, if possible.

There are three RRP areas associated with the project; Hylebos Creek, Surprise Lake Drain, and Wapato Creek. Hylebos and Surprise Lake Drain RRPs also involve stream relocations. Details on each of the three RRPs and their impacts are described in detail in Section 3.2-4.

Conceptual Riparian Restoration results for Lower Hylebos Creek.

Conceptual Riparian Restoration results for Surprise Lake Drain.

With conventional stormwater treatment, Hylebos Creek would still need to be relocated from Porter Way to 70th Avenue East and riparian area around the relocated stream would be established. However, Surprise Lake Drain would not be relocated and the RRP area identified around the relocated Surprise Lake Drain would not be established. Also the RRP area identified east of the I-5 corridor would not be established. The result is that the 54[1] acres of upland riparian buffer (buffer not associated with Hylebos relocation) that would be protected in the Hylebos area (including Surprise Lake Drain) under the RRP, would not be protected with the conventional treatment approach. In addition, 12 large stormwater ponds covering 34 acres in the vicinity of the I-5 Interchange would be required. This would result in 8 acres of additional wetland impact at this intersection.

With conventional treatment in the Wapato Creek portion of the project area (the Valley Avenue interchange area), the riparian upland buffer in the RRP area would be greatly reduced (from 60 acres to 7 acres) and approximately 16 stormwater ponds covering 24 acres would be required. Based on field conditions, the number and size of stormwater ponds may change during final design and construction.

A *Net Environmental Benefits Analysis* (NEBA, Section 3.17.2) was performed to quantitatively estimate and compare the relative ecological losses and gains between the use of conventional stormwater treatment ponds and the RRP approach. Project wide, the RRP was found to have 57 percent greater environmental benefit than the conventional treatment approach. In the Hylebos Basin there was an estimated 64 percent increase, in Surprise Lake Drain an estimated 79 percent increase, and in Wapato Basin a 43 percent increase in environmental benefits. These benefits were primarily due to improvements in wetlands, riparian uplands, and stream channel.

Use of the RRP represents an innovative approach to stormwater flow control and will minimize the need for conventional stormwater detention facilities for the SR 167 project. Its direct function is to address stormwater flow control, however RRP will also provide benefits that may be even more critical to the proper functioning of stream resources. Some of these benefits include

- Prevention of streambank erosion through both control of stormwater discharge and through direct stabilization of the streambank via riparian planting;
- Improved shading of the stream through streamside plantings and eventual development of a more diverse terrestrial and aquatic habitat structure;
- Reduction in transport of pollutants from the surrounding area and possibly improvement in the streams ability to assimilate pollutants generated upstream;
- More natural interaction of the streams and their associated floodplains that would allow the stream channels to form and change naturally;
- Wildlife corridor improvement and links to other existing habitat areas and development of more diverse terrestrial and riparian habitats;

[1] The results of the analysis describe acreages for upland riparian buffer, stormwater ponds, and additional wetland effects in approximate numbers that have been rounded to the nearest whole number.

- Reduction in the need for manmade structures (pipelines, culverts, outlets) and promoting natural dispersion and drainage patterns.

Evaluation of Pollutant Contribution

The type and quantity of pollutants in stormwater generated from highways varies widely. The variation is dependent upon the volume of traffic using the highway, highway maintenance activities (e.g., sweeping and vegetation control), the number of days between rain events (i.e., how much pollutants have accumulated on the roadway surface), surrounding land use, the characteristics of the rain event, and other factors. The reported data for urban stormwater and highway runoff quality is generally similar in terms of pollutant constituents and concentrations (FHWA 1996). The exceptions to this are elevated levels of heavy metals (particularly Cu and Zn) that are generated by vehicle use, wear, and emissions. Pb was previously considered an important metal associated with highway runoff, but the concentrations have decreased substantially as a result of the use of unleaded gasoline. For example, in recent monitoring of runoff from Washington State highways, Pb is frequently below detection limits (WSDOT 2004b).

Table 3.2-4 provides a summary of concentrations of key highway related pollutants reported in untreated stormwater from recent WSDOT monitoring efforts in high volume highways (WSDOT 2004b). The associated surface water quality standard is also included. The data depict the typical large range in measured concentrations of these pollutants. Concentrations of dissolved Cu and dissolved Zn are shown to routinely exceed water quality standards in untreated stormwater. Due to the low level of concern currently associated with lead, it has been removed from further analysis in this FEIS.

One purpose of stormwater BMPs is to remove these pollutants from the stormwater before they enter area water resources. However, the amount of pollutants removed or efficiency in terms of the percent reduction in pollutants is highly variable.

Table 3.2-4: Average and Range of Key Highway Related Pollutants Measured in Untreated Stormwater at High Traffic Sites

Parameter	Mean	Range	Acute Toxicity Standard(1)
TSS (mg/L)	121	ND – 1,416	
Total Cadmium (µg/L)	0.96	ND – 5.6	
Dissolved Cadmium (µg/L)	0.22	ND – 0.48	1.2
Total Copper (µg/L)	27.2	3.9 - 220	
Dissolved Copper (µg/L)	6.12	2.0 - 18	6
Total Lead (µg/L)	17.6	ND - 260	
Dissolved Lead (µg/L)	NA	ND	20
Total Zinc (µg/L)	154	17 – 1,200	
Dissolved Zinc (µg/L)	52.8	8.9 - 100	47

Source: WSDOT 2004b. Based on 41 samples from five different sites. High traffic represents ADT 90,000-120,000.
(1) Acute toxicity criteria for surface waters (WAC 173-201a), was calculated using a hardness value of 35, the average value measured in WSDOT stormwater samples (WSDOT 2004b).
ND = Not Detected NA = Not Applicable

Table 3.2-5 provides a comparison of pollutant removal efficiencies for various stormwater BMP types. The median values shown depict typical (50 percent of the time) pollutant removal efficiencies. The large standard deviations are evidence of the many factors that can impact removal efficiencies. Note that the removal efficiencies for metals are based on the concentration of total metals, not the dissolved form that is most toxic. The removal efficiency for dissolved metals is typically much lower. In recent monitoring of a suite of BMPs done by WSDOT (WSDOT 2004b) the reduction in total cadmium ranged from 36 to 85 percent, for total Cu from 72 to 91 percent, and for total Zn 55 to 86 percent. The removal rates for dissolved constituents was much lower. For dissolved Cu reductions were 8 to 60 percent, while for Zn they were 0 to 80 percent and dissolved cadmium ranged from increasing to a decrease of 62 percent.

Table 3.2-5: Percent Pollutant Removal Efficiencies (Median and Standard Deviations) of Different Stormwater Treatment Systems

	Total Suspended Solids	Total Phosphorus	Soluble Phosphorus	Total Nitrogen	Nitrates and Nitrites	Total Copper	Total Zinc
Dry Ponds	**47 +/-** 32	**19 +/-** 13	**-6 +/-** 8.7	**25 +/-** 16	**3.5 +/-** 23	**26**	**26 +/-** 37
Wet Ponds	**80 +/-** 27	**51 +/-** 21	**66 +/-** 27	**33 +/-** 20	**43 +/-** 39	**57 +/-** 22	**66 +/-** 22
Constructed Wetlands	**76 +/-** 43	**49 +/-** 36	**36 +/-** 45	**30 +/-** 34	**67 +/-** 54	**40 +/-** 45	**44 +/-** 40
Filtering Practices	**86 +/-** 23	**59 +/-** 38	**3 +/-** 46	**38 +/-** 16	**-14 +/-** 47	**49 +/-** 26	**88 +/-** 17
Infiltration	**95**	**80 +/-** 24	**85**	**51 +/-** 24	**82**	NA	**99**
Open Channel	**81 +/-** 14	**34 +/-** 33	**38 +/-** 46	**84**(3)	**31 +/-** 49	**51 +/-** 40	**71 +/-** 36

Source: Winer 2000
NA = Data is not available

Clearly, it is difficult to directly evaluate this wide range in incoming pollutant concentrations and wide range in removal efficiencies measured from conventional stormwater BMPs against water quality standards or expected pollutant loadings. A general conclusion from WSDOT's monitoring efforts is that "with treatment" 52 percent and 77 percent of dissolved Cu and dissolved Zn samples, respectively, met State standards (WSDOT 2004b), while 98 percent of dissolved cadmium met the standards. In this case "treatment" refers to a basic treatment facility. The stormwater generated from SR 167 is required to receive both basic treatment and enhanced treatment for metals removal and therefore should meet a higher rate of removal of dissolved metals than demonstrated by the monitoring data described above.

As described previously, enhanced treatment will involve either dispersion over a wide riparian buffer (i.e., over RRP area), filtration through special sand or other media filters, or use of manufactured, specialized treatment vaults designed for this purpose. WSDOT and others are currently testing different enhanced treatment technologies and will eventually be able to provide information on measured removal efficiencies for them. However, by providing enhanced treatment and therefore meeting the requirements of Ecology's stormwater management manual and the WSDOT *Highway Runoff Manual* (WSDOT 2004a) it is "presumed" that the project is in compliance with State and Federal water quality regulations.

A last consideration for evaluating compliance with State toxicity standards is that the information provided in the previous paragraphs refers to either "untreated stormwater" or "treated stormwater," while the water quality standards are based on the "receiving water" (i.e., Hylebos or Wapato Creeks). While the intention is that the acute toxicity criteria be met as close to the point of discharge as practicable, there is an allowed mixing zone. In the case of these metals, the maximum mixing zone would not extend more than 30 feet downstream, or not utilize more than 2.5 percent of the flow, or not occupy more than 25 percent of the width of the stream, whichever is most restrictive.

The mixing zone allowance needs to be applied on a site and conditions specific basis to make a determination of compliance. Using dissolved Cu as an example, and the maximum concentration measured by WSDOT (18 µg/L) and assuming an average of measured removal efficiencies (34 percent) would result in a maximum discharge concentration of 11.9 ug/L, after basic treatment. This means that the mixing zone would need to provide approximately a 2:1 dilution ratio to reach the water quality standard of about 6 ug/L. The predicted 2 year storm event flows in Hylebos (at SR 99 crossing) was 219 cfs (MGS et al. 2004), which means the discharge volume could be as high as approximately 5.5 cfs and still meet the standard (assuming flow was the most restrictive of the mixing zone criteria).

In summary, proposed stormwater treatment for the project is designed to meet or exceed requirements of Ecology's stormwater management manual or the WSDOT *Highway Runoff Manual* (WSDOT 2004a). The RRP approach is expected to provide a number of benefits beyond stormwater control that will improve overall stream functions. Overall, it has been calculated that the net environmental benefits to project area wetlands, streams, and uplands will be 75 percent greater than if the project is not built and 57 percent greater than if the project is built but conventional stormwater treatment is used (CH2M HILL 2005).

3.2.4 Impacts of Construction

No Build Alternative

No direct construction-related impacts to water resources are expected under this alternative. However, the study area is undergoing industrial, commercial, and residential development. The City of Fife and the City of Puyallup have implemented Comprehensive Plans under which land continues to be developed and roads, utilities, schools, and other facilities will continue to be improved, with associated pressures on water resources.

WSDOT would also continue with ongoing transportation projects in this area, with associated construction-related impacts. These projects would include improvements to I-5, SR 509, SR 99, SR 161, and SR 167. Specific improvements could include adding capacity, building HOV lanes, constructing park and ride lots, and improving intersections. Construction and operation of such projects would have the same types of impacts as the Build Alternative.

Build Alternative (Preferred)

The potential for impact of construction to water resources can generally be related to the amount of land disturbance, the existence of potential contaminants in the project area, and the number of construction activities that are planned in or near surface waters. The following is a general description of construction period related impacts that apply to all parts of the build alternative. More detail on activities specific to each surface water basin and project elements within those basins are then described.

Removal of vegetation and soil disturbance increases the likelihood of site erosion and subsequently the potential for increased turbidity and sediment delivery to surface waters. Construction activities that will disturb soil, include: site clearing and grading, in-water work associated with culvert and bridge work, excavation, filling, hauling, landscaping, and geotechnical drilling. Erosion and sedimentation rates are generally proportional to the amount of clearing and grading, slope steepness and length, proximity to receiving waters, and the occurrence of large storms during the construction period. Steep or long slopes are not an issue in the project area, but construction will be occurring in, and in close proximity to, a number of surface water resources. Construction will also occur year-round, which increases the likelihood of encountering a large storm event during construction.

