APPENDIX F

FLOOD PROBLEM WORKSHEETS

NOTE: Issues #1 and #2 use slightly different organization than later issues.

#1) In-Stream Debris (non-vegetation)

1. **Problem**- What is the problem? (Problem Statement)
   Increased inundation due to:

A. Ice jams causing flooding
B. Fences that cross stream channels catch debris
C. Historic waste (old concrete, asphalt, wood, trash) as well as current illegal dumps, cuttings from tree pruning, etc
D. Debris from overland flow can clog road ditches, culverts, and other structures- maintenance is needed.
E. Bedload (gravel) shifting can cause a decrease in capacity under bridges as well as changes in channel and flow direction.

A. Ice jams causing flooding

1. Causes- What is causing the problem?
   - Long periods of freezing temperatures cause the river to freeze. There are natural inversions that make Yakima-area rivers prone to anchor ice formation and ice jams.
2. What has *already been done* to address the problem?
   - Ice jams are usually monitored by residents, etc. and reported to the County.
3. What has *already been proposed* to address the problem?
4. Are there any *new solutions* that have not already been proposed?
   - Healthy riparian areas decrease freezing
5. What *still needs to be studied*?
   - Inventory of locations where ice jams are known to occur- identify them in the Flood Response Plan
6. Do these proposals address the causes of the problem?
7. Alternatives- What Alternative solutions will address the problem?
   - (1A-1) More bridge capacity, and more bridges without peers to prevent backup of ice due to lack of freeboard
   - (1A-2) Monitor ice jams
   - (1A-3) Outline the response to ice jams in the Flood Response Plan.
   - (1A-4) Heat irrigation gates, (gates are not in operation during the winter) Some gates are still in use for diverting stock water
   - (1A-5) Increase riparian vegetation, which reduces formation of anchor ice
   - (1A-6) Blast ice jams- normally only done on very stable ice jams
   - (1A-7) Inventory

B. Fences that cross stream channels and catch debris

1. Causes- What is causing the problem?
   - Fences cause water to back up and flood.
2. What has *already been done* to address the problem?

- One successful technique was hanging a steel pipe or cable high above the creek, and hanging lighter materials down from the cable. It worked as a fence, but was not lost during floods - has to swing downstream. (Suspension fence).

3. What has *already been proposed* to address the problem?
4. Are there any *new solutions* that have not already been proposed?
    - Run fences parallel with creek instead of crossing it.
    - Fences held back some distance from the creek
5. What *still needs to be studied*?
6. Do these proposals address the causes of the problem?
7. Alternatives - What Alternative solutions will address the problem?
    - 1B-1. Run fences parallel with creek instead of crossing it (How?)
    - 1B-2. Hold fences back some distance from the creek (How?)
    - 1B-3. Breakaway panels on creeks that flood frequently
    - 1B-4. Develop a program for repeat flood areas - create a riparian zone or flood control zone in these areas. Have someone work with the landowners to provide them with tools to deal with fencing across the creeks
    - 1B-5. Utilize suspension fences - hanging a steel pipe or cable high above the creek, and hanging lighter materials down from the cable. This works as a fence, but is not lost during floods.
    - 1B-6. Goals or policies in Critical Areas Ordinance addressing fences across streams
    - 1B-7. Identify program to people as they come in to develop their property (fences)
    - 1B-8. Pamphlets for new landowners - such as the pamphlet put out for small land owners by the Kittitas Conservation District. - It's important to talk to landowners just after a flood about how to better deal with fences.
    - 1B-9. Examine statewide laws relating to streams

C. Historic waste (old concrete, asphalt, wood, trash) as well as current illegal dumps

1. Causes- What is causing the problem?
    - Illegal and historic dumps contribute to pollution, particularly during flood events. Sometimes the pollution can be very toxic, as in the case of meth labs.
2. What has *already been done* to address the problem?
    - Solid waste regulations, recycling programs and facilities, and sanitary land fills are currently in place to prevent dumping in or near streams.
    - Under Washington State solid waste law, land owners are responsible for dumping that takes place on their property. If identification is found in the waste, then the person connected to that identification can be prosecuted for illegally dumping on someone else's property.
3. What has *already been proposed* to address the problem?
4. Are there any *new solutions* that have not already been proposed?
    - Stream cleanup programs - people clean the garbage from the creek.
5. What *still needs to be studied*?

- Can more measures be taken to deal with illegal dumping (meth labs, etc.)?
- Can funding be found to clean up these dumps on private ground?
- Are there other sources of funding for enforcement?

6. Do these proposals address the causes of the problem?
7. Alternatives - What Alternative solutions will address the problem?
    - Reconsider closing solid waste dumps
    - Stream cleanup programs - people clean the garbage from the creek.
    - Research how other communities deal with dumping, particularly concrete, fill etc.
    - More enforcement, especially for blatant disregard of the law
    - Empower regulatory side of the equation
    - Encourage citizens to report dumping
    - If a jurisdiction knows about a public hazard, they are liable to enforce their laws

D. Debris from overland flow can clog road ditches, culverts and other structures- maintenance is needed.

1. Causes- What is causing the problem?
    - Debris from construction projects, roads, etc. can enter streams and ditches, clogging drains and culverts, etc.
2. What has *already been done* to address the problem?
    - Roads departments maintain ditches and culverts
    - Irrigation Districts maintain ditches
    - Many residents maintain private culverts
    - Corrections crew roadside cleanup
3. What has *already been proposed* to address the problem?
    - Stormwater regulations
4. Are there any *new solutions* that have not already been proposed?
5. What *still needs to be studied*?
    - Can measures be taken to prevent runoff during floods (i.e. stormwater standards)?
6. Do these proposals address the causes of the problem?
7. Alternatives - What Alternative solutions will address the problem?
    - Roads departments maintain ditches and culverts
    - Irrigation Districts maintain ditches
    - Many residents maintain private culverts
    - Corrections crew roadside cleanup
    - Stormwater programs
    - Enforcement of stormwater regulations
    - Low lying areas - keeping debris from flood channels- public information (deep and fast modeling) when people are purchasing and developing properties. Better/different mapping products - *Would be difficult for the County to produce*

E. Bedload (gravel) shifting can cause a decrease in capacity under bridges as well as changes in channel and flow direction.

