Appendix D – Cumulative Impacts Analysis

1.1 Introduction

The Shoreline Management Act, RCW 90.58, require local shoreline master programs (SMPs) to regulate new development to maintain no net loss of shoreline ecological functions. Information provided in the Shoreline Inventory and Characterization Report (Appendix A) provides a baseline of existing shoreline conditions in Riverside, making it possible to determine if future development activities would result in a net loss to ecological functions. While some impacts are immediate and can be directly addressed through avoidance and mitigation, other impacts are cumulative in nature. Individually, the action may not result in a significant impact, but the composite of many similar actions over time may lead to a significant cumulative impact to the ecosystem. According to the National Environmental Policy Act, a cumulative impact is:

"the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

For example, the creation of a small area of impervious surface may have only a negligible impact on the environment. The creation of numerous impervious surfaces that in total result in a significant change in the amount of such surface throughout a watershed over time could lead to significant impacts, such as: water quality degradation, increased peak storm flows, channel erosion, decreased vegetation and habitat areas, increased local temperatures, and other potential impacts.

WAC 173-26-186(8)(d) states that:

"To ensure no net loss of ecological functions and protection of other shoreline functions and/or uses, master programs shall contain policies, programs, and regulations that address adverse cumulative impacts and fairly allocate the burden of addressing cumulative impacts among development opportunities. Evaluation of such cumulative impacts should consider:

> *(i) Current circumstances affecting shore lines and relevant natural processes;*
>
> *(ii) Reasonably foreseeable future development and use of the shoreline; and*
>
> *(iii) Beneficial effects of any established regulatory programs under other local, state, and federal laws.*

Planning provisions contained in the guidelines recognize that methods of determining reasonably foreseeable future development may vary according to local circumstances, including demographic and economic characteristics and the nature and extent of local shorelines.

In addition to the regulations and policies contained in the Town of Riverside's SMP, developments in the Town are regulated under the Town's Flood Damage Prevention ordinances. State and Federal regulations also apply to the town's shoreline jurisdiction when developments will affect critical areas or large areas adjacent to shorelines. Some of the state and federal regulations include, but are not limited to: the Endangered Species Act (ESA) to protect and recover federally listed species; the Clean Water Act (CWA) to protect water quality and regulate excavation and dredging; Hydraulic Project Approval (HPA) regulates projects that change waters of the state and affect fish habitat; and the National Pollution Discharge and Elimination System (NPDES) which regulates discharges into surface waters.

1.2 Reasonably Foreseeable Future Development

Consistent with the guidelines, an appropriate evaluation of cumulative impacts on ecological functions will consider reasonably foreseeable future development and use of the shoreline that is regulated by the shoreline master program, as well as actions that are caused by unregulated activities and development exempt from permitting. The focus of foreseeable development is on those actions that have been identified as potential impacts to the shoreline environment and that are or would be foreseeable based on past development patterns, dependent on shoreline regulations.

Based on current demographic trends, it is unlikely that the Riverside shoreline will experience significant residential development in the foreseeable future. According to US Census data, the Town saw a population decrease of approximately 20% between 2000 and 2010, falling from a total population of 349 in 2000 to 280 in 2010. Limited local economic opportunities could be one reason for the population decline; residents may be moving elsewhere to find jobs. Based on the Department of Housing and Urban Development's (HUD) 2000 Census Data, Riverside had a LMI (Low and Moderate Income Persons) percentage of 62.2%. Further commercial development is also unlikely, with only 7 commercial parcels currently located within city limits and limited numbers of parcels available for commercial development, (see Appendix A, Figure 8: Existing Land Use). Riverside residents can travel to neighboring Omak for many commercial services, which is located only 8 miles south of town. This likely decreases the demand for the expansion of local commercial developments. The location of the 100-year floodplain, which is extensive both within and outside of the shoreline jurisdiction in city limits, further limits development opportunities (see Appendix A, Figure 6: Floodway and Flood Hazard Zones).

While substantial future development is unlikely, it cannot be ruled out entirely. Future population growth to the larger neighboring communities of Omak and Okanogan to the south could increase residential development demand in Riverside. Existing agricultural and undeveloped lands could potentially be converted to smaller residential parcels. Other potential development could include agricultural land conversions, such as the conversion of livestock grazing lands to alfalfa hay or tree fruit production (or vice versa), and the extensions of Hazel, Grove and Riverside Streets, which are all public roads but currently undeveloped, into the shoreline jurisdiction area. Modifications of existing shoreline stabilization or installations of new stabilization could also occur at existing single family homes.

The Shoreline Inventory and Characterization Report, provided in Appendix A, divided the Town of Riverside shoreline into segments called reaches. The following sections, 1.3 and 1.4, provide a brief description of each reach, foreseeable future development, and potential cumulative impacts of foreseeable development.

1.3 Town Shoreline Reach Descriptions

The Town of Riverside shoreline is divided into 3 reaches, as shown on Figure 1.3.1 on the following page, and in more detail on Figures 11 and 12 in the Inventory and Characterization Report provided in Appendix A. These reaches were determined primarily by current land uses.