The erodibility for soils in the project area is slight. Tisch soils are rated as having "very slow" runoff and therefore a low erosion hazard. For all other soils, Briscot, Sultan, Alderwood, Puyallup and Kitsap, runoff is rated as "slow" and the hazard for water erosion is slight (Thurston County and Kitsap County Soil Surveys 1974).

Culvert replacements and other in-water work will result in direct physical disturbance to streams and streambeds as well as loss of streamside vegetation, which may result in increased sediment loading and turbidity. The activity at each site may last from one day to one week or longer for pier construction, depending upon complexity and the amount of streambed and bank re-shaping required. Diversion pump systems may be used in many cases to divert the stream during construction.

If possible, proposed bridges or culverts over Hylebos, Surprise Lake Drain, and Wapato Creek (including Wapato Creek's associated wetlands) will completely span these waterbodies, minimizing in-water work. However, since they will result in construction activities occurring near the water, there is still a high potential for movement of disturbed soils and other materials to the stream resulting in increased sediment loading and turbidity. The Build Alternative may also require some in-water piers for the new bridge over the Puyallup River and widening of the existing bridge is likely to require locating piers within the ordinary high water mark. In addition, three temporary structures (i.e., a temporary river crossing and two work trestles), will require in-water piers in the Puyallup River during construction.

Suspended solids increases can impact aquatic systems. In streams, high-suspended solids loads can injure or kill adult fish and damage spawning grounds. Sustained high suspended solids loads can result in increased sedimentation, which can result in a decrease in the stream channel's ability to pass high flows, resulting in an increased tendency for flooding. Destabilization of the stream bank can also occur as the channel responds to increased sediment loading by incising or widening.

These potential construction related impacts are addressed through development of a Temporary Erosion and Sedimentation Control (TESC) Plan for each construction site. This plan is a working document that sets forth the BMPs that will be used during construction to prevent erosion and control sedimentation. They may include anything from installation of silt fencing, hay bales and sediment ponds, to truck wash facilities. WSDOT also requires that stormwater BMPs be installed and operational prior to earthwork. During the life of the construction project, erosion and sediment control BMPs are continuously monitored and the TESC plan is modified in response to changing site and weather conditions. Specific elements of a TESC plan and BMPs are described in detail in the WSDOT *Highway Runoff Manual* (WSDOT 2004a).

Construction site discharges are regulated via the State Water Quality Standards. The proper application of TESC BMPs is intended to result in compliance with water quality standards to the greatest extent practicable.

The flat topography in the project corridor will generally cause runoff from cleared and graded areas to pond on-site rather than flow to surface waters. However, where soil is disturbed in close proximity to streams or ditches, impacts to surface water could occur. Should off-site movement of materials occur, the impact would likely be of moderate magnitude and short duration. However, an extreme storm event that surpasses Ecology's design criteria (Ecology 2001) could overwhelm even permanent BMPs, potentially discharging water that exceeds State Surface Water Quality Standards for turbidity.

In addition to land disturbance related concerns, construction activity can also increase the potential for contaminant release. Construction equipment, materials, and waste on the site represent potential sources of pollutants. These sources include oil and grease, hydraulic fluid, and concrete leachate. These materials could be introduced into the stormwater system and, if not contained or treated, could contaminate ground- and surface water resources. The size of potential contaminant spills ranges from small to large: for example, from leaking heavy equipment to a punctured fuel storage tank. The potential for surface water impacts from contaminant releases is related to the proximity of the staging and construction sites to streams and flood prone areas. Within the construction area, the high water table increases the potential for a large spill and accumulations of small spills to result in contaminated groundwater, especially during the winter months.

Construction activity can also exacerbate existing contaminant problems if there are unknown buried contaminant sources in the project area. Contaminated soils and sediments disturbed by earthwork can result in the delivery of toxic substances to surface waters.

Although all discharges to surface and groundwater are a concern, those that occur in wellhead protection zones or over aquifer recharge areas, are of greater concern due to the vulnerability of groundwater and/or drinking water to contamination in these areas. Type A and B public water supply systems that have designated wellhead protection zones that overlap staging area boundaries or construction sites are shown in Figure 3.2-5. Construction of the project could necessitate the removal and replacement of some of these water supply systems, if they are too close to the potential area of impact. Also, as indicated in Figure 3.2-5, the project area is located within an identified Aquifer Recharge area. The low permeability of the shallow alluvial aquifers decreases the risk of contamination; conversely, the high water table prevents filtration of pollutants and increases the risk of contamination from a spill.

Current construction practices seek to eliminate or minimize contaminant releases that commonly occur at storage and staging areas and construction sites. WSDOT contractors are required to develop and implement a Spill Prevention Control and Countermeasure (SPCC) plan. The SPCC plan specifies the procedures, equipment, and materials used to prevent and control spills of contaminated soil, petroleum products, contaminated water, or other hazardous substances. Contractors are required to provide WSDOT a SPCC plan prior to commencing work. Elements of the SPCC plan are further discussed in the *Hazardous Materials Discipline Study* (WSDOT 2004).

Clearing and grading estimates, the number of in-water or near water work sites, and existence of wellhead protection zones are described for each potentially affected drainage basin in the following project specific impacts sections.

Hylebos Basin

Construction activities that are specific to the Hylebos Basin include construction of the mainline between 20th Street East and the 54th Avenue East interchange, construction of two interchanges (54th Avenue East and I-5), re-alignment of 20th Street East, filling and re-locating of a portion of Hylebos Creek and Surprise Lake Drain, and construction of the RRP for both Hylebos and Surprise Lake Drain. These activities will result in 4.4 acres of temporary wetland impact to Hylebos Creek and 2.9 acres of temporary impact to Surprise Lake Drain (Section 3.3-3). These impacts are related to construction of the new stream channels. This temporary loss of wetlands is not likely to cause water-quality-related impacts other than what occurs through general disturbance of land by construction activities, which is accounted for in the descriptions of clearing and grading impacts. Potential wetland mitigation sites have also been identified in this basin. If one of these sites is selected, enhancement or restoration activities at the site would also result in a temporary impact to the wetland and possibly an impact to nearby surface waters. Due to the conceptual nature of the wetland mitigation plan these impacts cannot be qualitatively or quantitatively described at this time.

54th Avenue East Interchange

Table 3.2-6 provides a comparison of the primary construction activities that influence the magnitude of impacts. The magnitude of impacts from the Loop Ramp (preferred) and Half Diamond options are not expected to differ notably. Since there is no substantive difference between options at this interchange, the following analysis applies to both.

The Loop Ramp (preferred) and Half Diamond options will result in approximately 54.6 and 56.2 acres of clearing and grubbing, respectively. An additional approximately 52.5 acres of clearing and grading will be required for completion of mainline segments not directly associated with this interchange area. One new stream crossing of Fife Ditch is required under both options, the specific type of stream crossing is not yet known. At least two existing undersized stream crossings will be removed, which should help to improve flood passage. Construction site runoff from either option will discharge to Lower Hylebos Creek and Fife Ditch. Fill will be left on-site for an extended period of time in order to compact the soils beneath the mainline and interchanges.

Under both design options, there is a risk of increased movement of materials to the stream and increased turbidity from near water work (i.e., work occurring within or near the stream channel) is minimal. It is not yet known whether the new stream crossing of Fife Ditch for this interchange will be a clear span (i.e., a bridge that does not require support structures within the immediate stream corridor). This type of crossing would require no in-water work, but would result in disturbance of soils within or near the riparian zone. Therefore, modifications to the two existing stream crossings and possibly also the new stream crossing will require in-water work.

Table 3.2-6: Hylebos Basin Impacts Associated with Roadway Construction

	54th AVE E		I-5	Stream Relocation & RRP
	Loop Ramp	*Half Diamond*		
Acres of Clearing and Grading for Mainline	52.5 Total (10.7 are temporary)		79.3 Total (13.4 are temporary)	
Acres of Clearing and Grading at Interchange	56.2 Total (13.1 are temporary)	54.6 Total (12.2 are temporary)	55 Total (12.6 are temporary)	131.6
Wellhead Protection Zones Crossed	3	3	5	5
Temporary Stream Crossings	0	0	7	0
New stream crossings	1	1	3	6
Existing Crossings Improved or Removed	2	2	7	1
Total near water work sites	3	3	17	7

Note: If multiple structures cross at the same location, only the lowest structure was counted.

Due to the amount of required structure, construction can be expected to occur year-round. Exposed soils and soil disturbing activities occurring between October and April present the greatest potential for encountering erosive rain events. Some of the construction and staging areas will be located within flood prone areas.

Construction activities and staging areas associated with this interchange will be located within the wellhead protection zone (10-year time of travel) of three Group A water supply systems (Figure 3.2-5). Two of these wellhead protection zones are also within the area of impact from the I-5 Interchange. These activities could impact groundwater through the introduction of contaminants or disturbance of contaminated soils. Such groundwater impacts are avoided and/or minimized through the implementation of the SPCC plan. Additional protective measures may be implemented as specified with individual wellhead protection plans. Wells that lie directly beneath the project footprint will be decommissioned in accordance with state laws. City of Fife wells 5 and 6 may need to be abandoned, which would impact the City's water supply and require an alternate source be found. Water rights transfers and/or new water rights will be obtained from Ecology prior to decommissioning the wells. The potential for the introduction of contaminants to groundwater does not differ between options.

Because TESC BMPs and SPCC plan will be fully implemented, construction activities at the 54th Avenue East Interchange are expected to result in compliance with water quality standards.

I-5 Interchange

Approximately 55 acres will undergo clearing and grubbing and two new stream crossings will be necessary at this interchange (Table 3.2-6). At this time, it is expected that four existing crossings will be improved. These, in combination with temporary crossings, will result in a total of ten in- or near-water work sites. Construction site runoff is discharged toward Lower Hylebos Creek.

In-water work will occur as a result of the replacement of an existing culvert with a bridge span structure and widening of two bridges under I-5, which will require in-water pilings.

Construction activities and staging areas associated with this interchange will be located within four wellhead protection zones (10-year time of travel) for Group A water supplies, including the composite wellhead protection zone for seven Cityof Milton wells, and one Group B water supply (Figure 3.2-5). There is little potential for effects on the City of Milton wells through new contamination sources (because a highway corridor already exists in the area) or aquifer flow patterns.

These construction activities will be subject to the same potential sources of erosion and sedimentation and introduced contaminant impacts described in Section 6.1. Impacts will be avoided or minimized through the implementation of the TESC and SPCC plans and, therefore, the proposed activities are expected to be in compliance with water quality standards.

Stream Relocation and Riparian Restoration Proposal

Impacts associated with stream relocation and RRP development are summarized in Table 3.2-7. Approximately 2,050 lineal feet of Hylebos Creek (representing approximately 0.47 acre of streambed) and 2.5 acres of stream buffer would be filled to construct the I-5 Interchange. In addition, another 1,000 lineal feet of Surprise Lake Drain (representing 0.14 acre of streambed) would be filled or culverted (Table 3.2-7). Because agricultural activities extend to the top of the bank in this portion of the Surprise Lake Drain, there is no functional riparian buffer loss.

Table 3.2-7: Summary of Stream and Buffer Construction Impact Areas in the Hylebos Basin

	Loss due to Filling			Gain from Relocation & RRP		
	Stream (feet)	*Stream (Acres)*	*Buffer (Acres)*	*Stream (feet)*	*Stream (Acres)*	*Buffer (Acres)*
Hylebos Creek	2,050	0.47	2.5	4,010	2.21	87.4
Surprise Lake	1,000	0.14	0(1)	5,340	1.23	29.0

(1) No functional riparian buffer exists.

To compensate for the channel and buffer lost to fill, two new stream channel and buffer sections will be constructed. The new channels would be constructed to achieve a more natural sinuosity and channel configuration than the existing ditched and straightened channels. Approximately 4,010 lineal feet of new Hylebos Creek channel will be constructed and over 87 acres of riparian zone will be protected surrounding the new and existing channel within the project limits.

The entire section of the Surprise Lake Drain channel, from its confluence with the mainstem of Hylebos Creek to the crossing at Freeman Road will be restored and/or relocated into a new channel to improve the quality and condition of the stream, provide flood control, and habitat benefits. This amounts to approximately 5,340 lineal feet of new channel. Additionally, 29 acres of adjacent riparian area will be protected.

Approximately 700 feet of existing Surprise Lake Drain channel is impacted by mainline SR 167. This is a ditched portion of the channel located on the south side of the proposed highway corridor that is not within the RRP area. New bridge crossings will be constructed under the north- and south-bound lanes of I-5 to convey the combined Hylebos Creek and Surprise Lake Drain to the confluence with the old channel just upstream of SR 99.