1. Causes - What is causing the problem?
    - Bedload shifts during a flood, due to bridges, diversions, levees, at the downstream ends of channels that have been straightened, and as a result of natural seasonal processes.
    - When an in-stream project is constructed, significant (and sometimes unexpected) shifts in bedload can result.
    - In many cases, channels are artificial- they are not naturally "sized" for flood events. See "channel issues"
2. What has *already been done* to address the problem?
    - See bridges and culverts discussion, North Fork Ahtanum bridges, and channel issues discussion.
3. What has *already been proposed* to address the problem?
    - See bridges and culverts discussion, North Fork Ahtanum bridges, and channel issues discussion
4. Are there any *new solutions* that have not already been proposed?
    - See bridges and culverts discussion, North Fork Ahtanum bridges, and channel issues discussion
5. What *still needs to be studied*?
    - See bridges and culverts discussion, North Fork Ahtanum bridges, and channel issues discussion
6. Do these proposals address the causes of the problem?
7. Alternatives - What Alternative solutions will address the problem?

#2) Ahtanum Mission

Problem - What is the problem? (Problem Statement)

A. Headcuts through the fields at the Mission threaten to capture the flow of Ahtanum Creek- this is of particular significance with Hatton Creek.
B. Flow is directed to the communities of Ahtanum, Wiley City and other developments downstream, causing considerable damage to buildings and infrastructure
C. Damage or loss of irrigation infrastructure could affect the economy of the Ahtanum Valley
D. Infrastructure affecting flooding

***A.* Headcuts**

1. Causes - What is causing the problem?
    - Low banks on Ahtanum Creek
    - Location on the alluvial fan- three creeks/ditches proceed downstream from this point in the valley. Risk of avulsion.
2. What has already been done to address the problem?
    - 2003 - Levee, groin and road removals

- 2004 - Armored headcut
- County performed emergency work this spring- new road and low levee.
- Residents have put in small levees and hay-bale structures
- Two culverts from Mission side to the reservation were removed in '95
- Gravel removal projects have been permitted in the past

3. What has *already been proposed* to address the problem?
    - County planning surveys Fall '06 - will include detailed inventory of infrastructure, and modeling of interactions in the area - prediction of flood patterns. Based on model, changes to physical characteristics of infrastructure or management of existing infrastructure.
    - Major levee construction on Mission property
    - Ring dikes to protect Mission buildings
    - Tribe is working with the Herkes to do some stream restoration in the area
4. Are there any *new solutions* that have not already been proposed?
    - Recreating a flood overflow channel back to Ahtanum Creek from Hatton Creek (natural overflow channel blocked in the 1930s)
    - Removal of the old Hatton diversion
    - Modification of the old Hatton ditch channel below the diversion. Intent would be to block/armor channel to prevent opportunity for formation of headcuts.
    - Armoring stream channel to prevent migration of Ahtanum Creek to the North (could cut through soft levees)
    - Note - Need to address two mechanisms of channel movement in area- erosion from downstream in the form of head cuts, and lateral channel migration from upstream.
    - County (Surface Water) is planning surveys fall '06 - will include detailed inventory of infrastructure, and modeling of interactions in the area- prediction of flood patterns. Based on model, changes to physical characteristics of infrastructure or management of existing infrastructure.
5. What *still needs to be studied*?
    - What are the historical and cultural issues on this site that we need to be sensitive to?
    - What are the potential future downstream impacts/what level of flooding is acceptable?

B. Flow is directed to the communities of Ahtanum, Wiley City and other developments downstream, causing considerable damage to buildings and infrastructure

1. Causes - What is causing the problem?
    - Location on the alluvial fan- three creeks/ditches proceed downstream from this point in the valley
    - Infrastructure to manage the creeks, and other infrastructure such as bridges and levees
    - Culverts and bar ditches influence the direction of floodwaters

- Low banks on Ahtanum Creek
- Headcuts that form in the fields at the Mission, which threaten to capture the flow of Ahtanum Creek- this is of particular significance with Hatton Creek.

2. What has already been done to address the problem?
   - 2003 - Levee, groin and road removals
   - 2004 - Armored headcut
   - County performed emergency work this spring- new road and low levee.
   - Residents have put in small levees and hay-bale structures
3. What has *already been proposed* to address the problem?
   - County planning surveys fall '06 - will include detailed inventory of infrastructure, and modeling of interactions in the area- prediction of flood patterns. Based on model, changes to physical characteristics of infrastructure or management of existing infrastructure.
   - Major levee construction on Mission property
   - Ring dikes to protect Mission buildings
4. Are there any *new solutions* that have not already been proposed?
   - Recreating a flood overflow channel back to Ahtanum Creek from Hatton Creek (natural overflow channel blocked in the 1930s)
   - Levee along Hatton to redirect flow
   - Removal of the old Hatton diversion
   - Modification of the old Hatton ditch channel below the diversion
   - Coordination with Ahtanum Irrigation District for management during floods
5. What *still needs to be studied*?
   - What are the historical and cultural issues on this site that we need to be sensitive to?
   - What are the potential future downstream impacts/what level of flooding is acceptable?
   - What might happen to flooding downstream on Ahtanum Creek if its floodplain upstream is decreased? (i.e. Hatton Creek is completely cut off from being a flood channel of Ahtanum). Might make flooding at Emma Lane longer, but probably not add too much to the peak.
   - What is the role of Bachelor and Hatton in general?
   - Is there room for Ahtanum Creek to occupy old floodplain channels on the tribal land adjacent to Ahtanum Mission?

