

Environmental Considerations Matrix

Alternative 1: Swinomish Diversion

Features	Benefits (+) and Impacts (-)	Possible Mitigation Measures
<ul style="list-style-type: none"> ✓ 80,000 cfs Diversion 2,000 feet wide with low flow channel (approx, 200 cfs year-round) and 500-ft riparian buffer ✓ 100-year protection ✓ I-5 protected ✓ 500-ft setback levee through Burlington ✓ Riverbank excavated in 3-bridge corridor ✓ Existing riprap and toe rock remains in place to reduce channel migration. This riprap will be planted with riparian species. The riprap will be replaced on an as needed basis to maintain protection. <i>(Note: Corps is considering removing existing riprap and placing riprap on setback levees.)</i> ✓ No side channels allowed in setback areas so as to prevent river 	<p>I. Diversion</p> <ul style="list-style-type: none"> + Salmon utilization potential in Diversion + Increased estuary rearing habitat in Swinomish Slough + Conversion of uplands to wetlands as a result of Diversion construction - Some loss of land due to berm construction - Potential impacts to eelgrass beds in Padilla Bay - Potential water quality impacts to Padilla Bay - Increased sediment in Swinomish Channel during flood <p>II. Stronger Dikes</p> <ul style="list-style-type: none"> - Complicates future restoration options through levee - Channel locked in place with little off channel habitat - Changes in river flows could produce significant changes in channel substrate and form - Long-term impacts to riparian habitat and large woody debris (LWD) in channel 	<ul style="list-style-type: none"> ➤ Maintain year round low flow in channel ➤ Allow for fish passage to river ➤ Create marsh at downstream end of channel ➤ Create a 500-ft riparian buffer along low flow channel ➤ Open up historic side channels (e.g. Britts Slough, Dry Slough, and Hearts Slough) with inlet structures for fish passage ➤ Plantings in riprap and installation of LWD structures

<p>migration</p>	<p>III. Setback of Levees</p> <ul style="list-style-type: none"> + Potential for additional refugia during flood events - Long-term impacts to bank vegetation, side channel formation, and bank-side conditions (existing bank conditions maintained – riprap remains) - Loss of vegetation from over-bank excavation <p>IV. Loss of Floodplain Habitat to Urban Conversion</p> <p>V. Potential Loss, Temporary Impact to Habitat of ESA Species (Eagle, etc)</p> <p>VI. Cultural Resources</p> <ul style="list-style-type: none"> - Potential disturbance and/or destruction of known or unknown sites 	<ul style="list-style-type: none"> ➤ Plantings in riprap along river ➤ Plant 200 ft riparian buffer ➤ Remove old riprap and place new riprap at setback levees. Then side channels could be constructed in setback areas because levees are protected by riprap. ➤ Open up historic side channels (e.g. Britts Slough, Dry Slough, and Hearts Slough) with inlet structures for fish passage ➤ Enact additional development restrictions ➤ Evaluate for National Historic Register eligibility. Mitigation will be dependent upon content of discovery.
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Alternative 2: Small Swinomish Diversion with Setbacks