In the I-5 interchange area, re-vegetation and riparian plantings can begin in the portions of the RRP that will not be disturbed through any planned construction activities. And, portions of 8th Street East, 62nd Avenue, 67th Avenue, and adjoining residential buildings would be removed from the riparian buffer and floodplain. This will allow this area to begin to provide some filtering and storage capacity before the new stream channel is built. The actual stream relocation work will be carefully timed to insure that it does not become an obstacle during construction and also to avoid critical salmon migration periods. Relocation will begin with constructing the new channel, which will require clearing of approximately 132 acres and planting riparian vegetation (Table 3.2-6).

The proposed design of the “Preferred Option” at I-5 and Hylebos Creek would eliminate two existing stream crossings and replace them with only one that clear spans the stream channel. The two existing stream crossing structures would remain as they are an integral part of the roadway, but would no longer be necessary to convey flows of the relocated Hylebos Creek.

In-stream work during the removal of culverts and bridges, diversion of the stream, and the construction of new stream crossings will result in increased loading of suspended materials and therefore increased turbidity and sedimentation within Hylebos Creek. However, the turbidity increase is expected to be fairly short-lived and will be timed to avoid critical periods of salmon migration. The sedimentation affects would occur over a longer reach of the stream and be longer term in nature. Stream diversion will result in the same type of turbidity and suspended materials increase associated with the in-water work. However, it is also expected that smaller turbidity pulses will continue to occur during the first few rain events after diversion, as disturbed materials are washed downstream.

Potential impacts associated with contaminant spills or affects to water supplies and wellhead protection zones for this portion of the project are the same as those described for the I-5 Interchange.

Wapato Basin

Construction activities that are specific to the Wapato Basin include construction of the mainline between 20th Street East and the two Washington State Patrol (WSP) weigh stations, the Valley Avenue Interchange, a Park and Ride lot, and the RRP for Wapato Creek. Temporary wetland impacts for this project have been defined as those associated with stream relocation activities, therefore, no temporary wetland impacts have been identified in this Basin.

Valley Avenue Interchange

Approximately 105.4 to 127.3 acres will undergo clearing and grading depending upon which interchange option is selected (Table 3.2-8). This includes land associated with the Park and Ride lot. Additionally, approximately 95 acres will be impacted during construction of mainline segments. There will be either one, two, or three new stream crossings depending on the option. One crossing could be a culvert, but the other two are either clear span bridges or high structures that will not require in-water work. Two temporary crossings are planned at this time.

Under the preferred option (Valley Avenue), there will be five near- or in-water worksites. One of the stream crossings has been designed to span both Wapato Creek and adjacent wetlands in order to further avoid wetland impacts from this option. The Freeman Road and Valley Avenue Realignment Options have six and seven sites, respectively.

The Valley Avenue option listed in Table 3.2-8 has the fewest total near-water or in-water work sites of all the proposed interchange options. The Freeman Road and Valley Avenue Realignment options would have more impacts to near or in-water work sites than the Valley Avenue option.

Construction site runoff is discharged toward Wapato Creek. Construction of the Park and Ride lot associated with this interchange will not require in- or near-water work.

Table 3.2-8: Wapato Basin Impact Areas Associated with Roadway Construction

	Valley Avenue				Wapato RRP
	Valley Ave	*Freeman Rd*	*Valley Realignment*	*Park & Ride*	
Acres of Clearing and Grading for Mainline	94.8 acres Total (20.9 are temporary)				
Acres of Clearing and Grading for Interchange	127.3 Total (13.6 are temporary)	113.2 Total (14.6 are temporary)	105.4 Total (17.3 are temporary)	8.4 Total (1.1 are temporary)	60.8-69.3
Wellhead Protection Zones Crossed	2	2	2	2	2
Temporary Crossings	2	2	2	0	0
New stream crossings	3	1	2	0	0
Existing Crossings Improved or Removed	0	3	3	0	8
Total near water work sites	5	6	7	0	8

Construction activities and staging areas associated with this interchange will be located within two designated wellhead protection zones (10-year time of travel) for Group A water supplies (Figure 3.2-5).

Construction activities at this interchange will be subject to the same potential sources of erosion and sedimentation and introduced contaminant impacts described for the Build Alternative at the beginning of the construction impacts section. Impacts will be avoided or minimized through the implementation of the TESC and SPCC plans.

Valley Avenue Park and Ride Lot

Approximately eight acres of clearing and grading would be required to construct the Park and Ride lot. These construction activities would be located within the same two designated wellhead protection zones (10-year time of travel) for Group A water supplies as potentially affected by the Valley Avenue Interchange. No additional stream crossings or other in-water work is associated with this project element.

Construction activities at the Park and Ride will be subject to the same potential sources of erosion and sedimentation and introduced contaminant impacts as described for Interchange areas. Impacts will be avoided or minimized through the implementation of the TESC and SPCC plans. Wapato Creek lies within approximately 100 to 200 feet of the footprint of this Park and Ride lot.

Wapato Riparian Restoration Proposal

The RRP for Wapato Creek would result in at least a 300-foot-wide corridor through which Wapato Creek would flow. Although it was FHWA and WSDOT's goal to provide at least 200 feet along each side, in this area the corridor width is confined by the railroad on one side and the Valley Avenue Park and Ride lot on the other. Establishing the RRP would involve land acquisition along a continuous reach of 9,000 linear feet and conversion of about

73 acres of developed land to riparian habitat. Restoration would involve limited land disturbance associated with removing human encroachment (buildings, roads, culverts, etc.) in the RRP area and planting with native vegetation. Six existing, privately owned culverts and bridges that are undersized would be removed. Another two undersized culverts are slated for replacement to meet current design standards. Removal, replacement, and installation of new culverts represents the only in-water work related impact for this project element.

Old Oxbow Lake Ditch Basin

Over 20 acres of clearing and grading might be affected to construct the 18 to 19 acres of roadway that would be added to this Basin. However, stormwater controls will direct any runoff from these areas toward Wapato Creek and the Puyallup River. No stream crossings or other impacts are expected to this Basin.

Puyallup River Basin

Construction activities that are specific to the Puyallup Basin include; construction of the mainline between from the WSP weigh stations to the project end, the SR 161 Interchange, modification or replacement of two bridges over the Puyallup and the SR 161 Park and Ride lot. Potential wetland mitigation sites have also been identified in this basin. If one of these sites is selected, enhancement or restoration activities at the site would also result in a temporary impact to the wetland and possibly an impact to surface waters, if there are any close by. Due to the conceptual nature of the wetland mitigation plan these impacts cannot be qualitatively or quantitatively described at this time.

SR 161 Interchange

Approximately 41 acres will undergo clearing and grading under all three options (Table 3.2-9). Under all options, no new stream crossings are planned. However, two existing bridges over the Puyallup River will be affected. The steel bridge (northbound traffic) will be replaced. At this time, it is uncertain whether the replacement structure will span the river. More detailed analysis is needed to determine the type and profile of the replacement structure. The concrete bridge (southbound traffic) will be widened. In order to provide a conservative assessment of impacts, it is assumed that some piers will be located within the ordinary high water of the river for both the replaced and widened bridges. Three temporary structures, including a temporary river crossing and two work trestles, will also require in-water piers.

Table 3.2-9: Puyallup Basin Impact Area Associated with Roadway Construction

	SR 161			Park & Ride
	Urban	*Diamond Low*	*Diamond Med.*	
Acres of Clearing and Grading	40.7 Total (7.8 temporary)	41.4 Total (6.9 temporary)	41.4 Total (6.9 temporary)	4 Total (0.8 temporary)
Wellhead Protection Zones Crossed	2	2	2	2
Temporary Crossings	3	3	3	0
New stream crossings	0	0	0	0
Existing Crossings Improved or Removed	2	2	2	0
Total Near-water work sites	2	2	2	0

(1) Clearing and grading associated with mainline segments near this Interchange have been included in estimates for previously described interchange areas.

Construction of the new bridge requires that support structures are first put in place and then the bridge deck is built. To minimize the potential for impacts during formation of the support structures, casings are typically placed within the stream prior to drilling shafts and pouring concrete. Concrete leachate is then pumped from the casings and disposed of off-site. Installation of the casings may disturb soils and channel sediments resulting in short-term turbidity increases within the Puyallup River. Increased turbidity levels would probably be minor in comparison to background levels of glaciofluvial suspended solids. The casings would prevent or minimize the discharge of turbid water to the Puyallup River during the drilling of shafts. Concrete pouring activities could generate a temporary increase in pH and turbidity levels. However, the use of casings and leachate pumping is used to minimize and/or prevent such impacts.

Lead-contaminated paint chips and debris could be generated during the demolition or retrofit of the existing bridge. Without mitigation, such debris could enter the Puyallup River resulting in an impact. Although the details involved in bridge removal are not yet defined, performance standards are being developed for this project element that will focus on avoidance/minimization. Two preliminary performance standards during bridge removal are (1) no material or debris will enter the water and (2) containment will be achieved by the work trestles and the temporary detour. Additional performance measures may be identified in the Biological Opinion for the project.

Construction activities and staging areas associated with this interchange will be located within two designated wellhead protection zones (10-year time of travel) for Group A water supplies (Figure 3.2-5). City of Puyallup well 17 may be within the project footprint and need to be abandoned, which would affect the City's water supply, although this well is not a primary source for the City.

Construction activities at this interchange will be subject to the same potential sources of erosion and sedimentation and introduced contaminant impacts as generally described for the Build Alternative. Impacts will be avoided or minimized through the implementation of the TESC and SPCC plans.

SR 161 Park and Ride Lot

Approximately four acres of clearing and grading would be required to construct the Park and Ride lot (Table 3.2-9). These construction activities would be located within the same two designated wellhead protection zones (10-year time of travel) for Group A water supplies as potentially affected by the SR 161 Interchange. No additional stream crossings or other in-water work is associated with this project element.

Construction activities at the Park and Ride will be subject to the same potential sources of erosion and sedimentation and introduced contaminant impacts as described for Interchange areas. Impacts will be avoided or minimized through the implementation of the TESC and SPCC plans. Since there are no surface waters within 500 feet of this site, the potential for impact is very small.

3.2.5 Impacts of Operation

No Build Alternative

No direct, project-related operation effects on water resources would occur under the No-Build alternative. However, impacts to water resources would occur as non-project-related urban development pressure increases in the project area. The further urbanization of the project area would continue to occur as planned by the local jurisdictions as a result of their Growth Management Act (GMA) planning. The entire area has been re-zoned to facilitate conversion from rural agricultural land uses to more urban development of industrial, commercial, and residential uses. The potential effects of such land use conversion on water resources include increases in runoff and pollutant loading as impervious surface is added and floodplains are filled. Ultimately, ongoing development under the no build alternative would not likely result in lower potential for adverse impacts to water resources than building the proposed project facilities.

No-Build Alternative Land use Changes

In the City of Fife, south of I-5 to the city limits (Freeman Road), the land use has traditionally been farming; most of the land has been agricultural and vacant. However, the city annexed the land and removed the agricultural overlay designation and designated the majority of the land as industrial/commercial (Fife Comprehensive Plan Amendment, 2002). This land use conversion (from agricultural to industrial/commercial) is currently occurring and is expected to continue as planned by the comprehensive plan. (Fife Comprehensive Plan, land use maps, conversations with City Planning Office, and County Assessor database). The City has designated 1,571 acres for industrial development, approximately 47 percent of the entire City (Fife Comprehensive Plan, 2002 [Land Use Element p.2-19]). There are different transportation project scenarios identified in the City of Fife's adopted Transportation Plan (2002) that are influenced by whether or not SR 167 is constructed.

The City of Puyallup's unincorporated West Valley Sub-area (urban growth area (UGA)) has been in agricultural uses with some dispersed housing. North of the Puyallup River, which is within the project area, there are industrial and distribution uses. The UGA and incorporated land north of the river has been designated as Light Manufacturing (industrial/commercial) land use. "In portions of the UGA, agricultural lands provide a base for needed industrial development…" (Puyallup Comprehensive Plan 2005 update). Currently the UGA has been proposed for an industrial park development (City of Puyallup Current Projects Map). The remaining vacant land is being considered for other industrial land development (Puyallup Comprehensive Plan, land use maps, conversations with City Planning Office, and County Assessor database).

The City of Milton UGA that is south and west of Milton, adjacent to the Fife city limits along SR 99/Pacific Highway, is expected to be developed for residential and commercial uses (Milton Comprehensive Plan, land use maps [2002]).