C. Damage or loss of irrigation infrastructure could affect the economy of the Ahtanum Valley

1. Causes- What is causing the problem?
   - Irrigation infrastructure can be damaged by flood flows
   - Abandoned irrigation diversions and structures potentially impact flood flows
2. What has already been done to address the problem?
   - Re-routing Hatton diversion - completed in '95 - purpose of fish passage and fish screens

3. What has *already been proposed* to address the problem?
4. Are there any *new solutions* that have not already been proposed?
    - Inventory of existing irrigation infrastructure (working or abandoned)
    - Irrigation facility modification in order to better handle flooding
    - Improved access to Bachelor Diversion during floods
    - Move Bachelor Diversion upstream above the first 90 degree angle on Ahtanum Creek.
    - High flow diversion channel from Ahtanum creek
5. What *still needs to be studied*?
    - The effects of flooding on irrigation structures and of irrigation infrastructure on flooding patterns

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#3) North Fork Ahtanum Bridges

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1. **Problem** - What is the problem? (Problem Statement)
    A. North Fork Ahtanum road closures due to flooding or bridge damage/failure prevent access to residents - individuals, school buses, and emergency vehicles
    B. Properties adjacent to bridges are threatened by erosion and increased flooding

2. **Causes** - What is causing the problem?
    A. County and private bridges do not have enough capacity
    B. Bridges affect sediment transport and erosion
    C. Roadways and development constrict the channel- the stream threatens roadways where it is constricted.
    D. Sediment transport threatens bridge capacity
    E. Channel migration threatens roadways
    F. John Cox diversion interacts with bridge, aggravating flood problems

3. **Alternatives** - What Alternative solutions will address the problem?
    A. What has already been proposed to address the problem?
        1) Yakima County has submitted a JARPA application for work along three bridges on the North Fork. Work includes excavating sediment and installing weirs and bank stabilization material.
    B. Are there any new solutions that have not already been proposed?
        1) Change the maintenance regime for bridges (i.e. channel clean out).
        2) Replacement and redesign of bridges and road location, including standards for new private bridges.
        3) Planning requirements to minimize the number of new bridges built as development increases.
        4) County/other agency assist adjacent landowners in bank protection (levees and/or armor/bioengineering).
        5) Gravel removal
        6) Purchase of threatened property

7) Purchase of undeveloped property that would require bridge access
8) Modify channel conditions adjacent to bridges

C. What still needs to be studied?
1) Sediment transport rates/stream energy

#4) Emma Lane

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1. Problem - What is the problem? (Problem Statement)

A. This area experiences the most frequent flooding problems in the watershed
B. Floodwaters flood the Emma Lane neighborhood, north to Bachelor Creek, the airport, and the 16th/Ahtanum intersection
C. Some locations in the affected area are not mapped in the 100 year floodplain.

2. Causes - What is causing the problem?

A. The area is a natural alluvial fan, and Ahtanum Creek was diverted onto the highest point on the fan to facilitate irrigation conveyance. There is a natural propensity for flooding at this location. However, the area is no longer used extensively for agricultural purposes.
B. The creek takes a (manmade) 90 degree turn at the 42nd Avenue Bridge - water often overtops banks at this location. Gravel builds up in the channel upstream from bridge, increasing flooding.
C. Bachelor Creek Bridge on Ahtanum is angled "backwards" (up gradient), so creek backs up and floods at that location.
D. Culverts, roads, and the slope of the valley to the east and north, convey water throughout the area - some areas pond.
E. Many houses along Ahtanum Road were built slab on grade construction, which makes them more prone to damage from flooding.
F. These areas of known high flood risk are also poised for rapid growth.

3. **Alternatives** - What Alternative solutions will address the problem?

A. What has already been proposed to address the problem?
1) Move the creek to the low point in the floodplain. Requires:
a) Cooperation with the Yakama Nation
b) Acquisition of at least two homes
c) New bridge
d) Filling in of the old channel
e) Deciding how to deal with potential flooding at the top of the alluvial fan
2) A flood study, and some design guidance (i.e. How much flood protection do we really want/level of protection?)
3) Limiting future development in this area and/or strict development standards
4) Re-mapping of FEMA flood maps
5) Widening of bridge at 42nd

B. Are there any *new solutions* that have not already been proposed?

1) Reconfigure the Bachelor Creek Bridge on Ahtanum Rd.
2) Elimination of the Shropshire ditch.
3) Improve drainage throughout the entire area - culverts, roads, etc.
4) Improving stormwater system on Ahtanum Road- limit flow into the airport area, and downstream to 16th (which floods the intersection at Ahtanum Road).
5) Based on floodplain re-map, alter drainage systems- requires associated drainage easements.
6) Building standards - flood-proofed homes, buildings. Improved standards for roads
7) Improved conveyance at 16th
8) Open space plan which includes flood hazard reduction
9) Construction of a controlled side channel, rather than moving the creek.
10) Design that does not include filling in the old Ahtanum Channel- looking at the existing channel as habitat. The main flooding issue is groundwater.
11) Old fill removed on South side on Yakama Nation land just south of Emma Lane. Remove fill.
12) Controls on building

C. What *still needs to be studied*?
1) Conveyance downstream of 42nd and Ahtanum Rd.
2) Re-mapping is currently underway
3) Use of Unnumbered A-zones (Regulatory Parking Lot) on maps
4) Project study on the Emma Lane area
5) Cost-Benefit Analysis

#5) Inundation

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1. **Problem** - What is the problem? (Problem Statement)
A. Some places in the study area, particularly in Union Gap, are subject to being inundated by floodwaters, resulting in flood damages, and interruption in services and transportation.

