FEATURES OF BASIC SKAGIT FLOOD DAMAGE REDUCTION ALTERNATIVES (NO MITIGATION)

Mt. Vernon Floodwall –

In all alternatives a 5-foot floodwall will be built at Mt. Vernon

Sterling

Two levee options are being considered for Sterling area. One option would be a setback at Highway 20 river ward of the railroad. The same alinement as in Recon report. The second option would construct the levee across the Sterling area protecting the majority of structures.

The Sterling option has not been previously scoped.

Three Bridge Corridor Excavation (For all alternatives except number 6. In alternative 3 the excavation is less)

1. There will be a 500 foot setback in the three bridge corridor with no riprap removal of toe rock in the river, no plantings. Approximately 20 feet (vertical) of material would be excavated between the river channel and the setback levee. Excavation won't be below existing river surface. There could be possible stranding areas in setback zone. The setback levee would be riprapped with a buried toe.

Diversion (Alternative 1 or 7 is described below)

1. 2000' bermed channel with little excavation and no riprap on the side slopes. The channel would be utilized at greater than 10 to 25-year events. Design flow would be 80,000 cfs at 5 fps and 8 foot depth. The channel would be straight with no low flow channel or vegetation. Sheet pile grade control structures would be set at existing grade at major road crossings. There would be five of these grade control structures in alternative 1, set at major road crossings, and four of these grade control structures in alternative 7, placed on existing roads. Except for the La Conner Whitney road which would be placed on a trestle, and the Avon Allen Road in Alternative 7, all other roads would be at grade and passable except when flooding. There are two of these crossings in alternative 7 and four of these crossings in alternative 1.
2. There will be no tide gates to control saltwater intrusion. The upstream extent of tidal influence has not been calculated.
3. There will be a marsh at the end of the low flow channel to provide flow attenuation. No plantings or habitat enhancements are designed. The size of the marsh needed for flow attenuation is unknown. The marsh will also retain sediment as the velocities decline on entering the marsh from the diversion.
4. There will be a need to provide drainage structures for existing drainage facilities because the diversion crosses a ditching district and several sloughs used for local drainage.

5. There are an unspecified number of utilities running across the channel which will have to be protected.
6. Basic maintenance of the channel will consist of mowing the berms and keeping the channel free of woody vegetation. In the event that the channel is utilized, regrading as needed will be done after the event.
7. Acceptable land use activities have not been decided. No activities that will impede conveyance will be allowed.
8. The inlet will be 1100 feet wide using fuse gates to control flows. There will be no passage for fish.
9. The diversion point has not been set.
10. Channel length will be approximately 5 miles.
11. The trestle will not accommodate passage of wood. LWD in the channel will be removed.
12. All structures in the right of way will be removed.
13. No changes to levees downstream of the inlet are expected. These levees will not be part of the Federal project and will be covered by the maintenance procedures outlined in PL84-99.

There will be no additional risk to the reservation due to avulsion or sedimentation.

Setback Levee (Alternative 5 is described below)

1. Area downstream of three bridge corridor will be excavated on the right bank down to just below the Division Street bridge. Excavation will be similar to the three bridge corridor. Levee will be set back to Wall Street.
2. Division street bridge will be extended.
3. Area downstream of excavation will be setback 1000 total feet with no excavation. No riprap will be removed. Riprap will be maintained. No plantings will occur. No side channel formation will be allowed. See sheets C1.17, C1.18, C1.19
4. The existing levees will be removed and setback. Existing levee maintenance standards will be followed with regular mowing of the levees. County Riparian ordinance will have to be changed to allow for removal of riparian vegetation.
5. Maintenance requirements for channel are unknown. Dredging is not anticipated to be required.
6. There could be an option of building a small bypass around West Mt. Vernon to avoid the excavation of the old landfill. Design is unknown.
7. Tidegate retrofits are part of the project design to allow for fish passage (4d requirement).
8. No borrow pits onsite.
9. The entire inside bend in the Mt. Vernon area will not be opened up..

Overtopping (Alternative 3 is described below)

1. I-5 is protected
2. Two options for Sterling Levee. One option for Clear Lake.
3. Ring Dike around Burlington

4. 3 Bridge corridor excavation where levee will be set back 500-feet.
5. 4 overtopping sections, 3 on left bank, 1 one right bank (north Fork Fir Island). Overtopping Structures are between 1000 and 4000 feet long, with 4:1 hardened backslopes. There will be a 750-foot flowage easement behind the levee structure.
6. Raise levee 2 feet on right bank to protect freeway south of Mount Vernon.
7. Cross dike at West Mt. Vernon to protect west side from back-flooding.
8. Weak or low levees will be raised to preclude flood fighting (potentially weakest part of system). Existing levees will remain as is.
9. Existing water control structures will be retrofitted for fish passage
10. Sand dikes built into existing sea dikes will drain flood water from protected areas. Sand dikes will also allow designers to predetermine blowouts and aid access and repair. Other alternatives, such as tide gates, are too expensive.
11. Levee maintenance will continue. No channel encroachment
12. Baseflood elevation will change
13. Unknown need for maintenance dredging. Sediment is expected to drop in the main channel downstream from each overflow section. This is a local maintenance issue and the design would include features to minimize dredging.