Build Alternative (Preferred)

Project Land Use Changes

The land use changes to occur with the action are expected to occur similar to that without the No-Build Alternative. Land use change trends are expected to follow existing land use plans, zoning designations, and regulations adopted pursuant to the GMA by the affected jurisdictions that directly surround the proposed SR 167 highway extension (see attached local zoning figure 3.11-2). Zoning designations in the study area were obtained from the following sources: City of Fife zoning map (2000); Pierce County map of zones designated "general" and plat maps with zoning overlays (2000); City of Puyallup zoning map (2000); City of Milton zoning map (1999); and City of Tacoma zoning map (2000). However, there are different transportation project scenarios identified in the City of Fife's adopted Transportation Plan (2002) that are influenced by whether or not SR 167 is constructed.

The operation of the new SR 167 corridor has the potential to impact surface water quality and hydrology and groundwater resources over the long term. Potential sources of impacts include increases in peak flows and pollutant loads via stormwater runoff, maintenance activities, and contaminant spills on impervious surface.

The Build Alternative could reduce traffic on local roadways in 2030, compared to the No Build Alternative in 2030, according to traffic studies (PSRC 2001). The Build Alternative may thereby lower pollutant loadings on these local roadways, while increasing vehicle volumes on SR 167. The Build Alternative also would provide mitigating BMPs to treat runoff, while they do not exist on local roadways. Therefore, construction of this alternative might not worsen water quality in the Puyallup valley as a whole.

Traffic-related accidental spills of materials of a variable nature also could occur within the ROW on an infrequent basis. Proper design, location, and maintenance of stormwater management facilities will be important to reduce the potential of a spill resulting in contamination of surface or groundwater. Structures such as catchbasins, oil/water separators, and biofiltration swales provide intermediate locations between the roadway and local water resources where spilled materials can be more easily detained and removed.

Another potential source of pollutants is through highway maintenance practices. Maintenance activities that may impact the surface water and groundwater resources within the study area include: sanding and deicing, catch basin cleaning, ditch cleaning, herbicide applications, stormwater BMP maintenance, and bridge cleaning and painting. The *Water Resources Discipline Study* (EnviroVision 2005) describes current WSDOT maintenance practices that minimize the amount of impact to surface water and groundwater.

The amount of impact arising from maintenance activities is related to the amount of roadway. Overall, maintenance activities are not likely to result in any impacts over the life of the project. Many of the maintenance practices are in fact required to protect water quality by maintaining the effectiveness of the stormwater control facilities. The alternatives do not differ substantially in the amount of impact they may impose from maintenance practices.

The primary concerns for groundwater quality are due to the potential for contaminant spills from highway accidents or from general maintenance practices. As with maintenance related concerns, spilled materials would naturally be conveyed to the stormwater system where there is some opportunity for treatment and removal before the material would reach surface or groundwater.

There are also groundwater concerns associated with the potential for decreased aquifer recharge and subsequent decreases in stream baseflows in hydraulically connected streams and wetlands. A decrease in subsurface flow through the stream hyporheic zone could also impact oxygen and temperature in this zone, which provides important habitat for stream macroinvertebrates, fish eggs, and other organisms. Two potential contributing factors have been identified. First, that excessive soil compaction (primarily at roadway embankments) could inhibit the infiltration of groundwater. And, second, that increases in impervious surface would accelerate surface runoff and therefore also decrease infiltration.

There are a number of factors that diminish these concerns. First, recent hydrologic studies have indicated that baseflow to Lower Hylebos is largely generated from the upper watershed (MGS et al. 2004). Consequently, for the majority of the project area, baseflow is not driven by subsurface flow generated in the project area. In addition, the RRPs and utilization of deep fill infiltration may enhance aquifer recharge in their immediate area above what might normally occur. This could offset possible losses due to other aspects of the project. Furthermore, a preliminary analysis (i.e., based on conditions at a nearby site, site soils, and assumptions about roadway embankment heights and horizontal conductivity), suggested that impacts to groundwater flow regimes from embankments should be minimal. Additional field testing of vertical and horizontal flows under embankments is planned.

A last groundwater concern is the existing groundwater contamination associated with the now closed B&L Woodwaste site, which may be impacted by the Hylebos Creek relocation. Sections 3.8.3 and 3.8.5 provide information on this site.

Hylebos Basin

Project elements located within the Hylebos Basin that need to be addressed in terms of potential long-term operational impacts include; the mainline between 20th Street East and the 54th Avenue East interchange, two interchanges; 54th Avenue East and I-5, and the Hylebos and Surprise Lake Drain RRPs, and permanent impacts to wetlands.

Land Use Assessment

Table 3.2-10 depicts land use estimates for the Hylebos and Wapato basins. Existing land use estimates were based on GIS analysis of the individual basins, while future land use conditions were based on compliance with local comprehensive plans. These plans were developed on a 20-year planning horizon, and therefore reflect the future condition in about 2025. The *Water Resources Discipline Study* (EnviroVision 2005) provides more details on land use assessment.

Table 3.2-10: Current and Future Land Use (%) for Hylebos and Wapato Basins

Land Use	Hylebos Basin		Wapato Basin	
	Current	***Future***	***Current***	***Future***
Water/Wetlands	5.2	5.8	1.4	1.3
Forest	21.9	-	0.3	-
Grass	32.9	3.5	20.6	-
Multi-Family	4.2	8.9	14.0	4.1
Moderate Density	1.9	14.7	-	47.5
High Density	11.7	29.3	42.7	6.6
Commercial	22.2	36.9	21.1	39.4
SR 167	-	0.9	-	1.1

The land use predictions were used to estimate changes in impervious surface. Table 3.2-11 provides a comparison of changes in percent impervious area between existing and future land use. The largest increases in impervious surface are predicted to occur in the East Hylebos and Surprise Lake Drain subbasins. However, the vast majority of this increase is not associated with the SR 167 corridor. In fact, the Hylebos RRP alone would effectively preclude development and remove existing development from 116 acres of mostly commercial /industrial land in the lower Hylebos watershed. Future land use conditions are discussed more fully in Section 3.2-7 on Cumulative Impacts.

Table 3.2-11: Current and Future Percent Impervious Surface in the Basins

Basin	Subbasin	Acres	Current %	Future (w/ SR 167)	SR 167 %(1)
Hylebos	West	5,856	28.6	42.1%	0.1
	East	3,950	17.3	42.0%	0.2
	Lower	747	21.5	25.2%	4.9
	Surprise Lake	1,627	22.7	51.3%	3.2
	Total Basin	12,180	23.7	42.2%	0.9
Fife Ditch		1,043	50.4	76.8%	1.9
Wapato		2,801	34.6	43.0%	1.0

(1) Percent of SR 167 Corridor relative to total basin or subbasin acres.
Note: Puyallup Basin was not modeled using land use.

Hydrology and Flooding

Since the Hylebos basin is most affected by the project, an extensive analysis of the stream was done to document the hydrologic and geomorphic character of the streams. A model was developed to evaluate the hydrologic and flooding impacts from stream relocation and development of the RRP and to insure that the RRP could meet or exceed stormwater control requirements. The primary issues that were evaluated through this effort were the impacts to the size of the floodplain or the frequency or magnitude of flooding, changes to stream baseflows or low flow conditions, and potential impacts to stream stability or erosion.

Three methods have been used to estimate the area of the floodplain during different design phases of this project. The first was based on the FEMA floodplain maps, which represented the officially designated floodplain during early phases of the project. However, the FEMA floodplain markedly underestimated the area that was flooded during recent large storm events. Therefore, aerial photos from the flood events in 1996 were used to delineate the “flood prone area”; this phrase was used to reduce confusion between the official 100-year floodplain and the known frequently flooded area. In the Hylebos Basin, a third estimate of floodplain area was developed through hydrologic modeling of the basin. The greatest advantage of the modeling effort is that it is based on land use and can be used to predict flooding during future build-out conditions.

Table 3.2-12 summarizes the estimated flooded area using the two or three methods. (In this Table all impacts that do not vary by interchange option are summarized under the “Mainline Segment” to enhance ease of comparison between options.) Those acres affected by the I-5 Interchange and the 54th Avenue East Interchange primarily impact the Hylebos basin. Using the worst case estimate for the mainline (i.e., those associated with the MGS modeled floodplain) there are almost 35 acres of floodplain impact associated with the I-5 Interchange, while the 54th Avenue East interchange has a maximum of about 2 acres of impact.

Table 3.2-12: Acres of Floodplain Impacts from Mainline and Different Interchange Options using Three Estimating Methods

Project/Option	100-year Floodplain	Flood Prone Areas	MGS Floodplain
MAINLINE SEGMENT			
SR 509	0.97	1.75	0.38
I-5	12.26	29.2	34.05
Valley Avenue	0.13	5.34	0
SR 161	0	0.63	0
Mainline Total	13.36	36.92	34.43
INTERCHANGE			
54th Avenue East			
Loop Ramp (Preferred)	0.46	0	0
Half Diamond	2.02	0.01	0
Valley Avenue			
Freeman Road	1.01	1.56	0
Valley Ave. (Preferred)	0.7	3.21	0
Valley Ave. Realignment	0.35	3.37	0
SR 161			
Urban	0	0	0
Low Diamond	0	0	0
Medium Diamond	0	0	0
Total (minimum)	14.17	38.48	34.43
Total (maximum)	16.39	40.3	34.43

Under existing conditions, approximately 246 acres are predicted to be inundated during a 100-year flood event (MGS et al. 2004). Construction of the new stream channels, development of the RRPs, improvements to stream crossings and removal of existing obstructions to flood flows would improve the flooding condition. The result is that the flooded area is predicted to decrease to 187 acres; a 25 percent reduction over existing conditions. As stated previously, because flood discharge in the lower Hylebos is dominated by runoff from the upper watershed, replacing lost floodplain storage (as through the RRPs) would better manage stormwater than construction of conventional detention facilities.

Low flows were also assessed through the modeling effort. There were concerns that the increased impervious surface would cause less aquifer recharge and ultimately lower baseflows. Conversely, it was also possible that baseflows would increase since additional vegetation and lower urbanized land use associated with the RRP would result in increased storage of winter runoff in the streambanks and release via subsurface flow during summer. Hydrologic modeling indicated there was little difference in predicted low flows between the existing condition and future scenario with the project. This is largely because summer low flows are maintained by groundwater discharge to the stream that occurs along the mainstem of Hylebos Creek upstream of the project area (MGS et al. 2004) and also because the area impacted by the project (and RRP) is small compared to the overall basin.

The geomorphic analysis determined that the lower Hylebos and Surprise Lake streams are founded in cohesive soils that are resistant to erosion when compared to the more typical gravel-bedded streams. Streambank erosion would only occur during floods with recurrence intervals of greater than about 10 years for the majority of the study area. It was determined that the lower Hylebos and Surprise Lake Drain stream channels will be stable under future build-out conditions with the SR 167 project.

Water Quality

Results from a pollutant loading analysis performed for the FEIS are provided in Table 3.2-13. Water quality parameters analyzed were total suspended solids (TSS), total phosphorus (TP), total nitrogen (TN), lead (Pb), zinc (Zn), copper (Cu), and fecal coliform bacteria (FC). The pollutant yield constants used for this analysis were derived from monitoring in the Pacific Northwest and therefore were considered more applicable that other data sources. However, this still represents a very general pollutant estimating method. For example, pollutant yields are not provided for agricultural land, so the yield constants for grass were used for this land use, which is prevalent along Surprise Lake Drain. Also constants are not provided for agricultural chemicals. The estimates in Table 3.2-13 are for SR 167 stormwater runoff using predicted treatment efficiencies of constructed wetlands (Winer 2000).

Table 3.2-13: Estimated Median Annual Pollutant Loads(1) (kg/yr) from SR 167 after Stormwater Treatment(2) of Highway Runoff

SUBBASIN	TSS	TP	TN	Zn	Cu
Hylebos West	264	1.2	3.7	0.4	0.1
Hylebos East	346	1.6	4.8	0.5	0.1
Hylebos Lower	1777	8.3	24.8	2.6	0.5
Surprise Lake Drain	2528	11.8	35.2	3.6	0.8
Fife Ditch	985	4.6	13.7	1.4	0.3
Total Hylebos Basin	**5900**	**27.5**	**82.3**	**8.5**	**1.8**
Wapato Basin	1845	6.9	29.0	8.1	4.7
Puyallup Basin	2674	5.7	50.4	25.6	17.4
Total SR 167	**10419**	**40.0**	**161.7**	**42.2**	**23.9**

(1)Based on land use specific pollutant yields (Horner 1992).
(2)Based on median pollutant removal efficiencies for constructed wetlands (Winer 2000) of 76% for TSS, 49% for TP, 30% for TN, 44% for Zn, and 40% for Cu.