2. **Causes** - What is causing the problem?
A. "Inundation" is a category used to describe locations that are under water during floods, due to their location, and not due to some other identified cause. The three major causes of inundation in the Ahtanum-Wide Hollow are:
1) People live in the floodplain
2) Some areas naturally have high water tables
3) Backwater from Yakima River up the channel in Union Gap

3. **Alternatives** - What Alternative solutions will address the problem?
A. What has *already been proposed* to address the problem?
1) National Flood Insurance Program
2) Critical Areas Code

3) Re-mapping, so that standards and maps are more accurate
4) Stormwater design standards
5) More stringent development standards (i.e. prohibit land divisions in the floodplain).
6) Buy people out/provide incentives for landowners who provide floodplain storage
7) Structural flood control measures either by individuals or government
8) Flood–proof, elevate, make existing structures less flood damage-prone.

B. Are there any *new solutions* that have not already been proposed?
1) Include areas of high water table in the floodplain maps.
2) Improve sediment transport along the Yakima River (Refer to the Upper Yakima CFHMP)
3) Modify Wapato Dam
4) Preservation and restoration of floodplain in places, while allowing development in others.
5) Relocation of residents in areas subject to inundation
6) Coordinate with City of Yakima on checking old regulations against comprehensive plan updates.
7) Stormwater utility
8) "Full Build-out Mapping"

C. What *still needs to be studied*?
1) Causes and rates of channel aggradation in the Yakima River.
2) Changes on the Yakima River that affect water tables
3) Delineation of high groundwater areas for inclusion in FEMA maps

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#6) Irrigation Structures (Draft 1/04/07)

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1. **Problem** - What is the problem? (Problem Statement)

A. Irrigation ditches route water during floods, causing flooding in locations that shouldn't usually flood.
B. Debris tends to accumulate on irrigation diversions, causing flooding (i.e. John Cox diversion).
C. Flooding threatens irrigation structures themselves
D. Live streams have been converted into irrigation. We try to manage them as both ditches and creeks.
E. Abandoned and unmaintained irrigation structures can play a role in flooding problems.
F. Currently, there is little coordination between irrigation districts and other government entities for responding to floods.
G. Water from other watersheds enters into the system from Cowiche/Naches, affecting total amount of water, and riparian vegetation patterns in the basin.

2. **Causes** - What is causing the problem?

A. Irrigation has altered the nature of the Ahtanum-Wide Hollow watershed in terms of flow paths, overflows, vegetation and flooding.
B. Some of the irrigation structures are well-maintained and monitored. Others are abandoned or forgotten.
C. Perched channels (for the purpose of irrigation) place water at a higher elevation than surrounding land, contributing to flooding (addressed in "channel issues" PARKING LOT).
D. Altered water schemes caused by irrigation schedules causes growth of Pacific Willow, which causes flooding problems (addressed in "vegetation issues" PARKING LOT).
E. Irrigation structures attempt to fix the stream location both laterally and vertically, which changes the hydraulics of the stream.
F. Gravity diversion structures raise water surface locally to work correctly. Especially true of wheel-powered fish screens.
G. Irrigation diversions create a hard point, which increases local erosion.

3. **Alternatives** - What Alternative solutions will address the problem?
   A. Irrigation ditches route water during floods, causing flooding in locations that shouldn't usually flood.
      1) What has *already been proposed* to address the problem?
      2) Are there any *new solutions* that have not already been proposed?
         a) Identify where problem locations are.
         b) Install floodgates on diversion in some locations, based on an inventory which takes into account the scale of problems.
         c) Create hard structures in ditches and diversions, preserving natural drainages - Eric wondered if we were referring to partitions or cut-offs in the (artificial) watercourses
         d) Undershots - siphons through gullies and depressions under the ditch- prevents mingling of flow.
         e) Gates that are removable- retrofit structures and new structures in the irrigation system.
      3) What *still needs to be studied*?
   B. Debris tends to accumulate on irrigation diversions and ditches, causing flooding.
      1) What has *already been proposed* to address the problem?
         a) Better design of irrigation infrastructure
      2) Are there any *new solutions* that have not already been proposed?
         a) Temporary or sacrificial diversion structures adapted to existing channel locations and physiographies.
         b) Remove irrigation pumps, etc. when flooding occurs (removable structures)-(potential problem with ice in this situation)
         c) Maintenance of debris on structures- proactive debris removal
      3) What *still needs to be studied*?
   C. Flooding threatens irrigation structures themselves

1) What has *already been proposed* to address the problem?
2) Are there any *new solutions* that have not already been proposed?
    a) Consolidation of irrigation diversions to minimize stream impacts
    b) Irrigation upgrades, such as piping
3) What *still needs to be studied*?

D. Live streams have been converted into irrigation. We try to manage them as both ditches and creeks.
1) What has *already been proposed* to address the problem?
    a) Irrigation system could be diverted to a pressure-based system (i.e. Pine Hollow)
2) Are there any *new solutions* that have not already been proposed?
    a) Make choices as to status as stream or irrigation ditch, or urban stream
    b) Unified management plans for the irrigation ditches, streams, and "urban streams"
    c) Regulatory changes to account for streams with dual uses
    d) Recommend a study to address streams with dual uses
    e) Water conservation plan that includes designation of fish habitat and other uses
    f) Irrigation out of the creeks- separate irrigation from creeks
3) What *still needs to be studied*?
    a) Institutional and regulatory obstacles

E. Abandoned and unmaintained irrigation structures can play a role in flooding problems.
1) What has *already been proposed* to address the problem?
2) Are there any *new solutions* that have not already been proposed?
    a) Study - inventory of old drainage and irrigation systems that are affecting flooding
    b) Identify sources of funding for removal of abandoned structures
3) What *still needs to be studied*?