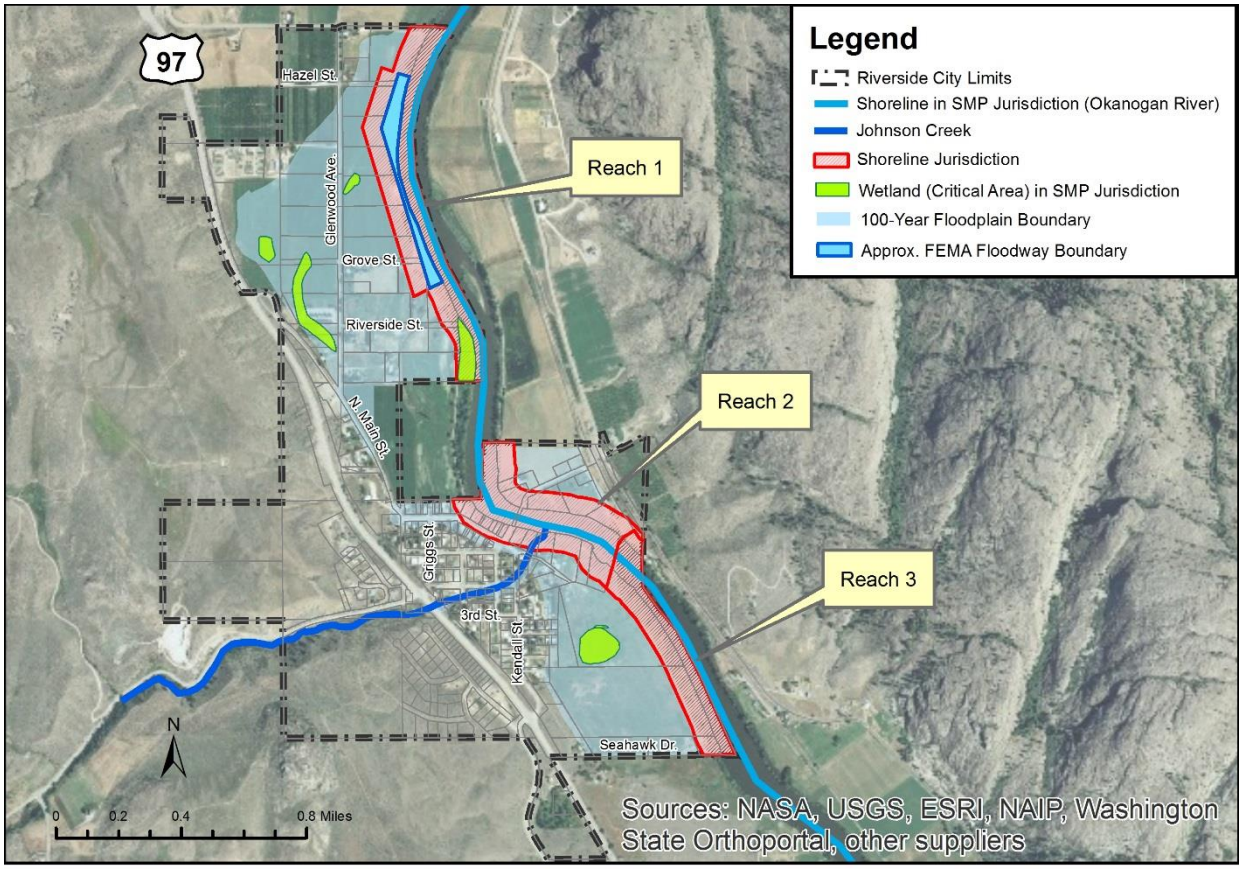

Figure 1.3.1: Shoreline Reach Map

The following is a brief description of each shoreline segment. Foreseeable development and potential cumulative impacts of such development within each reach is also discussed.

Reach 1 – North Side of Town

Reach 1 begins at the north city limit boundary, and extends south approximately 0.9 miles to the city limit boundary just south of Riverside Street. This area is characterized by large parcels mostly used for agricultural, (primarily alfalfa production). Three undeveloped parcels and an area of Freshwater Forested/Shrub Wetland are located at the southern end of the segment. The SMP environment designation is predominantly Conservancy, with areas of Shoreline Residential at the southern end of the reach in the vicinity of undeveloped lands. As is true with all other town shoreline reaches, lands located waterward of the OHWM are classified as Aquatic. All of the lands within the reach are privately owned. Riparian and upland vegetation has been cleared for agricultural uses and for the construction and contiuned maintenance of a dike that is present along the entire shoreline within the reach. One residential home is located near the mid-point of the reach.

<u>Foreseeable Develoment and Cumulative Impacts:</u>

It is possible that the undeveloped lands at the southern end of the reach, and agricultural lands located elsewhere could be subdivided into much smaller residential lots. Hazel, Grove, and Riverside streets would likely be extended into the shoreline jurisidction area with such development to provide access to homes. Utilities and secondary roads would also need to be built. The cumulative affects of this development could be significant, depending on the number of lots developed, lot density, extent of land filling in the floodplain and wetlands, removal of existing riparian vegetation and the area of new impervous surfaces. Other potential development could include the conversion of alfalfa farming to

other agricultural uses, (e.g. livestock grazing, orchards). The cumulative affects of livestock grazing could include removal of existing native vegetation, trampling of river banks, and water quality impacts. The conversion to orchards could result in the addition of more pesticides in agricultural runoff, thus impacting water quality and nutrient cycling.

Future single-family residential development is allowed with a substantial development permit in the Conservancy and Shoreline Residential portions of the reach. It is prohibited in Aquatic designated areas. New agricultural uses and development such as livestock grazing, cultivation, orchards and the construction of agricultural buildings are allowed with a substantial development permit in Conservancy and Shoreline Residential designation areas, while prohibited in Aquatic designated areas. Feedlots are one type of agricultural use that is prohibited in all shoreline environment designations in the reach.

Reach 2 – Downtown Riverside

Reach 2 begins at the city limit boundary, just upstream from the Tunk Valley Road bridge, and extends south about 0.60 miles to the WDFW boat ramp. The reach is located on both the west and east sides of the Okanogan River, centered around the small downtown area of Riverside. Johnson Creek, which is not a shoreline of the state, enters on the west side of the river near the middle of the reach. This reach is characterized primarily by small residential lots and a few small commercial properties, with the exception of some agricultural lands located on the east side of the river, and a couple of publically owned parcels on the west side of the river. These public lands are the town park and WDFW boat ramp. The SMP environment designation is Shoreline Residential, to reflect the predominate land use within the reach. Lands located waterward of the OHWM are classified as Aquatic. Riparian and upland vegetation has been cleared for residential and park landscaping, and for the construction and contiuned maintenance of a dike that is present along most of the shoreline in the reach.