Treated runoff from SR 167 represents a small percentage of the total pollutant loading estimated for existing land uses in the respective subbasins (Table 3.2-14). None of the estimated SR 167 loadings in Hylebos Creek East, Fife Ditch, Hylebos Creek West, and Wapato Creek basins exceed 2 percent for any of the pollutants analyzed. Only for TSS and TP in Lower Hylebos Creek subbasin and for TP in Surprise Lake Drain does treated SR 167 runoff exceed 5 percent of estimated loadings from existing land uses.

An overall percentage for SR 167 can not be estimated because the Puyallup basin percentages are not based on modeling of land uses, like the other percentages are.

Table 3.2-14: Treated SR 167 Runoff as a Percent[(1)] of Total Estimated Pollutant Loads from All Existing Land Uses

SUBBASIN	TSS	TP	TN	Zn	Cu
Hylebos West	0.10	0.16	0.05	0.02	0.01
Hylebos East	0.20	0.30	0.08	0.05	0.01
Hylebos Lower	7.74	9.72	2.90	2.38	0.61
Surprise Lake Drain	3.11	5.08	1.54	0.69	0.19
Total Hylebos Basin	**0.89**	**1.42**	**0.40**	**0.21**	**0.06**
Fife Ditch	**1.33**	**2.72**	**0.89**	**0.22**	**0.06**
Wapato	**1.40**	**1.70**	**0.70**	**0.90**	**0.70**
Puyallup	**0.20**	**0.60**	**NA**	**3.20**	**1.00**

(1)Values in Table 3.2-13 and mean annual pollutant yield estimates in the SR 167 Water Resources Discipline Study and technical memos were used to calculate percentages. Puyallup Basin was not modeled using land use.

Highway runoff is not considered to be a substantial contributor to the 303(d) listed water quality problems identified for this area (e.g., ammonia, DO, pH, temperature and FC bacteria). Although highways do contribute FC, the yield is estimated to be lower than what is generated from most other land use types (Horner 1992). The estimated yield from SR 167 in TN to Fife Ditch, where ammonia-N concentrations are a problem, is less than 2 percent of the loading from existing land uses, and the nitrogen would not be expected to be in the form of ammonia.

There could be concerns associated with indirect impacts from the roadway on temperature if the additional impervious surface represented by the highway caused a reduction in aquifer recharge and thus caused a reduction in summer stream flows. However, the establishment and protection of the riparian restoration areas (through the RRP) should offset the potential for reductions in recharge. The RRPs will also directly affect (improve) stream temperatures through improved streamside shading, which could also contribute to improved oxygen conditions.

There are additional water quality listings for Hylebos Waterway and Commencement Bay. These include benzene, dioxin, tetrachloroethylene, and trichloroethylene. Although these substances are sometimes detected in highway runoff, they are not a common constituent (Kobringer 1984) and highway runoff is not considered a major contributing source. Therefore, project development would not be expected to affect these 303(d) listings.

Because many existing vacant and agricultural lands in the Fife valley are being converted to commercial and industrial uses, and this trend is expected to continue, pollutant loadings were also estimated for future conditions in the subbasins. These results are presented in Section 3.2.7 on Cumulative Impacts. Because development will continue during the rest of the planning phase, throughout the design phase, and during phased construction of SR 167, direct effect of operation on pollutant loadings is expected to fall between the percentages estimated for existing and future conditions.

54th Avenue East Interchange

The total amount of stormwater pollutants generated by the highway is dependent upon the volume of traffic. Each interchange option will experience the same traffic volume. Thus, the estimated pollutant contribution is expected to be the same. However, the difference in impervious surface could affect the volume of runoff generated. The two interchange options, the Preferred Loop Ramp and the Half Diamond, will generate runoff from 30.3 and 31.3 acres of impervious surface, respectively. The difference would not be considered large in terms of runoff generated between options.

A series of biofiltration swales, constructed wetlands and ponds are proposed to detain and treat stormwater. Approximately 71 acres of new impervious (93 percent of the generated runoff) will drain to Hylebos Creek, 4.6 acres (7 percent) to Fife Ditch, which discharges to the creek near the mouth. The portion discharging to Hylebos Creek will receive further treatment as it disperses overland through the RRP area.

The new stream crossing of Fife Ditch will be designed to result in no long-term impact to water quality. Removal of undersized bridges on Lower Hylebos Creek should result in long-term improvement in terms of both floodwater passage and stream channel integrity. All stream crossings will be designed to pass 100-year storm runoff. All bridge and culvert work is likely to result in some permanent vegetation removal and placement of fill in the floodplain; for example for bridge support structures. Removal of fill encroachments in the floodplain will also represent a long-term benefit to water resource function.

Because water quality/flow control BMPs will be fully implemented with both options and maintenance practices will follow standard procedures designed to minimize impacts, highway runoff generated at the 54th Avenue East Interchange location is not likely to present major water quality impacts. Additionally, the magnitude of impacts from the Preferred Loop Ramp and Half Diamond options are not expected to differ notably.

I-5 Interchange

At this interchange, 54.1 acres of new impervious surface will drain to Lower Hylebos Creek, and 20.2 acres will drain to Fife Ditch. Therefore, 73 percent of the stormwater runoff generated will be discharged to Lower Hylebos Creek and 27 percent to Fife Ditch. Ultimately, since Fife Ditch drains to the Hylebos Creek estuary, all of this will affect the Hylebos Waterway.

Stormwater treatment at this interchange and mainline segment is expected to occur through ecology embankments, biofiltration swales, constructed wetlands, and ponds. Much of the discharge will receive enhanced treatment as it is dispersed through either the Surprise Lake RRP or the Hylebos RRP area.

Most of the new stream crossings at this interchange are expected to be span bridges and therefore should result in no long-term impact to water resources. The new stream crossings will span the streams' ordinary high water mark. Improvements to two existing crossings will improve floodwater passage and stream channel integrity. All bridge and culvert work is likely to result in some permanent vegetation removal and placement of fill in the floodplain; for example for bridge support structures.

Stormwater runoff and maintenance related impacts from the I-5 Interchange will be the same as those encountered at the 54th Avenue East Interchange. The potential magnitude of the impact is relative to the amount of roadway built. Because water quality/flow control BMPs will be fully implemented and maintenance practices will follow standard procedures designed to minimize impacts, highway runoff generated at the I-5 Interchange is not expected to result in substantial water quality impacts.

Hylebos Relocation and Riparian Restoration Proposal

Under existing conditions, Hylebos Creek in the I-5 interchange area is confined and constricted in a narrow channel between I-5 on the one bank and a vertical concrete wall on the other. The new channels would be constructed to achieve a more natural sinuosity and channel configuration, will have natural vegetated stream banks, and an intact riparian buffer.

The Hylebos RRP includes relocation and enhancement of Hylebos Creek as well as restoration of the riparian buffer. In the approximately 3,400-lineal-foot reach of Hylebos Creek in the vicinity of 8th Street East and Highway 99, 28.9 acres of riparian and floodplain area will be restored and protected. Portions of 8th Street East, 62nd Avenue, 67th Avenue, and adjoining residential buildings would be removed from this property. Restoration and protection would include; removing human encroachments, establishing native plants, removing invasive/nuisance plants, and developing a long term riparian management and invasive plant control plan.

The RRP concept is ecologically based and intended to provide a continuous functioning corridor between the estuary and the lower segments of Hylebos Creek. For example, the inclusion of the RRP area that is northwest of I-5 will ensure better downstream conveyance and will bring continuity with other nearby restoration projects. Although these benefits may not be as easily matched to specific project impacts, they are nonetheless critical considerations for the ecological success of the project.

The second part of the Hylebos RRP involves the reach in the vicinity of Highway 99 to Porter Way. This is currently a highly degraded, channelized stream; 2,050 lineal feet of which would be filled and 2.5 acres of associated buffer would be displaced to build the highway. Approximately 4,010 lineal feet of new channel would be constructed and over 87 acres of new riparian habitat would be developed through enhancement and protection. The resultant protected riparian corridor would be 150 to 600 feet wide. In addition to constructing a more natural meandering stream channel, the riparian area would be planted with appropriate riparian vegetation.

About 500 feet of existing Hylebos stream channel in the vicinity of the Highway 99 crossing does not need to be filled for construction of the highway. This segment will remain to serve as potential off-channel habitat.

One important direct water quality benefit from the RRP will be to stream temperature. Within this stream segment summer temperature can be expected to improve due to riparian shading. Over the long term, as the channel matures and develops shaded pools, they will provide cool refuge areas during summer low flows. Suspended solids, nutrient, bacteria, and possibly other contaminants should also decrease in the area immediately surrounding the RRP. This decrease would occur through improved filtering of surface runoff as it moves through the well-vegetated RRPs. While the RRPs cannot address upstream sources of these pollutants, the overall improved function of the streams may allow them to better assimilate these pollutants.

In addition to the improvements in water quality and quantity that can be somewhat quantified, there are important qualitative benefits from the RRP that are more difficult to evaluate but just as critical. A stream and its associated riparian area is a complex ecosystem formed and driven by a combination of hydrologic, geomorphic, and biological functions and processes. The RRP represents a more comprehensive approach to addressing lost ecosystem functions that would address much more than stormwater discharges. Sections 3.3 and 3.4 describe many of these additional benefits to wetlands and biological resources.

The WSDOT hydraulics manual generally requires that bridges have a minimum of 3 feet of freeboard during the 100-year flood to protect bridges and ensure that flood debris does not block traffic lanes. A number of measures have been recommended (MGS et al. 2004) to meet this requirement specifically for the 20th Street East and northbound I-5 bridge over relocated Hylebos Creek.

These measures would lower the flood elevations by more than one foot and would result in further reduction in the size of the future floodplain area when compared to the future with the project but without these mitigation steps. It would result in a mimimum of approximately 25 percent reduction over existing conditions. It would also prevent the Interurban Trail ROW from being overtopped and better protect the city of Fife proposed soccer complex. The lowered floodplain would increase floodplain storage downstream of SR 99, but would increase the floodplain area between SR 99 and 4th Street compared to the existing condition. Since this area is designated as RRP, there would be no additional threat to private property or structures.

Surprise Lake Drain Relocation and Riparian Restoration Proposal

This RRP entails relocation and restoration of the entire section of the Surprise Lake Drain from its upstream crossing under Freeman Road to its confluence with Hylebos Creek. Currently this stream is a series of linear, trapezoidal channels that wind through farmland. The new channel would be approximately 5,340 feet long and would include a floodway channel that varies between 60 to

150 feet wide. A low flow channel would meander within the floodway channel to provide for low flow conditions. This would also involve developing 29 acres of riparian habitat. Most of the new riparian corridor would be approximately 400 feet wide; the exception is the area near the city of Fife proposed soccer complex where it is reduced to 150 feet to accommodate the fields. No adverse impacts or reduced stormwater protection is expected due to the smaller 150-foot-wide riparian corridor at the Fife soccer complex. The smaller 150-foot-wide riparian corridor at the Fife soccer complex would have no adverse effect on stormwater protection because the surrounding area is constrained by urban land uses, contains other stormwater protection features, and would not require the full 400-foot-wide corridor to achieve expected stormwater protection. Low berms are proposed upstream of 20th Street East to contain flood discharge and prevent flow from expanding beyond the limits of the riparian corridor. Details on the channel design process and preliminary channel configuration are provided in the hydrologic study of Hylebos (MGS et al. 2004).

The relocated Surprise Lake Drain and surrounding RRP are also located within the I-5 Interchange impact area. Suspended solids, nutrient, bacteria, and possibly other contaminants (e.g. pesticides) should also decrease in the area immediately surrounding the RRP. This decrease would occur through two mechanisms; improved filtering of surface runoff as it moves through the well-vegetated riparian buffers and through conversion of what is now primarily agricultural land that can be expected to generate pollutants such as nutrients and pesticides, to protected riparian buffers. Removal of drain tiles beneath agricultural fields and changes to surface water hydrology should enhance formation of riparian wetlands. In addition, by removing the tiles and removing the land from agricultural use the potential for pesticides and fertilizers commonly generated by agricultural lands to enter the steam should also be reduced.