No Action

1. Random series of breaks both in levees and sea dikes
2. Levees will continue to be strengthened
3. There will be a biological opinion on levee maintenance
4. Sporadic development will continue in floodplain

POSSIBLE MINIMUM MITIGATION FEATURES NECESSARY FOR EACH OF THE PROJECTS.

This list does not include additional measures that may need to be taken (such as opening sloughs) if these measures don't don't adequately compensate for the impacts of the project.

Bypass:

1. ***Low flow stream***: The channel should contain adequate depths and velocities to provide appropriate rearing and flood refuge habitat. It should be variable to allow for a dynamic, self-maintaining channel. Specific criteria for depth and width should be developed to ensure that the channel is not too shallow and wide, which would result in increased water temperatures.
2. ***Inlet Structure:*** Should allow for fish passage for year round access.
3. ***Downstream Outlet:*** .No tide gate will be used for prevention of saltwater intrusion (Use of tide gates will severely limit the usefulness of the low flow channel for salmonid rearing).
4. ***Riparian Buffer:*** .500-foot native riparian buffer will be adjacent to the low flow channel
5. ***High Flow Refugia:*** Wetlands and/or sites for high flow refuge will be provided between the dikes. This could include placement of LWD in bypass area outside of the riparian buffer.
6. ***Land use:*** No farming or other activities that can result in disruption of natural processes necessary to provide "good" fish habitat should occur in the bypass area.
7. ***LWD:*** LWD might be placed in the diversion on an interim basis to provide habitat features. However, over the longterm, the riparian buffer should be managed to provide a source of new LWD to the system.
8. ***Saltwater Gradient:*** There needs to be an adequate saltwater gradient through the channel to assure for functioning marsh and proper juvenile salmonid rearing habitat. The control structures should not of impede the establishment of an appropriate salinity gradient or restrict fish passage.
9. ***Sediment Control:*** The marsh at the lower end of the diversion will be in part used as an energy dissipation area. However, appropriate sediment control must be in place to assure that sediment will not stack up in the "estuary" at the lower end, so that salt water and fish passage be impeded (see item 8 also).
10. ***Maintenance:*** Maintenance in the diversion should be kept to a minimum and clearly defined before implementation of the project. After flood events, reestablishment of mitigation features should be clearly defined.
11. ***Swinomish Channel:*** Appropriate dredging in Swinomish channel related to boat use and marina operations should be clearly defined before project implementation.
12. ***Water Quality:*** Water quality control measures and passage considerations for drainages entering the low flow channel need to be implemented.
13. ***Fishing:*** If large numbers of returning fish use the channel, some measures of enforcement to reduce/eliminate poaching need to be implemented.

Set back including Three Bridge Corridor:

1. ***Riprap Removal:*** In setback areas, riprap including toe rock must be removed from the areas where on river levees are being removed. It is understood that 100 percent efficiency in riprap recovery will not be obtained.
2. ***Side Channel Formation:*** It is expected that the river will be allowed to meander within the setback area and side channel formation will be allowed
3. ***Riparian Buffer:*** There will be establishment of riparian vegetation within areas outside of the dike prism to the rivers edge
4. ***Retrofitting of Dikes with Bioengineering and Fish Structures:*** Bioengineering will be used along the new and old dikes to provide habitat better and will be supplemented with inwater habitat structures.
5. ***Dredging:*** No maintenance dredging will be allowed. After significant flood events, restoration of the main channel may be necessary (reference Toutle River, St. Helens event)
6. ***Maintenance:*** Maintenance in the setback areas should be kept to a minimum and clearly defined before implementation of the project. After flood events, reestablishment of mitigation features should be clearly defined. No clearing of channel obstructions is expected. Levees should be maintained with some woody vegetated cover.
7. ***Fish Passage:*** Existing and new gates and pumphouses will be retrofitted for fish passage.

Overtopping

1. ***Riparian Buffer:*** There will be establishment of riparian vegetation within areas outside of the dike prism to the rivers edge
2. ***Retrofitting of Dikes with Bioengineering and Fish Structures:*** Bioengineering will be used along the new and old dikes to provide habitat better and will be supplemented with inwater habitat structures.
3. ***Dredging:*** No maintenance dredging will be allowed
4. ***Maintenance:*** Maintenance should be kept to a minimum and clearly defined before implementation of the project. After flood events, reestablishment of mitigation features should be clearly defined. No clearing of channel obstructions is expected. Levees should be maintained with some woody vegetated cover.
5. ***Fish Passage:*** Existing and new gates and pumphouses will be retrofitted for fish passage.

If the results of the studies indicate that the features outlined above do not adequately compensate for project impacts, then the features listed below could be used for additional mitigation. Otherwise these features could be added to the project as restoration actions.

Other Potential Mitigation/Restoration Features

Put natural meanders in the diversion channel.
Reopen sloughs
Reopen side channels
Restore estuary areas
Modify Swinomish Channel Jetty to enhance fish use and passage
Connect bypass to other side channels

Monitoring

The channel and flood plain elevations should be monitored following project completion to determine how the channel is responding. Several cross sections should be established in each channel. These should be surveyed every three to five years.