F. Currently, there is little coordination between irrigation districts and other government entities for responding to floods.
1) What has *already been proposed* to address the problem?
2) Are there any *new solutions* that have not already been proposed?
    a) Include Irrigation Districts in communications with the EOC (emergency operations center)
    b) Install a North Fork gage
    c) FCZD should communicate potential risks to irrigation systems to Irrigation Districts
    d) Management of creeks to prepare for flood overflow, such as on Bachelor and Hatton.
    e) address hot spots on Hatton-
    f) Forecasting of flooding, coordinate opening gates for flood relief.
3) What *still needs to be studied*?

PARKING LOT - riparian vegetation, channel issues

#7) Channel Issues (Capacity and Overflow) (Draft 7/26/07)

1. **Problem** - What is the problem? (Problem Statement)
   A. Man-made alterations in the stream channel (levees, armor and straightening) contribute to flooding in places throughout the study area (See also Irrigation Infrastructure and Infrastructure).
   B. Perched irrigation conveyances are at a higher elevation than much of the land around them. This setup was useful for former irrigation practices, but is not compatible with natural flooding patterns and development.
   C. Natural changes in the channel become a problem when they threaten homes, businesses, agricultural land, or infrastructure.
   D. Unidentified overflow routes can cause flooding where it was not expected
   E. Artificial channels and Drainage Improvement District (DIDs) facilities may not be properly sized to handle flood flow, or are not located in natural drainage ways. Some may be "decommissioned" in the future.
   F. Some hollows flood during lower frequency flood events- in hollows, flooding is very unpredictable, and often occurs as sheet flow. Hollows are not identified on maps as a hazard, which places new developments at risk from unexpected flooding.
   G. Loss of floodplain capacity contributes to flooding (See Land Use, Regulatory PARKING LOT).
   H. There are bedload problems in many locations in the upper watershed-High energy water picks up sediment, then dumps its load when the gradient decreases- (downstream from Wide Hollow, Pine Mountain, John Cox- east of Carson Rd. Bridge 107 - island in the creek- used to be 10 ft. wide, now it's 20+.)
   I. Brush/trees overgrown due to de-watering of creek from irrigation (Wiley Road - Hatton Creek).
   J. Incision of channel at the airport.

2. **Causes** - What is causing the problem? (lettering identifies the problem the cause relates to)
   A. There have been wholesale changes to natural drainage patterns in many areas of the basin (i.e. the Bachelor/Hatton system, the pre-Rimrock Yakima-Tieton irrigation system, etc.) (A)
   B. Ditches and drains convey flood waters to areas outside the natural floodplain. (B)
   C. Natural channels have been altered to direct creeks in a certain direction (i.e. both Ahtanum and Wide Hollow Creeks have 90° angles). Straightened channels cause increased velocity. During high water, the creeks back up at 90° angles and flood surrounding neighborhoods. (C)

D. Creek channels naturally change over time (migration, aggradation, erosion, sedimentation, etc.) (C,D)

E. Many hollows never had a channel, but did convey floodwaters. Channels constructed in these areas are not sized for floods and do not respond to floods predictably. Shaw Creek is the prototypical example of a hollow. Weather event timing (winter, frozen ground, snow cover, etc.) particularly important. (E,F)

F. Floodplain loss from development (PARKING LOT See Land Use issues, Regulatory) (G)

3. **Alternatives- What Alternative solutions will address the problem?**

A. Man-made alterations in the stream channel (levees, armor and straightening) contribute to flooding in places throughout the study area (See also Irrigation Infrastructure and Infrastructure).

1) What has *already been proposed* to address the problem?

a) Channel reconfiguration and reconstruction at Emma Lane and Shaw Creek, and lower Wide Hollow in Union Gap and the Mission.

b) Periodic channel maintenance (Stream clean out)

2) Are there any *new solutions* that have not already been proposed?

a) Identify areas where man-made alterations are affecting flooding (i.e. Fulbright Park, Upstream of 64th and Diversion #14, and The Narrows) to allow for cooperative projects.

3) What *still needs to be studied*?

B. Perched irrigation conveyances are at a higher elevation than much of the land around them. This setup was useful for former irrigation practices, but is not compatible with natural flooding patterns and development.

1) What has *already been proposed* to address the problem?

a) Channel reconfiguration and reconstruction at Emma Lane and Shaw Creek/ditch, and lower Wide Hollow in Union Gap.

b) Levees constructed along perched channels (i.e. Cottonwood Grove)

c) Separate irrigation conveyance from natural streams (i.e. Build Pine Hollow and pipe the irrigation water) based on studies where it is shown this would be effective.

d) Acquisition/easement of land surrounding flood problem areas (i.e. West Valley Park) (See also Land Use)

e) Preserve off-site storage (existing pastures, alfalfa) (storage of water and sediment), possibly with floodplain easements- maintaining farmland. (See also Land Use)

f) New floodplain mapping and modeling leading to more accurate locations of floodplains on maps and consistent application of land use regulations.

2) Are there any *new solutions* that have not already been proposed?

a) Identification of areas that are near perched channels (disclosure that the area is at high risk for flooding). *Identify areas that are of particular concern.*

b) Protection of farmland (as a use) in areas that flood near perched channels, *in areas of particular concern.* If it's all under one ownership, the creek/ditch is more likely to be maintained for both purposes - irrigation and flood control.

c) Flood overflow channels/conveyances where channels are perched

3) What *still needs to be studied*?

a) Identify other perched stream locations

C. Natural changes in the channel become a problem when they threaten homes, businesses, agricultural land, or infrastructure.

1) What has *already been proposed* to address the problem?

a) Levees, armor, buffers, CMZ (channel migration zones)

b) "Softer" solutions for bank stabilization (plantings, etc.)