Foreseeable Develoment and Cumulative Impacts:

There are limited opportunities for continued residential and commercial development within this reach, with only one existing undeveloped lot. It is possible that a few existing larger residential lots and agricultural parcels could be sudivided into smaller residential parcels in the foreseeable future. The extent of cumulative affects of such development would depend on many factors, some of which include: the number of parcels developed, lot densities, amount of impervious surfaces constructed, extent of riparian and other vegetation removal, and construction of shoreline hardening (e.g. rip rap). While the development of only one residential lot in the reach would have minimal affects, the development of many could have a significant impacts on existing surface and groundwater processes, extent and diversity of wildlife habitat, and nutrient and pollutant cycling.

Other forseeable developments that could take place in the reach include improvements to the existing WDFW boat ramp, (e.g., new restroom, paved parking lot, storm treatment and detention facilities, new utility services), and improvement to the town's park, (e.g. development of an accessible path to the river bank, fencing to control foot traffic and protect riparian vegetation and soils). Cumulative affects from these developments should be minimal, as that they would only affect small areas of the town's shoreline.

Future single-family residential development is allowed with a substantial development permit in the Shoreline Residential portion of the reach, while prohibited in Aquatic designated areas. Water-dependent and water-related recreational uses are allowed in Shoreline Residential designated areas with a substantial development permit, while a conditional use permit is required for this type of development in Aquatic designated areas.

Reach 3 – South Side of Town

Reach 3 begins at the east boundary of the WDFW boat ramp parcel and extends south approximately 0.8 miles to the south city limit boundary. The majority of the reach is located on the west side of the river, other than a small portion located on the east side across from the boat ramp. This reach is characterized by large parcels used for agricultural, (primarily livestock grazing). There is a single residential property located at the southern end of the reach. An area of Freshwater Pond Wetland is located in this reach. The SMP environment designation is Conservancy. Lands located waterward of the OHWM are classified as Aquatic. All of the lands within the reach are privately owned. Riparian vegetation, upland vegetation, river banks and the wetland have been impacted by livestock grazing.

Foreseeable Develoment and Cumulative Impacts:

It is possible that agricultural parcels could be subdivided into smaller residential lots. North Main, Montvue and City Streets would likely need to be extended towards the river with such development to provide access to homes. Utilities and secondary roads would also need to be built. The cumulative affects of this development could be significant, depending on the number of lots developed, lot density, extent of land filling in the floodplain and wetland, removal of existing riparian vegetation and the area of new impervous surfaces. Other potential development could include the conversion of livestock grazing to other agricultural uses, (e.g. alfalfa, orchards), or increased livestock grazing. The cumulative affects of conversion to orchards or other agricultural uses could result in the addition of more pesticides in agricultural runoff, thus impacting water quality and nutrient cycling. Increased livestock grazing would place more pressures on fragile riparian vegetation and soils.

Future single-family residential development is allowed with a substantial development permit in the Conservancy designated portion of the reach. It is prohibited in Aquatic designated areas. New agricultural uses and development such as livestock grazing, cultivation, orchards and the construction of agricultural buildings are also allowed with a substantial development permit in Conservancy designation areas, while also prohibited in Aquatic designated areas. Feedlots are one type of agricultural use that is prohibited in all shoreline environment designations in the reach.

1.4 Ecological Functions and Processes at Risk from Future Developments

The Inventory and Characterization Report in Appendix A, identified existing and potential stressors by shoreline reach. The following subsections provide a brief description of existing conditions and potential ecological functions and processes at risk from future development using the information provided in this report.

Vegetation and Habitat

Existing vegetation and wildlife habitat was inventoried as part of the shoreline characterization for the Town of Riverside. It was found that riparian vegetation generally varies between 20 and 80 feet wide throughout all stream reaches, with the most extensive vegetation found in undeveloped areas located at the southern end of Reach 1. Native deciduous tree species such as black cottonwood, alder, and water birch are present in the riparian zone, as well as non-native species such as elm and locust. Native shrub species such as willows, dogwood, spirea, hawthorn and rose also occur, in addition to native grasses. Upland areas in stream reaches contain limited remnant shrubsteppe vegetation consisting of sagebrush, rabbitbrush, and native grasses. While no formal vegetation surveys have been conducted in the shoreline area, it is likely that some invasive weed species also occur especially in disturbed areas. Agricultural vegetation dominates upland areas in Reach 1, while non-native grasses and weeds dominates upland areas in Reach 3. Upland areas in Reach 2 have mostly been converted to residential

and commercial uses. Landscaping has replaced native vegetation in some residential areas and in portions of the city park.

The Washington Department of Fish and Wildlife classifies certain habitats and species determined to be priorities based on defensible criteria. In all shoreline reaches, three such priority species are known to occur: mule deer, golden eagles and bald eagles. Mule deer occur in the Riverside area year-round, and riparian areas provide important breeding habitat for golden and bald eagles. While bald eagles were removed from the Federal List of Endangered and Threatened species in 2007, they remain classified as a federal species of concern and are also classified as a sensitive species in Washington. The Okanogan River is home to many native fish species, including three federally listed species: spring chinook, summer steelhead and bull trout. Summer Chinook utilize the river habitat in the vicinity of Riverside for spawning.