Wapato Basin

As expected in this portion of the Puyallup Watershed, existing forest and grass will be converted to commercial and other higher intensity uses in the future. The proposed new roadway would represent less than 1 percent of the future land use for the entire Wapato Basin. The Wapato Basin is expected to experience an increase of almost 10 percent in total impervious surface, 2 percent of this 10 percent increase (24 acres) can be attributed to the highway corridor.

Hydrology and Flooding

As previously described, the Wapato RRP in combination with conventional stormwater control ponds are proposed to mitigate the potential impacts to hydrology and flooding from project development in the Wapato Basin. During initial design phases, conventional treatment systems were considered for this interchange area.

The *Water Resources Discipline Study* (EnviroVision 2005) provides a comparison of the conventional approach to meeting stormwater control needs and the innovative approach represented by the RRP for Wapato Creek. With conventional facilities almost 24 acres of land would be required for the ponds; it would be very difficult to locate these large ponds without additional impacts to wetlands and floodplains. According to model results (WSDOT 2004c), implementation of the RRP would result in fewer stormwater ponds and smaller pond sizes. Six conventional stormwater treatment ponds would be used in combination with the RRP area to meet required flow duration standards. During construction, actual design may change based on field conditions.

Floodplain impacts in Wapato basin would primarily be associated with the Valley Avenue Interchange. Using the worst case flood prone areas estimate, construction of this interchange would impact 1.6 to 3.4 acres of flood prone area (Table 3.2-11). Although the detailed modeling of future land use conditions was not performed for the Wapato, it can be assumed that development will occur at the same pace as in the Hylebos basin.

The Hylebos Creek Basin and Wapato Creek Basin are similar in that the upper watershed is a mixture of commercial and residential property and, as you travel downstream to the lower reaches of each watershed, they converge on each other in the Puyallup River Valley and enter Commencement Bay. The land use in the upper watershed is fairly stable and mostly built out. However, in the lower reaches this area has historically been used for farmland and, over the last 10 years, is being converted to industrial warehouses. Because the property around these two creeks is zoned primarily industrial, and based upon the growth that has occurred in the Puyallup River Valley over the last 10 years, we expect the development in these basins to continue to be mirror images of each other.

The RRP is not expected to reduce flooding; however, it is intended to remove many homes and buildings that are frequently flooded. The area that has been identified to implement the RRP is very urbanized and void of a natural environment. In fact, Hylebos Creek and Surprise Lake Drain have been forced into man-made ditches, some of which are lined with concrete and choked with reed canary grass and blackberries. The goal of the RRP is to restore these streams to a natural environment by allowing them to meander through a forest of native vegetation. This will allow the stream and natural environment to more easily handle and react to flooding conditions because the stream banks will be armored with the type of vegetation that resists erosion and traps sediment and debris, which creates natural pools and eddies. Not only will the RRP help these streams encounter flooding events, it will also provide year-round benefits by offering shade to the stream during the summer months. Consequently, no substantive change to the flooding condition, as compared to the future condition without the SR 167 project is expected.

Low flows were not assessed through the modeling effort for Wapato Creek. It is not known how much the potential impact to reduced aquifer recharge from increased impervious surface would be offset by increased storage and subsurface flow from the RRP and bioretention elements of the project. It is likely that the impact would be similar to Hylebos Creek. Therefore, there would be little difference between existing and future conditions.

Water Quality

Table 3.2-14 includes a summary of the predicted percent change in pollutant loads for the study area, including Wapato Basin. As shown, all pollutants except nitrogen and FC are predicted to increase. The largest percent increases will occur in loads of the metals and TP. As indicated by Table 3.2-14, less than 1 percent of the increase in metals load can be attributed to SR 167 runoff.

The 303(d) listed problems in Wapato (i.e., oxygen, flow, FC and benzene) are not likely to be appreciably impacted by the roadway project. It is possible that summertime low flows could be indirectly affected by the project through lower aquifer recharge due to increased impervious area. However, the establishment and protection of the riparian restoration areas through the RRP and use of deep fill infiltration for stormwater may offset this affect, although it is unknown the extent to which this would be the case. The RRPs will also directly affect (improve) stream temperatures through improved streamside shading, which could also contribute to improved oxygen conditions. Although benzene is sometimes detected in highway runoff, it is not considered to be major contributing source and project development is not expected to affect this 303(d) listing.

Valley Avenue Interchange

The amount of stormwater pollutants generated by the highway is largely dependent upon traffic volumes; therefore pollutant contribution is not expected to change between options. However, differences in impervious surface could affect the volume of runoff generated. Approximately 41 to 48 acres of new impervious surface would be created for this interchange. Less than 10 percent of this would be directed toward the Old Oxbow Lake Basin, approximately 50 percent would be directed to the Hylebos Basin and the remainder to the Upper Wapato Basin. There is almost a 15 percent difference (6.5 acres) between the option with the least impervious surface area (Valley Avenue) and the option with greatest impervious surface area (Valley Avenue Realignment) (Figure 2-14).

Stormwater from this portion of the project will be treated via biofiltration swales, deep fill infiltration, landscaped fill slopes with composted soils, constructed wetlands, ponds and through the RRP. All of the stormwater generated from the highway will be treated to meet flow and water quality control requirements as described in the WSDOT *Highway Runoff Manual* (WSDOT 2004a). Therefore, by design, it is expected that water quality standards will be met and hydrology maintained to the extent defined by the regulations. Some of the discharge will receive enhanced treatment as it discharges through the Wapato Creek RRP area. This does not imply that additional pollutant loading will not occur or that there may not be some modification in hydrology as a result of the project. The magnitude of impacts from the different options are not expected to differ notably.

The new stream crossings planned for this interchange are expected to be clear spans and are expected to result in no long-term water quality impacts. The new stream crossings will span the streams' ordinary high water mark. For the Valley Avenue Option (preferred), one stream crossing has been further expanded to span the associated wetland and thereby decrease wetlands impacts as well. All bridge and culvert work is likely to result in some permanent vegetation removal and placement of fill in the floodplain; for example for bridge support structures. The eight undersized crossings that will be removed or improved as a result of the project (Table 3.2-8) would result in overall improvements to stream functioning and reduced flooding and related erosion.

Valley Avenue Park and Ride Lot

Stormwater would also be generated by this impervious area. This added area is included in the calculation of added impervious area described for the Valley Avenue Interchange options and included in initial calculations for stormwater treatment needs. Stormwater generated from this site would also need to meet flow and water quality control requirements as described in the WSDOT *Highway Runoff Manual* (WSDOT 2004a). No other potential long-term impacts to water quality have been identified for the Park and Ride lot.

Wapato Riparian Restoration Proposal

The Wapato Creek RRP addresses flow control mitigation for impervious surface added for the Valley Avenue Interchange area. The RRP is a site specific stormwater management plan that is designed to address many of the existing impairments of Wapato Creek while meeting flow control requirements. Runoff from the interchange will sheet flow off the roadway and infiltrate into landscaped fill slopes or receive some other type of approved water quality treatment. Runoff leaving the fill slopes will then be naturally dispersed toward the riparian buffer. The riparian buffer between the highway and stream will provide additional treatment of any surface runoff. Runoff from overpasses and the longer structures will be routed to conventional stormwater ponds for runoff treatment.

The Wapato RRP entails establishing an approximately 9,000-lineal-foot-long continuous riparian buffer along both sides of the stream, except for a section adjacent to Valley Avenue. The RRP would result in an approximately 300-foot-wide corridor through which Wapato Creek would flow. Approximately 73 acres of existing farmlands and residences will be converted into a riparian landscape by removing encroachments (buildings, roads, culverts and other infrastructure) from the land. The riparian area will be planted with native vegetation. This restoration will allow for more natural floodplain processes to occur within the channel migration zone. This will involve some in-stream work associated with removal or replacement of existing encroachments and stream crossings.

This portion of Wapato Creek is impacted by agricultural and urban development land uses and lacks riparian vegetation and instream structure. These conditions can be expected to contribute to temperature, DO, and bacteria problems in the stream. Establishment of a well-vegetated, protected riparian buffer will, in the near term, result in improved bank stability, improved summer temperature and oxygen conditions, and decreased pollutant loading from overland runoff that enters via the riparian buffer. Over the long term, the buffer is wide enough to allow for eventual establishment of large trees, which will in turn eventually contribute to instream structure and more diverse habitat and more stream shading. Also, the conversion of developed lands to forested conditions could reduce surface runoff from this area and increase infiltration and aquifer recharge. Removal of the six existing privately owned culverts, removal of human encroachments in the floodplain, improved channel stability and additional protected floodplain area will result in long-term improvements from restored fluvial processes.

The improvements to water quality as a result of this would be similar to those described for the Hylebos Creek and RRP without those benefits that are directly associated with stream relocation activities. Direct impacts would include improvements to summer stream temperatures due to improved riparian shading, improved removal (via filtering through the RRP) of suspended solids, nutrients, bacteria and other contaminants. More qualitative improvements might include improved bank stability, better food and cover for aquatic and terrestrial organisms, better protection of more natural floodplain processes and generally a more intact, functioning riparian corridor.

Old Oxbow Lake Ditch

Although there are no interchange areas or other project components for which Old Oxbow Lake Ditch is the primary discharge point, construction of two of the interchange areas (Valley Avenue and SR 161) will result in an increase in impervious surface in the basin. An increase of 18 to 19 acres is predicted. However, stormwater from this impervious area is expected to be directed primarily toward Wapato Creek and the Puyallup River. No stream crossings or other impacts are expected to this Basin. The largest potential impact is from the deep fill infiltration that may be used to minimize mainline stormwater discharge near the southern terminus of the Valley Avenue Interchange area. Some of the water that moves through this fill would likely move underground and contribute flow toward this stream. This could result in ponding during the winter but also in increased aquifer recharge that may improve summer period hydrology in this system.

Puyallup Basin

Due to the size of this basin and the small area impacted by the roadway, no land use analysis was done and therefore no pollutant load changes could be estimated that would be meaningful for assessing the magnitude of potential impact. It can be expected that in the lower end of the basin, development will continue to occur at approximately the same rate as predicted for the other basins. This will result in a similar increase in pollutant loads. However, an even smaller portion of these loads will be attributable to the expanded SR 167 roadway, since the roadway will account for a very small portion of the developed area.

Only one of the Interchange areas (SR 161) is located within this basin. It would result in an addition of 17 to 21 acres of impervious area, depending upon which interchange configuration is selected. No direct floodplain or flood prone area impacts are identified for this Basin. The amount of impervious surface added is similar to the total amount of impervious surface that would be added to the Wapato Basin. Therefore, the total load of highway-generated pollutants contributed to the Puyallup Basin would also be similar.

SR 161

The amount of stormwater pollutants generated by the highway is largely dependent upon traffic volumes; therefore pollutant contribution is not expected to change between options. However, differences in impervious surface could affect the volume of runoff generated. Approximately 33 to 39 acres of new impervious area will be created for this interchange and the connecting mainline, depending upon the alignment option selected. The preferred Urban option has the most impervious area increase. Approximately 50 percent of this will be in the Puyallup Basin, 40 percent in the Old Oxbow Basin, and the rest in the Upper Wapato Basin.

Stormwater from this portion of the project will be treated via biofiltration swales, deep fill infiltration, constructed wetlands, and treatment. Although the impervious area includes portions of Old Oxbow Lake and Wapato Basins, the stormwater will be directed toward the Puyallup River. The stormwater generated from the highway will be treated to meet flow and water quality control requirements as described in the WSDOT *Highway Runoff Manual* (WSDOT 2004a). Therefore, by design, it is expected that water quality standards will be met and hydrology maintained to the extent defined by the regulations. This does not imply that additional pollutant loading will not occur or that there may not be some modification in hydrology as a result of the project.

Because BMPs and maintenance practices will follow standard procedures designed to minimize impacts, highway runoff generated from the interchange area is not likely to present substantial water quality impacts. The magnitude of impacts from the different options are not expected to differ notably.

There are no new stream crossings planned or removal of existing crossings, however the existing steel bridge over the Puyallup River (northbound SR 161) will be replaced and the existing concrete bridge (southbound SR 161) will be widened. More design detail is needed to determine whether the new northbound bridge can be spanned and still meet flood and alignment needs. Widening of the concrete bridge may not require additional in-water support structures. However, to provide a conservative assessment of impacts, it is assumed that some piers will be located within the ordinary high water mark of the river for both the replaced and widened bridges. All bridge and culvert work is likely to result in some permanent vegetation removal and placement of fill in the floodplain; for example for bridge support structures.