2) Are there any *new solutions* that have not already been proposed?

a) Buyouts/relocation/easements and flood-proofing for areas threatened by meandering and erosion.

b) Agricultural subsidies allowing flooding on some farmland. Depends on erosion verses sheet flow. Compensation program for productive ag land lost to erosion. Linked to property loss protection program (?).

c) Property buyouts for lost property

d) Flood easements

e) Minimize new homes/structures etc. in harm's way.

f) Identify areas that are at risk for channel migration in addition to identified CMZ.

g) Complete floodway mapping in the region

h) Information about flood history to realtors, lenders, etc. in proposed new developments

i) Required disclosure of flood history by realtors

j) Workshops and other outreach for realtors

3) What *still needs to be studied*?

a) Clarification: Define threatening. Centers around erosion and the potential for land and buildings lost. Is there a threshold level of risk?

D. Unidentified overflow routes can cause flooding where it was not expected

1) What has *already been proposed* to address the problem?

a) New floodplain mapping and modeling leading to more accurate locations of floodplains and consistent application of land use regulations.

b) Regularly scheduled updates

c) Mapping of Channel Migration Zones and Hazards mapping

d) Acquisition/easement of land surrounding flood problem areas (i.e. West Valley Park)

2) Are there any *new solutions* that have not already been proposed?

a) Documentation of floods (air photos, etc.) Open contract with flights

3) What *still needs to be studied*?

E. Artificial channels (not streams) and Drainage Improvement District (DIDs) facilities are not properly sized to handle flood flow, or are not located in natural drainage ways delete. Identify streams- designation and a better definition. Note: (Commissioners have designated Bachelor, Hatton as a stream….) Some DIDs may be "decommissioned" in the near future.
   1) What has *already been proposed* to address the problem?
   2) Are there any *new solutions* that have not already been proposed?
      a) Size drainage facilities for future build-out and flood flows.
      b) Limit new connections to existing undersized systems
      c) Decommission DIDs as land use changes
      d) Designate stream or ditch based on a variety of factors (damage to people, damage to wildlife, etc.)
      e) Re-define regulatory measures for artificial drainages (what regulations are streams subject to, what regulations are ditches subject to?) (Regulatory)
   3) What *still needs to be studied*?

F. Some hollows flood during lower frequency flood events- in hollows, flooding is very unpredictable, and often occurs as sheet flow. Hollows are not identified on maps as a hazard, which places new developments at risk from unexpected flooding.
   1) What has *already been proposed* to address the problem?
      a) Drainage systems
   2) Are there any *new solutions* that have not already been proposed?
      a) Process for identifying overflow areas aside from the formal FEMA mapping process
      b) Identify critical hollows through risk assessment and through flood benefit (for protection measures)
      c) Identify special flood protection measures for hollows
   3) What *still needs to be studied*?

G. Loss of floodplain capacity due to development contributes to flooding (See land use, regulatory PARKING LOT).
   1) What has *already been proposed* to address the problem?
      a) Stormwater standards for detention and retention - On-site and regional stormwater detention facilities.
   2) Are there any *new solutions* that have not already been proposed?
      a) Size drainage facilities for future build-out and flood flows.
      b) (*See Regulatory)*
      c) *(See Land Use)*
   3) What *still needs to be studied*?
   4) Model flood effects of build-out
      a) Mapping of Channel Migration Zones and Hazards mapping

Notes:

1. There are bedload problems in many locations in the upper watershed-High energy water picks up sediment, then dumps its load when the gradient decreases- (downstream from Wide Hollow, Pine Mountain, John Cox- east of Carson Rd. Bridge 107- island in the creek used to be 10 ft. wide, now it's 20+.)
2. Brush/trees overgrown due to de-watering of creek from irrigation (Wiley Road - Hatton Creek).
3. Incision of channel at the airport.
4. consistency of staffing/programs in regulating agencies
5. Fill - inconsistently dealt with, based on thresholds

#8) Management of Spring Creek in Union Gap (Draft 1/25/07)

1. **Problem**- What is the problem? (Problem Statement)
   A. Spring Creek was a natural side channel of the Yakima River with associated water rights prior to construction of I-82. Since construction of I-82 the Yakima River channel elevation has risen.
   B. A history of flooding along Spring Creek prompted the installation of a floodgate where Spring Creek travels under I-82. The floodgate has been closed for two years. There is no agreement for permanent closure and opening of the gates may be desired for improved fish usage of Spring Creek. Similar to other areas, such as Shaw Creek, there is some disagreement on the classification of all or portions of Spring Creek, regarding the Hydraulic code and the Critical Areas code of Union Gap and Yakima County.
   C. When I-82 was constructed, culverts were placed under the freeway to allow Spring Creek to flow back into the Yakima River, and a new irrigation channel was constructed parallel to the freeway to serve existing irrigation rights. Migration and aggradation of the Yakima River caused water to flow backwards through these culverts and flood adjacent mobile home park and areas downstream along the irrigation channel.
   D. Both lower Spring Creek and lower Wide Hollow Creek are flooded by backwater from the Yakima River via Wide Hollow culverts under the freeway and Hwy. 97. This area has the greatest predicted depth of water during a 100 year flood event in Yakima County (over 9 feet). The City of Union Gap's wastewater pump station is located in this area and has been damaged in the past, and is threatened by future damage.

2. **Causes** - What is causing the problem?
   A. Migration and aggradation of the Yakima River since the construction of I-82.
   B. Because of changes in the Yakima River, drainage patterns have been altered and drainage infrastructure does not function as designed.
   C. Spring Creek is an active side channel of the Yakima River - without the floodgate in place, floods affect the Spring Creek area.