As noted in the shoreline characterization report, the presence of healthy riparian vegetation is critical to water quality and fish and wildlife habitat. Riparian vegetation stabilizes river banks which reduces erosion and sedimentation, filters pollutants and sediments from agricultural and storm runoff, slows runoff velocities which reduces shoreline scouring and erosion, provides nesting habitat for birds, provides shade which reduces stream temperatures important for salmonid survival, and provides Large Woody Debris (LWD) important for wildlife habitat and food sources. Based on the many benefits of riparian vegetation, it is very important that these areas be protected from future development activities. Activities such as livestock grazing, clearing of land for agricultural purposes, removal of native vegetation for the installation of ornamental landscaping, and the construction of roads and dikes have all contributed to the reduction of riparian vegetation in the town's shoreline. Current town policy does not provide options for conservation easements and restoration assistance, although these options are discussed in the Restoration Plan provided in Appendix C.

Wetlands

Wetland areas have been inventoried as part of the shoreline characterization for Riverside. Figure 5: Wetland Locations, given in the characterization report shows that five wetland areas occur within city limits. As that all of these wetlands are located within the 100-year floodplain, they all are also located within the town's shoreline jurisdiction. Three areas of Freshwater Emergent Wetland occur in Reach 1, with a total area of approximately 4.5 acres. Freshwater Forested/Shrub Wetland occurs in one area of Reach 1, with a total area of about 2.5 acres, while an area of Freshwater Pond wetland occurs in Reach 3, with a total area of about 3.2 acres. Wetland locations were determined from US Fish and Wildlife National Wetlands Inventory Data, and have not been field confirmed by wetland specialists.

All of these wetlands are proposed to be protected by this SMP from future development activities. Section 6.3 – Wetland Provisions, requires wetland buffers of varying widths, depending on the category of wetland to be protected. Existing wetlands are not protected by current city policies or regulations, and have been degraded by livestock grazing and removal of vegetation for agricultural land conversions. The construction of a dike along the shoreline in Reach 1 has limited the river channel's ability to access adjacent floodplains during high water events, and this has also likely impacted wetlands. Based on field observations by Forsgren Associates staff while conducting the shoreline inventory, the Freshwater/Shrub Wetland occurring at the southern end of Reach 1 appears to be the most intact of all identified wetland areas.

Protection of wetlands from future development is important for several ecological reasons. Wetlands filter toxins from agricultural and urban runoff, thus improving water quality. They also provide important habitat for wildlife, flood protection by acting as sponges to absorb flood waters, and vegetation which reduces erosion by holding soil in place.

Floodplains

Floodplains are a substantial feature in the town, as can be seen on Figure 6: Floodway and Flood Hazard Zones, given in Appendix A. Reach 1 lies entirely within the 100-year floodplain. Reaches 2 and 3 are also almost entirely within the 100-year floodplain, with the exception of small areas on the east side of the river which are outside the 100-year floodplain. City staff has stated that the area in the vicinity of the WDFW boat ramp at the south end of Reach 2 often floods annually. This annual flooding primarily affects the boat ramp parcel and a residential parcel located to the north of the boat ramp. The City does not currently have a formal flood hazard management plan, but does require potential developments located within the floodplain to obtain a Floodplain Development Permit. Section 6.6 – Frequently Flooded Areas Provisions of this SMP specifies policies and regulations to provide a framework for floodplain management within the town's shoreline jurisdiction.

The floodplains have been impacted by the construction of dikes along the shoreline in Reaches 1 and 2. The dike likely limits the river channel's ability to access adjacent floodplains during high water events. The dike was constructed to protect agricultural and residential lands in these reaches. It is not apparent if a dike exists along the shoreline in Reach 3.

Floodplain protection should be a consideration in future development decisions within the town's shoreline jurisdiction due to the many important benefits they provide. Floodplains provide a broad area to spread out and temporarily store floodwaters. This reduces flood peaks and velocities and the potential for erosion. Floodplains connected to river channels also allow for the replenishment of wetland areas that are important for wildlife habitat, and also for replenishment of nutrients to agricultural soils through the natural processes of sediment transport and deposition. Developing floodplain management policies which help minimize more vulnerable development and encourage more compatible uses will help maintain floodplain functions and processes.

Geologically Hazardous Areas

There are no known geologically hazardous areas within the town's shoreline. The topography of the jurisdiction area in all reaches is relatively flat, and there are no known active landslide areas. However, certain sections of the river bank in all reaches are fairly steep with slopes exceeding 15%. These steep river banks are especially susceptible to erosion. The cumulative impacts of future development could expose larger sections of the town's river banks to erosion through the removal of riparian vegetation which is needed to hold soil in place. This riparian vegetation removal could be caused by the cumulative effects of future development (e.g., residential developments, clearing of vegetation to expand agricultural operations) and to uncontrolled livestock access to the river.

Alteration of Nutrient Delivery and Removal

Nutrient delivery and removal can be altered by a variety of processes that take place in the Town of Riverside, some of which include: runoff and irrigation from agricultural uses, residential landscaping, livestock grazing, and land clearing. These processes lead to an excess of nutrients being released into the Okanogan River, due to loss of riparian vegetation and wetlands which are important for nutrients cycling and storage.

Surface and Groundwater Flow

Surface and groundwater flow within the Town of Riverside floodplain has likely been altered by development and infrastructure resulting in disrupted interactions between the riverine ecosystems and the hyporheic zone. Overbank flooding and hyporheic flows in the floodplain areas are important processes. Surface and subsurface water flow processes support the hydrology of existing wetlands and riverine ecosystems. Development causes greater areas of impervious surfaces through the construction of roads and buildings, over-compaction of native soils, and removal of vegetation that would intercept

precipitation. All of these factors lead to greater surface runoff and lower infiltration rates, which decrease aquifer recharge. Riparian vegetation and wetlands help reduce surface runoff velocities and provide storage for surface runoff, allowing for infiltration into underlying soils. Artificial structures, such as storm detention ponds which are often required as part of land development plans, can provide some of these same benefits. They provide storage for runoff, allow for infiltration, and release run-off at pre-development rates. Existing diking, present along shoreline areas in Reaches 1 and 2, has also modified hydrology processes by disconnecting the river channel from its adjacent floodplains.