SR 161 Park and Ride Lot

Stormwater would also be generated by this impervious area. This added area is included in the calculation of added impervious described for the SR 161 Interchange.

3.2.6 Indirect Impacts

Indirect impacts are those effects caused by the proposed action that are later in time or farther removed in distance, but still reasonably foreseeable. The geographic boundary for indirect impacts to water resources includes the area in the immediate vicinity of the project corridor interchanges as well as the drainage area that is within an area of influence. Indirect impacts for this project will not vary by water basin or by any of the Interchange options.

No Build Alternative

Development would continue in the project area according to land use plans, zoning designations, and regulations adopted by affected communities. The population increase will result in conversion of low-intensity land use, such as agriculture and open space to higher intensity land uses such as residential, commercial, and industrial (Port of Tacoma 1999).

Under the No Build Alternative, development would occur in a piece-meal fashion which is likely to be concentrated in the area near the Port of Tacoma, Commencement Bay and the I-5 corridor and radiating out from there. One impact from many small development projects as compared to this large roadway project is that there will be fewer opportunities to provide for the type of large-scale mitigation projects that are proposed for the SR 167 Extension project (i.e., stream relocation and riparian revegetation).

Build Alternative

The SR 167 Extension project is compatible with and would support planned and anticipated urban growth in the project area by reducing congestion and travel time, especially in the Fife area. This project would not be expected to induce unplanned regional growth; however, it would enable growth and influence the pattern of development within the indirect impact area. The project could alter the rate, timing, and location of development within the project corridor and result in more immediate impacts to water resource functions. For example, the area immediately adjacent to the highway corridor interchanges would be more quickly developed and would be likely to include more commercial and higher intensity land use developments than might occur without the project. This, in turn, results in a ripple affect on development as it is translated across the basin. At some point in time and distance from the project area interchanges, this ripple affect would not be measurably different from what would occur without the project.

Development increases impervious surface and increases the amount of pollutants potentially generated, which can result in important changes to local hydrology (i.e., increased flooding, decreased base flows and stream channel alterations). Over the long term, these changes would not be notably different (in terms of their potential impact to water resources) if the development in the project corridor was a mixed urban setting rather than primarily highway.

One aspect of development that can affect indirect water resource impacts is how much of the development occurs near water resources. Impacts are greater or more difficult to protect against, when they occur closer to surface water resources. The proposed project will not directly or indirectly cause development to occur close to surface waters and in fact prevents development from occurring near some portions of affected streams. In the case of the two stream relocations, the streams are effectively moved away from developed areas. As a consequence, for this aspect of the project, the indirect effects of the Build Alternative may be less than those of the No Build Alternative.

The Build Alternative is not expected to cause indirect impacts to groundwater that would not occur without the project. Impervious surface will increase with or without the project and the extent to which this affects groundwater recharge will be the same. The potential for contamination of groundwater would not change under the Build Alternative.

3.2.7 Cumulative Impacts

Cumulative impacts are those impacts on the environment, which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collective actions taking place over a period of time.

Pierce County is currently developing a Habitat Protection and Regulatory Package. While this package is not being developed in response to the SR 167 Build Alternative, the proposed regulations pertain to development occurring within the unincorporated portions of Pierce County and will guide conditions, treatment and mitigation in portions of the project study area. The changes eliminate exemptions currently granted in the stormwater management regulations for areas that are located within critical areas, increase buffers around environmentally sensitive areas which provide a greater filter for stormwater runoff, and require tree conservation which serves to infiltrate stormwater runoff through evaporation and transpiration of rainfall. The proposal also includes a low impact development chapter that is designed to reduce the stormwater impacts resulting from current development practices and to establish the pre-European settlement condition as the pre-developed condition for purposes of hydrologic modeling. Incorporated areas of Pierce County include the cities of Fife, Milton, Puyallup, Edgewood, and Tacoma. Development in these areas will be guided by local ordinances.

All new development will need to meet requirements of the stormwater manual (Ecology 2001) and other regulatory requirements that are protective of streams and stream functions (i.e., stream and wetland buffers, construction site controls, mitigation needs). However, these will not fully control or compensate for the increases in impervious surface, changes to hydraulics and hydrology, and pollutant loading that is associated with highly developed areas. Therefore, projected future growth will continue to have a cumulative adverse impact on the quality of surface and groundwater. Impacts to water resources would be incremental in relation to the incremental increases in impervious surface and pollutants generated by the development.

No Build Alternative

Under the No Build Alternative, development would continue in the project area according to land use plans, zoning designations, and regulations adopted by affected communities. The population increase will result in conversion of low-intensity land use, such as agriculture and open space, to higher intensity land use, such as residential, commercial, and industrial. This planned development may occur at a slower pace than under the Build Alternative. Predicted future land use changes are described in Section 3.11. This growth will occur in the project area with or without the SR 167 Extension project. However, under the No Build Alternative, this development would not be focused first in the area of the proposed roadway corridor, and the rate and timing of the development would differ, as described above.

Traffic congestion would continue to increase under the No Build Alternative, resulting in more congestion-related delays and incompatible use of residential streets for heavy trucks. However, users would continue to depend on the existing transportation system, and trips may be influenced by traffic backups and delays caused by overcrowded travel conditions. Eventually, new roadways would be built to accommodate the traffic but they would be local roads. Since the quantity of pollutants generated is directly related to the number of vehicles on the road, the No Build Alternative will not result in any decrease in pollutants generated.

Figure 3.2-6 shows results of modeling 100-year floodplains in the Hylebos basin under future conditions with and without the SR 167 Extension project. A future 100-year flood under the No Build Alternative would result in 360 acres being flooded, a 45 percent increase over existing conditions.

Build Alternative

For the preferred Build Alternative, 187 acres will be flooded during the future 100-year flood. Thus, the Build Alternative will minimize cumulative impacts of future development on 100-year flooding in the Hylebos basin by 48 percent from that predicted for the No Build Alternative.

Results from a pollutant loading analysis performed for the FEIS are provided in Table 3.2-15. The pollutant yield constants used for this analysis were derived from monitoring in the Pacific Northwest and therefore were considered more applicable than other data sources. However, this still represents a very general pollutant estimating method. The table indicates the percent change in pollutant loads between existing and future conditions. The future condition was based on the land use analysis previously described. As shown, in almost all cases the pollutant load generated is predicted to increase in the future. The very high percent increases in metals are simply driven by the fact that the yield of these pollutants increases by hundreds and thousands-fold when progressing from the existing semi-rural watershed condition to commercial. The most notable exception to the overall pollutant loading increases is in the Lower Hylebos basin where a decrease in the load of certain pollutants (suspended solids, lead, zinc [Zn], and bacteria) is predicted. This is the result of two changes in land use: there was a decrease in commercial land use and an increase in water/wetlands land use in this basin. A reduction in pollution loads occurs because commercial land pollutant yields are far higher for these pollutants than highway-generated yields. More importantly, the decrease in loading values reflect the impact of the Hylebos and Surprise Lake Drain RRPs in this basin.

Table 3.2-15: Predicted Percent Change in Median Annual Pollutant Loads[1] Generated Under Existing and Future Land Use (with SR 167) Conditions (negative numbers indicate a decrease)

BASIN	SUBBASIN	TSS	TP	TN	Pb	Zn	Cu	FC
Hylebos	West	53.7	54.7	63.8	326.4	639.2	1,159.1	37.6
	East	78.1	88.1	55.5	247.7	263.1	247.3	35.3
	Lower	-11.1	55.7	0.8	-10.7	-9.1	1.1	-18.4
	Surprise Lake	30.2	85.5	12.7	113.1	103.3	109.8	-14.4
	Total Basin	51.7	68.9	47.6	216.7	279.2	324.0	23.0
Fife Ditch		28.0	24.4	1.2	70.1	88.5	70.4	-49.8
Wapato		10.4	19.6	-3.9	61.8	65.0	52.2	-28.8

(1)Based on land use specific pollutant yields (Horner 1992).
Note: Puyallup Basin was not modeled using land use.

The percent increase shown in Table 3.2-15 represents the load that will be generated by the land under future conditions. This is not the same as the amount that would be expected to enter the streams. Stormwater treatment systems and maintenance practices such as street sweeping will greatly reduce the load. Table 3.2-16 represents the predicted percent change in load that might be discharged to water resources. It was calculated by applying the load reductions associated with constructed wetland facilities to the predicted generated loads in Table 3.2-15. This is not an entirely accurate representation of future loads because it assumes existing development would also receive additional treatment and all development would use constructed wetlands for treatment. Nonetheless, the table is informative for comparative purposes at this preliminary design stage. In this pollutant-loading analysis the most important objective was that the potential impacts from the highway be equitably compared to existing and future land use scenarios. Reductions associated with constructed wetlands were used because this represents one of the more common stormwater BMPs used by WSDOT.

Table 3.2-16: Predicted Percent Change in Median Annual Pollutant Loads[1] Discharged Under Existing and Future Land Use (with treated SR 167) Conditions (negative numbers indicate a decrease)

BASIN	SUBBASIN	TSS	TP	TN	Pb	Zn	Cu	FC
Hylebos	West	12.9	27.9	44.7	29.4	358.0	695.5	-
	East	18.8	44.9	38.9	22.3	147.3	148.4	-
	Lower	-19.5	28.4	0.6	-20.5	-13.1	0.7	-
	Surprise Lake	7.3	43.6	8.9	10.2	57.9	65.9	-
	Total Basin	12.4	35.1	33.3	19.5	156.3	194.4	-
Fife Ditch		6.7	12.4	0.8	6.3	49.6	42.3	-
Wapato		2.5	10.0	-5.1	5.6	36.4	31.3	-

(1)Based on land use specific pollutant yields (Horner 1992).
Note: Puyallup Basin was not modeled using land use.

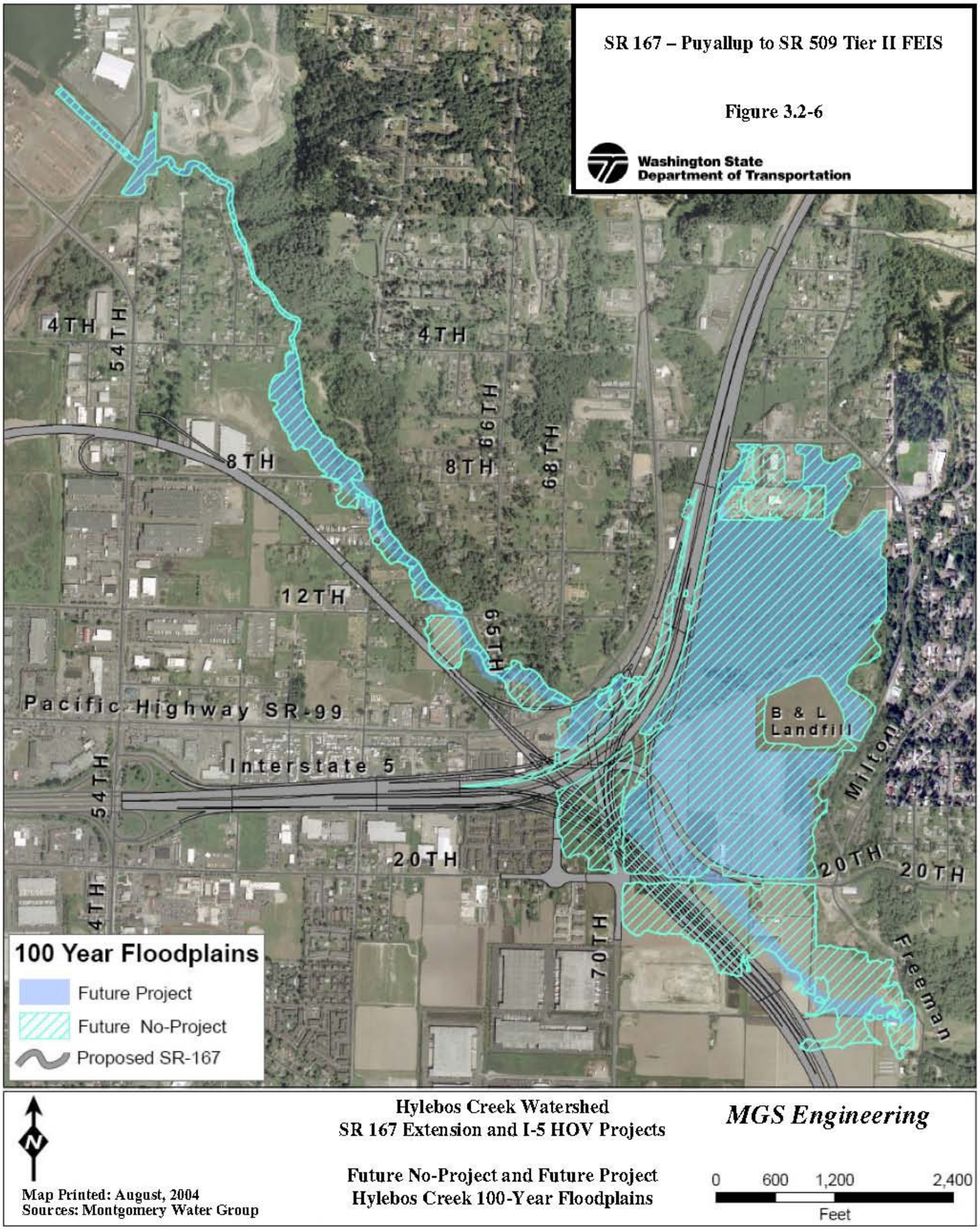
SR 167 – Puyallup to SR 509 Tier II FEIS
Figure 3.2-6
Washington State
Department of Transportation
4TH
54TH
4TH
8TH
8TH
66TH
68TH
12TH
65TH
Pacific Highway SR-99
Interstate 5
54TH
20TH
70TH
B & L
Landfill
Milton
20TH
20TH
Freeman
4TH
100 Year Floodplains
Future Project
Future No-Project
Proposed SR-167
N
Map Printed: August, 2004
Sources: Montgomery Water Group
Hylebos Creek Watershed
SR 167 Extension and I-5 HOV Projects
Future No-Project and Future Project
Hylebos Creek 100-Year Floodplains
MGS Engineering
0
600
1,200
2,400
Feet