Features	Benefits (+) and Impacts (-)	Possible Mitigation Measures
<ul style="list-style-type: none"> ✓ 40,000 cfs Diversion 1,000 feet wide, with low flow channel (approx. 200 cfs year-round) and 500-ft riparian buffer ✓ 100-year protection ✓ I-5 protected ✓ 500-ft setback levee through Burlington ✓ Riverbank excavated in 3-bridge corridor ✓ Existing riprap and toe rock remains in place to reduce channel migration. This riprap will be planted with riparian species. The riprap will be replaced on an as need basis to maintain protection. <i>(Note: Corps is considering removing existing riprap and placing riprap on setback levees.)</i> ✓ No side channels allowed in setback areas so as to prevent river migration ✓ Excavated riverbank at Mount Vernon ✓ 500-ft setback levee downstream of Mount Vernon 	<p>I. Diversion</p> <ul style="list-style-type: none"> + Salmon utilization potential in Diversion + Increased estuary rearing habitat in Swinomish Slough + Conversion of uplands to wetlands as a result of Diversion construction - Some loss of land due to berm construction - Potential impacts to eelgrass beds in Padilla Bay - Potential water quality impacts to Padilla Bay - Increased sediment in Swinomish Channel during flood <p>II. Stronger Dikes</p> <ul style="list-style-type: none"> - Complicates future restoration options through levee - Channel locked in place with little off channel habitat - Changes in river flows could produce significant changes in channel substrate and form - Long term impacts to riparian habitat and LWD in channel 	<p>Possible Mitigation Measures</p> <ul style="list-style-type: none"> ➤ Maintain year round low flow in channel ➤ Allow for fish passage to river ➤ Create marsh at downstream end of channel ➤ Create a 500-ft riparian buffer along low flow channel ➤ Open up historic side channels (e.g. Britts Slough, Dry Slough, and Hearts Slough) with inlet structures for fish passage ➤ Plantings in riprap and installation of LWD structures

	<p>III. Setback of Levees</p> <ul style="list-style-type: none"> + Potential for additional refugia during flood events - Long-term impacts to bank vegetation, side channel formation, and bank-side conditions (existing bank conditions maintained – riprap remains) - Loss of vegetation from over-bank excavation <p>V. Loss of Floodplain Habitat to Urban Conversion</p> <p>VI. Potential Loss, Temporary Impact to Habitat of ESA Species (Eagle, etc)</p> <p>VII. Cultural Resources</p> <ul style="list-style-type: none"> - Potential disturbance and/or destruction of known or unknown sites 	<ul style="list-style-type: none"> ➤ Plantings in riprap along river ➤ Plant 200-ft riparian buffer ➤ Remove old riprap and place new riprap at setback levees. Then side channels could be constructed in setback areas because levees are protected by riprap. ➤ Open up historic side channels (e.g. Britts Slough, Dry Slough and Hearts Slough) with inlet structures for fish passage ➤ Enact additional development restrictions ➤ Evaluate for National Historic Register eligibility. Mitigation will be dependent upon content of discovery.
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Alternative 3: Setback Levees with Selected Overtopping

Features	Benefits (+) and Impacts (-)	Possible Mitigation Measures
<ul style="list-style-type: none"> ✓ Over-topping levees down stream at River Bend and downstream of Mount Vernon ✓ 500-ft setback levee through Burlington ✓ Riverbank excavated in 3-bridge corridor ✓ I-5 protected ✓ Excavated riverbank at Mount Vernon. Levee segments to protect Burlington and Mount Vernon. 100-year protection. ✓ Rest of floodplain protected to 25-year event ✓ Existing riprap and toe rock remains in place to reduce channel migration. <i>(Note: Corps is considering removing existing riprap and placing riprap on setback levees.)</i> 	<p>I. Stronger Dikes</p> <ul style="list-style-type: none"> - Complicates future restoration options through levee - Channel locked in place with little off channel habitat - Changes in river flows could produce significant changes in channel substrate and form - Long term impacts to riparian habitat and LWD in channel <p>II. Setback of Levees</p> <ul style="list-style-type: none"> + Potential for additional refugia during flood events - Long-term impacts to bank vegetation, side channel formation, and bank-side conditions (existing bank conditions maintained – riprap remains) - Loss of vegetation from over-bank excavation <p>III. Ring Dikes - Cities</p> <ul style="list-style-type: none"> - Wetland impacts due to levee construction 	<ul style="list-style-type: none"> ➤ Open up historic side channels (e.g. Britts Slough, Dry Slough, and Hearts Slough) with inlet structures for fish passage ➤ Plantings in riprap and installation of LWD structures ➤ Plantings in riprap along river ➤ Remove old riprap and place new riprap at setback levees. Then side channels could be constructed in setback areas because levees are protected by riprap. ➤ Open up historic side channels (e.g. Britts Slough, Dry Slough, and Hearts Slough) with inlet structures for fish passage ➤ Wetland mitigation most likely in diversion