Sediment Delivery and Removal

Sediment delivery and removal in the Town of Riverside has been affected by the same factors that have altered other important processes. Some of these factors include: the conversion of previously forested riparian areas and floodplains to agricultural uses, the construction of impervious surfaces, livestock grazing, land clearing and river bank modifications. Other factors outside of the town's city limits have also affected sediment processes in the Okanogan River basin including: high runoff from steep areas adjacent to the river, upstream vegetation removal due to logging, grazing and wildfire, and urban development. Future land development, land filling of wetlands and floodplain areas, and agriculture uses could contribute to further impacts to sediment processes in the town's shoreline areas.

1.5 Foreseeable Development

The above stressors to the shoreline environment can result from individual developments and modifications, or as the result of many developments. Shoreline stressors, potential cumulative impacts, and the benefits of regulation and policies found in the SMP are examined by segment in the tables on the following pages. These tables will help in determining if significant impacts will result from potential development in Riverside's shoreline areas.

Table 1 - Cumulative Impacts to Shoreline Environement
(Nutrient/Pollutant Delivery and Removal)

Shoreline Process & Function	Resource at Risk	Shoreline Alterations Impacting Processes & Functions	Proposed Regulatory Measures & Policies	Proposed Non-Regulatory Measures & Restoration Opportunities
Process - Nutrient/pollutant delivery and removal Function - Water Quality	The Okanogan River floodplain and associated functional wetlands, and riparian zones.	*Development of residential areas with associated impervious surfaces* New development resulting in additional impervious surfaces, increasing nutrient & pollutant delivery to the river *Clearing of riparian vegetation* New development could result in the removal of riparian vegetation. This vegetation filters nutrients and pollutants from runoff. Its removal impacts nutrients cycling and storage. *Filling of Wetlands* Removes hydrophilic soils and associated wetland vegetation, which eliminates pollutant filtering and nutrient cycling and storage. *Agricultural Conversion* Conversion of one agricultural type to another, resulting in increased pollutant and nutrient discharge to the river (e.g. conversion from alfalfa production to cattle grazing). <u>*Degree of Future Cumulative Impact*</u> Reaches 1 and 3 have existing agricultural lands that could potentially be converted to residential uses. Impacts to existing wetlands and riparian vegetation could occur, which may impact nutrient/pollutant proccesses and water quality functions. Reach 2 has limited numbers of vacant residential or commercial parcels, so future impacts should be low in this segment. However, some agricutural lands on the east side of the river in this reach could potentially be converted to other uses. The presence of the 100-year floodplain in all reaches will limit future development opportunities. Livestock are currently present only on agricultural lands in Reach 3. If agricultural lands in Reach 1 were converted to livestock grazing activities, this could have a significant impact on riparian vegetation and water quality if livestock are allowed uncontrolled access to the river.	All shoreline developments and uses shall utilize measures to minimize any increases in surface water runoff and to control, treat, and release runoff so receiving water quality and shoreline properties and features are not adversely affected. The Stormwater Management Manual for Eastern Washington (SMMEW) should be consulted for acceptable Best Management Practices (BMP's). Section 4.3, Policy C. Development work and other projects shall be designed to avoid the removal of trees in shorelines wherever practicable and to minimize the removal of other woody vegetation. Where riparian vegetation is removed, measures to mitigate the loss of vegetation shall be implemented to assure no net loss of ecological function. Section 4.5, Policy A. New development shall, at a minimum, preserve native riparian vegetation and if possible, enhance it. Section 4.3, Policy H. For lawns and other vegetation maintained within the shoreline jurisdiction, alternatives to the use of chemical fertilizers, herbicides, and pesticides shall be a preferred BMP. Section 4.6, Policy D. Riparian and building setbacks are specified in Table 5.2.2, Section 5.2(M), as well as lot impervious coverages based on Environment Designation. Fertilizers shall be applied in a manner which will minimize entry into surface waters. Section 5.3(A)(6). If wetlands or other environmentally sensitive areas are located on the development site, clustering of residential units or similar design shall be required in order to avoid any development in such areas. Section 5.3(F)(4). Storm drainage and treatment facilities shall be required for residential development projects	The Town, local conservation groups and area watershed councils could work with private landowners to voluntarily restore native riparian vegetation, (Appendix C: Restoration Plan. Opportunity A, Reaches 1 & 2, Opportunity B, Reach 3). Prevent further "Hard" Shoreline Stabilization. Future development should be encouraged to utilize "soft" shoreline stabilization. Because soft shoreline stabilization techniques often take advantage of vegetation, they can provide added benefits such as creating fish and wildlife habitat and filtering pollutants from agricultural runoff from adjacent fields. (Appendix C: Restoration Plan. Opportunity B, Reach 1.) Landowners should be encouraged to limit agricultural activites in wetland areas, and fencing could potentially be installed around the perimeters of wetlands for their protection. (Appendix C: Restoration Plan. Opportunity D, Reaches 1 & 3.) Existing storm water discharges could be retrofitted with treatment facilities such as detention ponds, sediment settling basins and oil/water separators to treat storm runoff prior to discharge to the river, (Appendix C: Restoration Plan. Opportunity B, Reach 2). The Town and/or local conservation groups could organize volunteer community stream bank litter pick-up events. (Appendix C: Restoration Plan. Opportunity F, Reach 2). Restrict livestock access to the river. Fencing could be installed to limit livestock grazing to areas outside of the riparian zone, and to consolidate river

Table 1 - Cumulative Impacts to Shoreline Environement
(Nutrient/Pollutant Delivery and Removal)

Shoreline Process & Function	Resource at Risk	Shoreline Alterations Impacting Processes & Functions	Proposed Regulatory Measures & Policies	Proposed Non-Regulatory Measures & Restoration Opportunities
Process - Nutrient/pollutant delivery and removal Function - Water Quality	The Okanogan River floodplain and associated functional wetlands, and riparian zones.		involving five or more lots. Section 5.3(F)(8). Wetland buffers are specified in Table 6.3.1, Section 6.3. If activities will result in the loss or degradation of a regulated wetland or buffer, a mitigation or enhancement plan prepared by a qualified expert shall be submitted for review and approval by the Town. Section 6.3(G).	access locations for livestock. (Appendix C: Restoration Plan. Opportunity A, Reach 3).