Table 3.2-17, indicates the percentage of the increase that can be attributed to SR 167. The percent of the future increase that can be attributed to SR 167 is typically some small fraction of 1 percent. The exceptions to this occur in Lower Hylebos and to a lesser extent in Surprise Lake and Fife Ditch subbasins. The larger percent contributions from the highway are a reflection of the fact that the highway represents a proportionately larger volume of the landmass in these basins. In the lower Hylebos the roadway would account for 7 percent to 8 percent of the predicted increase in TSS and Pb and almost 10 percent of the increase in TP. It is important to understand the distinction between Tables 3.2-16 and 3.2-17. For example, in the case of TSS in the Lower Hylebos, Table 3.2-16 indicates that there will be an overall decrease in the load of this pollutant in the future. However, there will still be a load of TSS generated from the subbasin; Table 3.2-17, indicates that almost 8 percent of this total load will be generated from the highway.

The percent increases predicted for metals may be the most serious concern, since some of the streams already exhibit elevated metals concentrations. It is not yet feasible for WSDOT (or other developers) to reasonably expect to remove all of these pollutants. Current monitoring data indicates that after basic treatment, water quality standards for metals are met 52 percent (dissolved copper), 77 percent (dissolved Zn), 98 percent (dissolved cadmium) and 100 percent (dissolved lead) of the time.

Table 3.2-17: Percent of Future Pollutant Loading Attributed to SR 167

Basin	Subbasin	TSS	TP	TN	Pb	Zn	Cu	FC
Hylebos	West	0.10	0.16	0.05	0.06	0.02	0.01	<0.01
	East	0.20	0.30	0.08	0.14	0.05	0.01	<0.01
	Lower	7.74	9.72	2.90	6.70	2.38	0.61	0.10
	Surprise Lake	3.11	5.08	1.54	1.76	0.69	0.19	0.05
	Total Basin	0.89	1.42	0.40	0.57	0.21	0.06	0.01
Fife Ditch		1.33	2.72	0.89	0.58	0.22	0.06	0.05
Wapato		1.40	1.70	0.70	1.70	0.90	0.70	0.02

Note: Puyallup Basin was not modeled using land use.

These results do not reflect the additional load that would be removed from enhanced treatment (for example, it does not account for removal that would occur as the runoff that moves over the wide buffers that constitute the RRPs). Consequently, the increases shown in the Table for the Lower Hylebos, Surprise Lake, and Wapato systems are higher than would be expected and even less likely to contribute to water quality problems. Last, the largest increases are predicted for lead. As indicated by stormwater monitoring data from Washington State and elsewhere, the contributions of this pollutant have greatly decreased in recent years. The yield value used for these predictions cannot be supported by more recent data.

To put the percent increases in loading into perspective with actual predicted loads; the following example is provided for total Cu contributions to Lower Hylebos Creek. The existing annual load for Cu was predicted to be 143.42 Kg/yr (from *Water Resources Discipline Study* [EnviroVision, 2005]). Assuming most of this receives conventional basic treatment, then 26 to 57 percent of this load will be avoided, resulting in an annual input to the stream of 62 to 106

Kg/yr. If SR 167 is built, the future load of Cu is predicted to be 145.02 Kg/yr; assuming the same removal efficiencies as above, the annual input to Lower Hylebos would be 62 to 107 Kg/yr. This does not take into account the additional removal that should be attained by enhanced treatment of the highway runoff. However, even if enhanced treatment provided 90 percent removal efficiencies for the SR 167 area, the estimated annual input to Hylebos Creek would change by less than 0.01 kg/yr.

The SR 167 project would contribute to the cumulative impacts that will occur in the project area. In general, its contribution will be proportional to its share of the developed area (e.g., approximately 2 percent of the Hylebos and Wapato Basins future impervious). However, it is not likely that other small and scattered development projects will offer the extensive stormwater treatment, mitigation, and long-term protective operations and maintenance practices that a project of this size does. In that sense, the proposed roadway's contribution to cumulative impacts would be lessened.

The RRPs and protected stream corridors are expected to result in many indirect improvements to stream and wetland functions that reach beyond reduction in pollutant loads and flooding. The RRP, in combination with two adjacent restoration projects, will help to establish a continuous functioning riparian corridor in the lower segment of Hylebos Creek that nearly extends to the estuary. This will represent a large improvement in overall stream and riparian area function when compared to what is currently present. In Wapato basin the project does not extend to the estuary but the length of stream corridor and wetland habitat protected is substantial. It is unknown the extent to which the stream relocations and RRPs can compensate for future upstream impacts and whether productivity can be sustained in these streams in the future. For example, although temperature should improve in the protected stream reaches, whether it improves enough to compensate for upstream impacts and brings this segment of the stream into compliance with standards, is dependent upon the upstream changes.

In summary, the Build Alternative is expected to improve the overall functioning of the stream- riparian-wetland complex in the project area. Certainly the affected stream segments themselves are expected to be properly functioning, which is not the case under the current condition. However, no single project can compensate for all future development. It is likely that water quality, habitat complexity and many other water resource metrics will be impacted by future development regulated by other agencies.

3.2.8 Hydrology and Water Quality Permits Requirements

The primary impacts associated with construction and operation of SR 167 include instream work, an increase in the number of stream crossings, loss of floodplain storage, and potential increase in pollutant loads and changes to the hydrologic regime of local surface waters. These impacts are largely avoided or mitigated through existing regulations and permits. Requirements contained in regulatory permits, agreements, and plans may include additional specific mitigation measures and monitoring requirements, which ensure that activities are conducted in a manner that protects surface and groundwater quality. Construction site sediment discharges are regulated via the State Water Quality Standards for turbidity. State Water Quality Standards are applied to construction site runoff at or downstream from the point of discharge.

NPDES General Construction Permit is required for construction sites larger than five acres of discharge stormwater. The permit is issued by Ecology on behalf of the EPA. Obtaining a permit involves submitting a public Notice of Intent and developing a Stormwater Site Plan (SSP). Elements within the SSP include: (1) Project Overview, (2) TESC Plan, (3) BMP Selection Form, (4) a project specific Maintenance and Operations Schedule, (5) Vegetation Management Plan, and (6) Downstream Analysis Plan.

WSDOT's Municipal NPDES permit for Separate Storm Sewer Systems requires that WSDOT provide water quantity and quality treatment in order to minimize and avoid water quality impacts to surface waters as specified in NPDES Phase I permit areas.

A Hydraulic Project Approval (HPA) permit is required for all in-water work occurring below the ordinary high water mark, including stream bank protection, bridge and pier construction, channel relocation, placement of outfall structures, and culvert replacement. WDFW issues the HPA permit to ensure that construction is performed in a manner that prevents damage to the state's fish, shellfish, and their habitat. To this end, the HPA sets forth conditions on construction activities such as erosion control requirements, timing restrictions, procedures, and guidelines for in-water construction work, monitoring requirements, and additional project mitigation requirements.

WSDOT and Ecology established an Implementing Agreement in 1998 that specifies the conditions under which short-term modifications to the state's water quality standards are allowed. In- or near-water activities that will unavoidably violate state water quality criteria on a short-term basis required a temporary modification of water quality criteria. Activities requiring a temporary modification included discharges of turbid stormwater runoff from construction sites after All Known and Reasonable Technologies have been applied. While the Order no longer directly applies, WSDOT routinely follows the guidelines set forth in it.

Clearing and grading activities occurring outside of WSDOT right-of-way require a city grading permit. The grading permits specify procedures and design criteria to minimize and avoid impacts to surface water. Potential jurisdictions issuing grading permits include the Cities of Puyallup, Fife, and Tacoma.

Wellhead Protection Plans are developed by Group A and B purveyors in accordance with the Federal and State Safe Drinking Water Acts. Construction and operations occurring within the boundaries of established wellhead protection zones will necessitate coordination with purveyors and implementation of measures, specified in the wellhead protection plans, which would minimize or eliminate contaminant impacts. The Wellhead Protection Program is implemented by the DOH. City and County Health Departments are responsible for coordinating wellhead protection measures for multiple purveyors.

The City of Fife requires all development in flood hazard areas to be in accordance with the flood damage prevention ordinance. Flood hazard areas are to be identified using city and county flood insurance studies, in conjunction with FEMA maps.

3.2.9 Mitigating Measures

The primary impacts associated with construction and operation of SR 167 include instream work, an increase in the number of stream crossings, loss of floodplain storage, and potential increase in pollutant loads and changes to the hydrologic regime of local surface waters. These impacts are largely minimized through existing regulations and permits. Requirements contained in regulatory permits, agreements, and plans may include additional specific mitigation measures and monitoring requirements, which further ensure that activities are conducted in a manner that protects surface and groundwater quality.

Numerous applicable permits, plans and agreements require construction and operations to be performed in a manner that is protective of water resources. Through the reiterative process of project design and environmental evaluation that has been followed for the SR 167 project, a number of measures that may have been considered as mitigation at one time have now become part of the project design, which are briefly summarized below. It is possible that more specific mitigation measures will be identified during final phases of design and permitting.

Construction Mitigation

The placing of fill and stockpiling of native soils would increase slope steepness and the probability that soils would be exposed to erosive rains for up to one year, particularly during the winter months. In addition to the general procedures used to stabilize disturbed soils, specific measures can be implemented to reduce the erosion potential of soil stockpiles. These measures include cat-tracking the slopes and hydro-seeding the fill piles with bonded fiber matrix mulch. The tops of the piles can be flattened and the perimeter of the tops can be bermed to prevent the formation of rills on the steep slopes. The flattened tops of the piles should be graded such that the water travels a short distance before being collected and then transported, via flex pipe, downslope to a sediment pond or, if sufficient quality is maintained, discharged off-site.

On most WSDOT projects, construction contracts are written to give the contractor leeway as to when they will work. However, the contract will be written to control the timing of earthwork, minimizing the exposure of disturbed soils during the rainy winter months. The contract could require that major soil disturbing activities be performed during the summer, while specifying that disturbed areas be protected and that concrete and bridge work be performed during the winter.

When staging areas cannot be located outside of frequently flooded areas, fuels, oils, and other potential contaminants will be confined within a berm or barrier.

Operational Mitigation

A number of measures (MGS et al. 2004) to reduce flood elevations at the 20th Street East bridge and/or the northbound I-5 bridges have been recommended. These hydraulic mitigation measures include

- Widening the culvert at 12th Street East;
- Creating an approximately 100-foot-wide off-channel depressed floodplain (bench cut) adjacent to the south side of Hylebos Creek from SR 99 to 12th Street East;
- Widening the channel immediately downstream of 12th Street East to smooth the transition from the new box culvert to the existing channel;
- Removing debris and maintaining invert elevation of the channel under SR 99.

New stream crossings will be designed to pass the 100-year storm event at a minimum. When practicable, these structures will support natural stream processes by minimizing channel constriction and riprap placement.

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