Alternative 4: Setback Levees with Overtopping

Features	Benefits (+) and Impacts (-)	Possible Mitigation Measures
<ul style="list-style-type: none"> ✓ Over-topping levees downstream at River Bend and downstream of Mount Vernon ✓ Transportation corridor is NOT protected ✓ 500-ft setback levee through Burlington ✓ Riverbank excavated in 3-bridge corridor ✓ Excavated riverbank at Mount Vernon. Levee segments to protect Burlington and Mount Vernon. 100-year protection ✓ Ring dikes to protect Burlington and Mount Vernon. 100-year protection ✓ Rural floodplain protected to 25-year event ✓ Existing riprap and toe rock remains in place to reduce channel migration. <i>(Note: Corps is considering removing existing</i> 	<p>I. Stronger Dikes</p> <ul style="list-style-type: none"> - Complicates future restoration options through levee - Channel locked in place with little off channel habitat - Changes in river flows could produce significant changes in channel substrate and form - Long-term impacts to riparian habitat and LWD in channel <p>II. Setback of Levees</p> <ul style="list-style-type: none"> + Potential for additional refugia during flood events - Long-term impacts to bank vegetation, side channel formation, and bank-side conditions (existing bank conditions maintained – riprap remains) - Loss of vegetation from over-bank excavation <p>III. Ring Dikes - Cities</p> <ul style="list-style-type: none"> - Wetland impacts due to levee construction 	<ul style="list-style-type: none"> ➤ Open up historic side channels (e.g. Britts Slough, Dry Slough, and Hearts Slough) with inlet structures for fish passage ➤ Plantings in riprap and installation of LWD structures ➤ Plantings in riprap along river ➤ Remove old riprap and place new riprap at setback levees. Then side channels could be constructed in setback areas because levees are protected by riprap. ➤ Open up historic side channels (e.g. Britts Slough, Dry Slough, and Hearts Slough) with inlet structures for fish passage ➤ Wetland mitigation most likely in diversion

Alternative 5: Setback Levees

Features	Benefits (+) and Impacts (-)	Possible Mitigation Measures
<ul style="list-style-type: none"> ✓ 100-year event contained within the setback levees ✓ In 3-bridge corridor, set back levee 500 feet including bank excavation ✓ In West Mount Vernon; set back levee additional 500 feet behind Ball Street ✓ Downstream of Mount Vernon, set back levees combined total of 1,000 feet, no bank excavation. Taper back to normal at bridges on both North and South Forks. ✓ Existing riprap and toe rock remains in place to reduce channel migration. <i>(Note: Corps is considering removing existing riprap and placing riprap on setback levees.)</i> 	<p>I. Setback of Levees</p> <ul style="list-style-type: none"> + Potential for additional refugia during flood events - Long-term impacts to bank vegetation, side channel formation, and bank-side conditions (existing bank conditions maintained – riprap remains) - Loss of vegetation from over-bank excavation <p>II. Loss of Floodplain Habitat to Urban Conversion</p> <p>III. Potential Loss, Temporary Impact to Habitat of ESA Species (Eagle, etc)</p> <p>IV. Cultural Resources</p> <ul style="list-style-type: none"> - Potential disturbance and/or destruction of known or unknown sites 	<ul style="list-style-type: none"> ➤ Plantings in riprap along river ➤ Remove old riprap and place new riprap at setback levees. Then side channels could be constructed in setback areas because levees are protected by riprap. ➤ Plant 200-ft riparian buffer ➤ Open up historic side channels (e.g. Britts Slough, Dry Slough, and Hearts Slough) with inlet structures for fish passage ➤ Enact additional development restrictions ➤ Evaluate for National Historic Register eligibility. Mitigation will be dependent upon content of discovery.