D. Spring Creek also receives drain water from the Ahtanum Road drain and drains facilities under downtown Union Gap. There are reports of runoff increasing since Union Gap has experienced development.

3. **Alternatives**- What Alternative solutions will address the problem?
   A. Spring Creek was a natural side channel of the Yakima River with associated water rights prior to construction of I-82. Since construction of I-82 the Yakima River channel elevation has risen.
      1) What has *already been proposed* to address the problem?
         a) See Upper Yakima CFHMP recommendations
      2) Are there any *new solutions* that have not already been proposed?
      3) What *still needs to be studied*?
   B. A history of flooding along Spring Creek prompted the installation of a floodgate where Spring Creek travels under I-82. The floodgate has been closed for two years. There is no agreement for permanent closure and opening of the gates may be desired for improved fish usage of Spring Creek. Similar to other areas, such as Shaw Creek, there is some disagreement on the classification of all or portions of Spring Creek, regarding the Hydraulic code and the Critical Areas code of Union Gap and Yakima County.
      1) What has *already been proposed* to address the problem?
      2) Are there any *new solutions* that have not already been proposed?
         a) Keep the floodgate closed for the foreseeable future
         b) Remotely controllable floodgate that could be opened some times of year, closed others
         c) Coordinate with restoration plan (WDFW)
      3) What *still needs to be studied*?
   C. When I-82 was constructed, culverts were placed under the freeway to allow Spring Creek to flow back into the Yakima River, and a new irrigation channel was constructed parallel to the freeway to serve existing irrigation rights. Migration and aggradation of the Yakima River caused water to flow backwards through these culverts and flood adjacent mobile home park and areas downstream along the irrigation channel.
      1) What has *already been proposed* to address the problem?
      2) Are there any *new solutions* that have not already been proposed?
         a) If the Yakima River and the lower Wide Hollow floodplain continues to aggrade, relocation or floodproofing of the pump station and the mobile home park may be required, or allow for massive filling.
         b) Diking around the pump station
         c) New mapping may impact homeowners' decision to elevate (floodproof)
         d) Stricter ordinances - (i.e. Base flood plus 2 or 3 feet)
         e) Construct floodgates on Wide Hollow culverts if action below is implemented:

f) Re-route Wide Hollow into Ahtanum Creek. (See also Union Gap discussion)

g) Wapato dam modifications - addressed in Upper Yakima CFHMP

3) What *still needs to be studied*?

a) What kind of future flood impacts may occur as a result of aggradation?– What are the rates of aggradation?

D. Both lower Spring Creek and lower Wide Hollow Creek are flooded by backwater from the Yakima River via Wide Hollow culverts under the freeway and Hwy. 97. This area has the greatest predicted depth of water during a 100 year flood event in Yakima County (over 9 feet). The City of Union Gap's wastewater pump station is located in this area and has been damaged in the past, and is threatened by future damage.

1) What has *already been proposed* to address the problem?

a) WSDOT has plugged or repaired culverts. Recent observations indicate they are once again backwatering. They either need to be plugged and repaired or sealed.

2) Are there any *new solutions* that have not already been proposed?

a) Improve conveyance downstream of the culverts on the Spring Creek irrigation channel by increasing grade- would help in most flood events (possibly not in large-scale flooding).

b) If the Yakima River and the lower Wide Hollow floodplain continues to aggrade, relocation or floodproofing of the pump station and the mobile home park may be required, or allow for massive filling.

c) Construct floodgates on Wide Hollow culverts if action below is implemented:

d) Re-route Wide Hollow into Ahtanum Creek. (See also Union Gap discussion)

3) What *still needs to be studied*?

a) If the Yakima River and the lower Wide Hollow floodplain continues to aggrade, relocation or floodproofing of the pump station and the mobile home park may be required, or allow for massive filling.

b) Construct floodgates on Wide Hollow culverts if action below is implemented.

c) Re-route Wide Hollow into Ahtanum Creek. (See also Union Gap discussion)

*Potential restoration plan for fish habitat at Spring Creek. Restoration plan- restoring fish passage will help with flood (gradient)

#9) Shaw Creek (Draft 2/12/07)

1. **Problem** - What is the problem? (Problem Statement)
   A. Many people and organizations consider Shaw Creek a man-made feature. Protection of the creek/ditch as fish and wildlife habitat as required under both Hydraulic code and Critical Areas code conflicts with managing it as an artificial irrigation and drainage facility.
   B. Flooding that originates in Shaw creek has a high probability of causing significant damage to existing and future high density residential developments which are currently not in the mapped floodplain.
   C. Many residents who may be affected by flooding do not have flood insurance.
   D. Shaw Creek at Pear and Tieton Dr. has a history of flooding Tieton Dr. and areas downstream.
   E. There is potential for water quality problems in Shaw Creek during a flood, since floodwaters will likely utilize city streets as conveyances, particularly in the new Cottonwood Grove subdivision.

2. **Causes** - What is causing the problem?
   A. Criteria in both the Hydraulic Code and Critical Areas Ordinance include the creek as fish and wildlife habitat even though it may be entirely artificial or highly altered from its natural state and is not currently serving any of the purposes for which it was originally constructed.
   B. Shaw Creek/Ditch has been moved and perched above its natural floodplain for former farming and irrigation practices.
   C. Shaw Creek/Ditch goes through a rapidly developing high density area.
   D. No parts of Shaw Creek/Ditch are included in the Flood Insurance Rate Maps.
   E. Artificial channels are insufficient for handling flood volumes due to small channel size and low gradient.
   F. The Wide Hollow Creek watershed behaves like a hollow in some locations- meaning that sheet-flow enters the creek during rain on snow/ice events.