Table 2 - Cumualitive Impacts to Shoreline Environement
(Surface and Groundwater Flow)

Shoreline Process & Function	Resource at Risk	Shoreline Alterations Impacting Processes & Functions	Proposed Regulatory Measures & Policies	Proposed Non-Regulatory Measures & Restoration Opportunities
Process - Surface and Groundwater flow Function - Reduce downstream flooding and erosion, aquifer recharge and storage, water quality, enhancing summer base flow for the river.	The Okanogan River floodplain and associated functional wetlands, and riparian zones.	*Development of residential areas with associated impervious surfaces* Increasing impervious areas and associated removal of vegetation decreases infiltration recharge, subsurface storage, and groundwater discharge to the river and wetlands. It also increases storm runoff velocities and quantities by decreasing areas of available infiltration, increasing the likelihood of flooding and erosion. *Fill in Floodplain* Fill and development in the floodplain reduces surface storage and increases flooding frequency and duration. *Filling of Wetlands* Removes wetland surface storage and increases flooding frequency and duration. Also removes potential areas for stormwater runoff storage from developed areas. *Disconnection of River Channel from Adjacent Floodplain* Construction of new dikes and levees disconnects the river from the floodplain and wetlands. Channelization of river results in greater flood peaks and higher stream velocites, causing more erosion. *Alteration and/or removal of native soils* Removal or compaction of native soils can impact infiltration and shallow sub-surface flow. Can also increase storm runoff velocities and quantities by reducing the areas available for infiltration into underlying soils. *Removal of vegetation* Removal of riparian and upland vegetation could cause storm and agricultural runoff to enter the river more quickly. Intact vegetation along river banks helps to mitigate high runoff events, and allows runoff to infiltrate into soils and be released more gradually to the river over longer periods of time. This is especially important during low summer flow periods. <u>*Degree of Future Cumulative Impact*</u> Reaches 1 and 3 have existing agricultural lands that could potentially be converted to residential uses. Impacts to surface and groundwater flow could include increased runoff velocities and volumes due to the construction of impervious surfaces, and the filling of floodplains and wetlands to create more buildable land. Reach 2 has limited numbers of vacant residential or commercial parcels, so future impacts should be low in this segment. However, some agricutural lands on the east side of the river in this reach could potentially be converted to other uses. The presence of the 100-year floodplain in all reaches will limit future development opportunities.	All shoreline developments and uses shall utilize measures to minimize any increases in surface water runoff and to control, treat, and release runoff so receiving water quality and shoreline properties and features are not adversely affected. The Stormwater Management Manual for Eastern Washington (SMMEW) should be consulted for acceptable Best Management Practices (BMP's). Section 4.3, Policy C. Land clearing, grading, filling, and alteration of natural drainage features and landforms shall be limited to the minimum necessary for development. Surfaces cleared of vegetation and not to be developed must be replanted as soon as possible. Section 4.3, Policy E. The location, design, construction, and management of all shoreline uses and activities shall protect the quality and quantity of surface and groundwater adjacent to site. Section 4.6, Policy A. New agricultural lands created by diking, draining, or filling wetlands or channel migration zones shall not be allowed, Section 5.3(A)(9). Fills shall be permitted only when it is demonstrated that the proposed action will not: Adversely alter natural drainage and current patterns or significantly reduce floodwater capacities. Section 5.3(H)(3)(c)(ii). Filling to create dry land is prohibited in floodplains except where it can be clearly demonstrated that the geohydraulic characteristics and floodplain storage capacity will not be altered to cause increased flood hazard or other damage to life or property in excess of accepted standards provided by state and/or federal agencies. Section 5.3(H)(3)(i). Grading of a development shall not alter natural drainage patterns in a manner that would increase the rate or quantity of surface runoff.	Restoration Goals: Protect and improve water quality, preserve existing natural riparian vegetation, reduce impacts of flooding events, (selected goals given in Appendix C: Restoration Plan). The Town, local conservation groups and area watershed councils could work with private landowners to voluntarily restore native riparian vegetation, (Appendix C: Restoration Plan. Opportunity A, Reaches 1 & 2, Opportunity B, Reach 3). Prevent further "Hard" Shoreline Stabilization. Future development should be encouraged to utilize "soft" shoreline stabilization which utilizes native vegetation and bio-engineering approaches instead of "hard" stabilization which utilizes structures such as rip rap, concrete walls, and stone reinforcement. (Appendix C: Restoration Plan. Opportunity B, Reach 1.) Hard stabilization techniques can contribute to the channelization of the stream, thus constricting the channel during high water events. This constriction contributes to increased rates of erosion caused by higher stream velocities. The Town should continue to enforce its floodplain development permitting procedures, and enforce policies and regulations given in Chapter 6, Section 6.6 - Frequently Flooded Areas Provisions of this SMP as it relates to future development. Discourage the construction of new dikes, levees and fills. (Appendix C: Restoration Plan. Opportunity E, Reaches 1 & 3, Opportunity D, Reach 2). An evaluation could be conducted to determine the feasibility of removing sections of the dike, or installing culverts under the dike, which would allow the river channel to access adjacent flood plains during high water events.