Alternative 6: Samish Diversion

Features	Benefits (+) and Impacts (-)	Possible Mitigation Measures
<ul style="list-style-type: none"> ✓ 80,000 cfs Diversion 1,500 feet wide to Samish Bay ✓ For the Skagit River, existing riprap and toe rock remains in place to reduce channel migration 	<p>I. Diversion</p> <ul style="list-style-type: none"> + Enhancement of riparian corridor along the Samish River + Increased estuary rearing habitat in Samish Bay + Potential impacts to eelgrass beds in Samish Bay + Conversion of uplands to wetlands as a result of Diversion construction - Some loss of land due to berm construction - Potential water quality impacts to Samish Bay - Increased sediment in Samish Bay during flood <p>II. Stronger Dikes</p> <ul style="list-style-type: none"> - Complicates future restoration options through levee - Channel locked in place with little off channel habitat - Changes in river flows could produce significant changes in channel substrate and form - Long-term impacts to riparian habitat and LWD in channel <p>III. Loss of floodplain habitat to urban conversion</p> <p>IV. Potential loss, temporary impact to habitat of ESA species (Eagle, etc)</p> <p>V. Cultural Resources</p> <ul style="list-style-type: none"> - Potential disturbance and/or destruction of known or unknown sites 	<ul style="list-style-type: none"> ➤ Create marsh at downstream end of channel ➤ Create forested buffer along Samish River ➤ Open up historic side channels (e.g. Britts Slough, Dry Slough, and Hearts Slough) with inlet structures for fish passage ➤ Plantings in riprap and installation of LWD structures ➤ Enact additional development restrictions ➤ Evaluate for National Historic Register eligibility. Mitigation will be dependent upon content of discovery.

Alternative 7: Upper Swinomish Diversion

Features	Benefits (+) and Impacts (-)	Possible Mitigation Measures
<ul style="list-style-type: none"> ✓ 80,000 cfs Diversion 2,000 feet wide ✓ 100-year protection ✓ 500-ft setback levee through Burlington ✓ Riverbank excavated in 3-bridge corridor ✓ Existing riprap and toe rock remains in place to reduce channel migration. <i>(Note: Corps is considering removing existing riprap and placing riprap on setback levees.)</i> 	<p>I. Diversion</p> <ul style="list-style-type: none"> + Salmon utilization potential in Diversion + Increased estuary rearing habitat in Swinomish Slough + Conversion of uplands to wetlands as a result of Diversion construction - Some loss of land due to berm construction - Potential impacts to eelgrass beds in Padilla Bay - Potential water quality impacts to Padilla Bay - Increased sediment in Swinomish Channel during flood <p>II. Stronger Dikes</p> <ul style="list-style-type: none"> - Complicates future restoration options through levee - Channel locked in place with little off channel habitat - Changes in river flows could produce significant changes in channel substrate and form - Long-term impacts to riparian habitat and LWD in channel 	<ul style="list-style-type: none"> ➤ Maintain year round low flow in channel ➤ Allow for fish passage to river ➤ Create marsh at downstream end of channel ➤ Create a 500-ft riparian buffer along low flow channel ➤ Open up historic side channels (e.g. Britts Slough, Dry Slough, and Hearts Slough) with inlet structures for fish passage ➤ Plantings in riprap and installation of LWD structures

	<p>III. Setback of Levees</p> <ul style="list-style-type: none"> + Potential for additional refugia during flood events - Long-term impacts to bank vegetation, side channel formation, and bank-side conditions (existing bank conditions maintained – riprap remains) - Loss of vegetation from over-bank excavation <p>IV. Loss of Floodplain Habitat to Urban Conversion</p> <p>V. Potential Loss, Temporary Impact to Habitat of ESA Species (Eagle, etc)</p> <p>VI. Cultural Resources</p> <ul style="list-style-type: none"> - Potential disturbance and/or destruction of known or unknown sites 	<ul style="list-style-type: none"> ➤ Plantings in riprap along river ➤ Remove old riprap and place new riprap at setback levees. Then side channels could be constructed in setback areas because levees are protected by riprap. ➤ Plant 200-ft riparian buffer ➤ Open up historic side channels (e.g. Britts Slough, Dry Slough, and Hearts Slough) with inlet structures for fish passage ➤ Enact additional development restrictions ➤ Evaluate for National Historic Register eligibility. Mitigation will be dependent upon content of discovery.
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