Table 2 - Cumualitive Impacts to Shoreline Environement
(Surface and Groundwater Flow)

Shoreline Process & Function	Resource at Risk	Shoreline Alterations Impacting Processes & Functions	Proposed Regulatory Measures & Policies	Proposed Non-Regulatory Measures & Restoration Opportunities
Process - Surface and Groundwater flow Function - Reduce downstream flooding and erosion, aquifer recharge and storage, water quality, enhancing summer base flow for the river.	The Okanogan River floodplain and associated functional wetlands, and riparian zones.		Section 5.3(H)(4)(h). All proposed activities within aquifer recharge areas must comply with the water source protection requirements of the EPA, state Dept. of Health and the Okanogan County Health District. Section 6.4 C. Non-structural control solutions are preferred over structural flood control devices, and should be used wherever possible when devices are needed. Section 6.6(A). Any use or development shall maintain pre-development movement (volume and velocity) of surface (storm runoff) water to prevent or minimize the unnatural diversion of flood water to otherwise flood-free areas which could necessitate expensive and environmentally disruptive flood control methods. Section 6.6(C). Development in floodplains should not significantly or cumulatively increase flood hazards or be inconsistent with comprehensive flood hazard management plans adopted pursuant to RCW 86.12. Section 6.6(G). Residential development shall not be approved if geotechnical analysis demonstrates that flood control or shoreline protection measures are necessary to create a residential lot or site area. Residential development shall be located and designed to avoid the need for structural shore defense and flood protection measures. Section 5.3(F)(3).	(Appendix C: Restoration Plan. Opportunity F, Reach 1). Existing storm water discharges could be retrofitted with treatment facilities such as detention ponds, sediment settling basins and oil/water separators to treat storm runoff prior to discharge to the river, (Appendix C: Restoration Plan. Opportunity B, Reach 2). Detention ponds are especially important in maintaining pre-development runoff rates. They provide storage for runoff, allowing it to be released to the river at pre-development rates. Landowners should be encouraged to limit agricultural activites in wetland areas, and fencing could potentially be installed around the perimeters of wetlands for their protection. (Appendix C: Restoration Plan. Opportunity D, Reaches 1 & 3.) Wetlands provide additional storage areas for floodwater and storm runoff.

Table 3 - Cumualitive Impacts to Shoreline Environement
(Sediment Transport)

Shoreline Process & Function	Resource at Risk	Shoreline Alterations Impacting Processes & Functions	Proposed Regulatory Measures & Policies	Proposed Non-Regulatory Measures & Restoration Opportunities
Process - Sediment Transport Function - Sediment delivery and removal from the river.	The Okanogan River floodplain and associated functional wetlands, and riparian zones.	Several factors have contributed to the sedimentation of the Okanogan River, some of which include: high runoff from adjacent steep terrain, removal of riparian vegetation due to land conversions and grazing, construction of impervious surfaces in urban areas, and loss of vegetation due to fire and logging. Grazing, agricultural land conversions and the resulting removal of vegetation, and the construction of impervious surfaces have altered or accelerated sediment transport processes within Riverside itself. <u>*Degree of Future Cumulative Impact*</u> Further sediment delivery into water systems without protective vegetation due to land clearing and development upstream of Riverside. Potential residential development in Reaches 1 and 3 could impact wetlands and floodplains which in turn could affect flooding and erosion functions within shoreline areas. Further livestock grazing in Reach 3, or the introduction of grazing in Reach 1 could increase sediment delivery to the river through the de-stabilization of river banks due to vegetation removal and trampling.	Stabilization of erosion-prone surfaces along shorelines shall primarily use vegetation and non-structural approaches when feasible. More intensive measures may be permitted providing the project will result in no net loss in shoreline function, (Section 4.5(C)). Vegetation removal that would likely result in significant erosion or the need for structural shoreline stabilization measures is prohibited, (Section 4.5(D)). Fills shall be designed, constructed, and maintained to prevent, minimize, and control all material movement, erosion, and sedimentation from the affected area. Fill perimeters shall be designed and constructed with silt curtains, vegetated buffer areas, or other methods to prevent material movement. In addition, the sides of the fill shall be appropriately sloped to prevent erosion and sedimentation, both during initial fill activities and afterwards. Section 5.3(H)(3)(e). All clearing and grading activities shall be limited to the minimum necessary for the intended development, including any clearing and grading approved as part of a landscape plan. Surfaces cleared of vegetation and not developed must be replanted as soon as possible. Section 5.3(H)(4)(b). In its review of clearing and grading proposals, the Town of Riverside shall require and utilize a clearing and grading plan that addresses species removal, replanting, irrigation, erosion and sedimentation control, and plans for protecting shoreline resources from harm. Section 5.3(H)(4)(g). Immediately upon completion of construction or maintenance activity, remaining cleared areas shall be restored to a naturalistic condition using compatible, native vegetation or native compatible self-sustaining vegetation in accordance with Chapter 4, Section 4.5. Section 5.3(H)(4)(i). Every erosion hazard area mitigation plan shall	Develop storm water pre-treatment infrastructure to protect the river from non-point source pollution in runoff. Sedimentation ponds are a type of pre-treatment that could be utilized to allow for the removal of sediments prior to discharge to the river. Encourage property owners to consider installing fencing parallel to the stream bank to limit livestock access to the riparian area and control access points to the river. The Town, local conservation groups and area watershed councils could work with private landowners to voluntarily restore native riparian vegetation, (Appendix C: Restoration Plan. Opportunity A, Reaches 1 & 2, Opportunity B, Reach 3). As noted, vegetation is important for the filtration of pollutants including sediments.

Table 3 - Cumualitive Impacts to Shoreline Environement
(Sediment Transport)

Shoreline Process & Function	Resource at Risk	Shoreline Alterations Impacting Processes & Functions	Proposed Regulatory Measures & Policies	Proposed Non-Regulatory Measures & Restoration Opportunities
Process - Sediment Transport Function - Sediment delivery and removal from the river.	The Okanogan River floodplain and associated functional wetlands, and riparian zones.		include a run-off management plan or an erosion control plan to reduce sedimentation problems. Section 6.7(G). All shoreline development shall be located, designed, constructed and maintained to minimize interferences with beneficial natural shoreline processess, such as water circulation, sand and gravel movement, accretion and erosion. Section 4.3(D). Prior to the issuance of a Building Permit, Substantial Development Permit, or other development approval, the developer shall submit adequate plans for the preservation of shoreline vegetation, for control of erosion during and after construction, and for the replanting of the site after construction resulting in permanent shoreline stabilization. Section 5.3(F)(9).	

Table 4 - Cumualitive Impacts to Shoreline Environement
(Fish and Wildlife Habitat)

Shoreline Process & Function	Resource at Risk	Shoreline Alterations Impacting Processes & Functions	Proposed Regulatory Measures & Policies	Proposed Non-Regulatory Measures & Restoration Opportunities
Process - Habitat Function - Fish and Wildlife Habitat	The Okanogan River floodplain and associated functional wetlands, and riparian zones. Spawning habitat for salmon.	The Okanogan River provides important in-stream and riparian habitat within Riverside's city limits. Many factors alter habitat functions, some of which include: removal of vegetation, urban development, road construction and stream bank modifications and hardening. Habitat elements important to fish and wildlife include riparian cover, large woody debris (LWD), clean water, water at appropriate temperatures for the survivability of native species, spawning habitat for fish, nesting trees for birds, foraging habitat, and the availability of food sources. The loss and alteration of these elements has a great impact of on the abundance, survivability, and diversity of native species. <u>*Degree of Future Cumulative Impact*</u> Reaches 1 and 3 have existing agricultural lands that could potentially be converted to residential uses. The filling in or draining of existing wetlands and the removal of riparian vegetation could occur, which would have an impact on fish and wildlife habitat availability. Increased rates of erosion and sedimentation could also occur with future development, which could cover river gravels needed for salmon spawning. The river in the vicinity of Riverside is an important breeding area for summer chinook. Reach 2 has limited numbers of vacant residential or commercial parcels, so future impacts should be low in this segment. However, some agricutural lands on the east side of the river in this reach could potentially be converted to other uses. The presence of the 100-year floodplain in all reaches will limit future development opportunities.	All development shall be located, constructed and managed to protect and/or not adversely affect those natural features which are valuable, fragile, or unique to the community including but not limited to: wetlands, fish, wildlife habitats, migratory routes, and spawning areas. Section 4.3(F)(1 & 2). Development work and other projects shall be designed to avoid the removal of trees in shorelines wherever practicable and to minimize the removal of other woody vegetation. Where riparian vegetation is removed, measures to mitigate the loss of vegetation shall be implemented to assure no net loss of ecological function. Section 4.5(A). Restoration or enhancement of any shoreline area that has been disturbed or degraded shall use recommended plant species approved by state agencies and local conservation organizations such as the Okanogan County Extension Service, Okanogan County Noxious Weed Control Board, Dept. of Fish and Wildlife, and Washington Native Plant Society. Native plants are preferred. Section 4.5(B). Topping of trees shall be prohibited, except where required to maintain overhead utility lines. Section 4.5(G). Clearing invasive non-native shoreline vegetation listed on the Okanogan County Noxious Weed Control Board Noxious Weed List is permitted in shoreline locations, provided hand held equipment is used and native vegetation is promptly re-established in the disturbed area. Section 5.3(H)(4)(j). All proposed development in the town's shoreline jurisdiction has the potential to impact critical wildlife habitat. Habitat management plans, prepared by qualified experts, will be required for all proposed developments. Habitat management plans shall be in conformance with Washington Department of Fish and Wildlife requirements, and be submitted for evaluation to local, state, and federal agencies. Section 6.5(A). Section 6.5(B) goes onto to explain the	Encourage property owners to restore native vegetation in shoreline areas, as well as to aggressively control invasive weed species. Work with landowners to develop conservation easements. The Town, local conservation groups and area watershed councils could work with private landowners to voluntarily restore native riparian vegetation, (Appendix C: Restoration Plan. Opportunity A, Reaches 1 & 2, Opportunity B, Reach 3). Landowners should be encouraged to limit agricultural activites in wetland areas, and fencing could potentially be installed around the perimeters of wetlands for their protection. (Appendix C: Restoration Plan. Opportunity D, Reaches 1 & 3.) Restrict livestock access to the river. Fencing could be installed to limit livestock grazing to areas outside of the riparian zone, and to consolidate river access locations for livestock. (Appendix C: Restoration Plan. Opportunity A, Reach 3). Manage existing and prevent noxious weed invasions. The Towns should work with organizations such as the Okanogan County Noxious Weed Control Board to develop a list of known Class A and B noxious weeds that are present or potentially present in the shoreline in order to develop an integrated pest management plan. (Appendix C: Restoration Plan. Opportunity C, Reaches 1, 2 & 3.

Table 4 - Cumualitive Impacts to Shoreline Environement
(Fish and Wildlife Habitat)

Shoreline Process & Function	Resource at Risk	Shoreline Alterations Impacting Processes & Functions	Proposed Regulatory Measures & Policies	Proposed Non-Regulatory Measures & Restoration Opportunities
Process - Habitat Function - Fish and Wildlife Habitat	The Okanogan River floodplain and associated functional wetlands, and riparian zones. Spawning habitat for salmon.		specific requirements of the habitat management plan.	