3. **Alternatives** - What Alternative solutions will address the problem?
   A. Many people and organizations consider Shaw Creek a man-made feature. Management of the creek/ditch as fish and wildlife habitat as required under both Hydraulic code and Critical Areas code conflicts with managing it as an artificial irrigation and drainage facility.
      1) Classification of Shaw Creek
      2) Reconfiguration of Shaw Creek to function as floodplain and fish and wildlife habitat.
      3) Shaw Creek stops at 80th.
      4) Modified natural channels - drainage or irrigation

See discussion under b and c.

B. Shaw Creek/Ditch has been moved and perched above its natural floodplain for former farming and irrigation practices.
   1) What has *already been proposed* to address the problem?
      a) Relocation of Shaw Creek to the low point in the drainage to allow for more natural stream and floodplain function, and less maintenance.
      b) Diking along Shaw Creek to protect new development
   2) Are there any *new solutions* that have not already been proposed?
   3) What *still needs to be studied*?
      a) Relocation of Shaw Creek and the potential for a larger solution that includes concurrent considerations on Wide Hollow Creek

C. Shaw Creek goes through a rapidly developing high density area.
   1) What has *already been proposed* to address the problem?
      a) Protection of natural floodplain functions in Shaw Creek's watershed
      b) Critical Areas Ordinance
      c) Integrate; protect the floodplain function in association with Capitol facilities improvements. Tieton Drive, Orchard, and 96th, proposed "Nob Hollow" connector.
   2) Are there any *new solutions* that have not already been proposed?
      a) Change zoning code/amend the Comprehensive Plan to allow for less development, and protection of floodplain function.
      b) Administrative designation of floodplain based on historic flood patterns in the Shaw Creek area prior to updating of the FIRM maps.
      c) More effectively integrate protection of floodplain functions/flood hazard reduction in individual subdivision platting process.
      d) Large-scale detention/retention/flood water conveyance facilities, and associated maintenance. Identify potential locations.
      e) Design of subdivisions and homes should incorporate flood risks.
   3) What *still needs to be studied*?

D. No parts of Shaw Creek are included in the Flood Insurance Rate Maps.
   1) What has *already been proposed* to address the problem?
      a) Mapping the floodplain for NFIP rate maps, and enforcing NFIP standards for new development.
   2) Are there any *new solutions* that have not already been proposed?
      a) Model the watershed at full build-out
      b) Residents can purchase flood insurance even if they are not in a mapped floodplain.
      c) Hold neighborhood meeting for residents living near Shaw Creek (public outreach).
      d) Send information about Shaw Creek flooding to residents at risk of flooding (public outreach).
   3) What *still needs to be studied*?

E. Shaw Creek at Pear and Tieton Dr. has a history of flooding Tieton Dr. and areas downstream.
   1) What has *already been proposed* to address the problem?
      a) Relocation of channel
         (i) School owns property, and may be amenable to relocation.
         (ii) Nob Hollow Road possibly a problem, possibly remove bridges, which would help with conveyance on Wide Hollow.
         (iii) If all creeks diverge on Wide Hollow during a major flood, it won't get past 80th and West Valley Park.
         (iv) Address Zeigler's property
         (v) Move Wide Hollow Creek South of Wide Hollow Road (if Nob Hollow is not constructed).
      b) Diking along creek
   2) Are there any *new solutions* that have not already been proposed?
      a) Regional retention upstream of Tieton Dr
      b) Certain vacant properties - find ways to keep them undeveloped.
   3) What *still needs to be studied*?

F. There is potential for water quality problems in Shaw Creek during a flood, since floodwaters will likely utilize city streets as conveyances, particularly in the new Cottonwood Grove subdivision. Shallow drainfield at school - also a potential problem.
   1) What has *already been proposed* to address the problem?
   2) Are there any *new solutions* that have not already been proposed?
   3) What *still needs to be studied*?

This problem/watershed is a high priority

Should we be trying to address this now? –
1. Recommend quick actions which allow us to keep options open:
   A. Notify developers and prospective residents of the current flood hazard
   B. Require drainage easements,
   C. Keep at-risk areas undeveloped and,
   D. Allow for high density development in areas that are not at risk.

#10) Vegetation Problems (Draft 2/15/07)

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1. **Problem** - What is the problem? (Problem Statement)
   A. Vegetation (particularly Pacific Willow and Reed Canarygrass) grows into streams and decreases capacity.
   B. Branches and debris from vegetation pile up on impediments, causing flooding.
   C. Lack of riparian vegetation causes greater variation in temperature throughout the year, which can result in more and/or anchor ice formation. Lack of riparian vegetation allows for increased bank erosion

D. Natural rates of large wood inputs are essential for habitat development and reduction of stream energy. Even in the natural environment, large wood can reduce conveyance, cause flooding and increase bank erosion. In addition, large wood can accumulate or negatively affect infrastructure such as bridges and irrigation diversions and conveyance systems (from "Debris" Parking Lot).

2. **Causes** - What is causing the problem?
   A. Irrigation-fed streams (particularly Wide Hollow, Bachelor and Hatton creeks) are affected by an inverse hydrologic cycle. These creeks experience higher flows in the summer due to irrigation tail water. Pacific Willow and Reed Canarygrass thrive in this regime, and grow into the creeks, decreasing the capacity of the channel. Reed Canarygrass makes streams more prone to avulsion.
   B. Protection of stream-side vegetation can conflict with landowner and agency land management objectives - maximize agricultural/residential/public uses on a limited land base, or amenity values (I want to see the creek!), or pose a hazard to adjacent structures.
   C. In many locations in the watershed, channels have been straightened and subsequently incised. This results in an environment where riparian vegetation does not establish.
   D. Noxious weeds invade unmanaged, vacant land, preventing reestablishment of riparian vegetation.
   E. Natural process of wood recruitment to stream

3. **Alternatives** - What Alternative solutions will address the problem?
   A. Vegetation (particularly Pacific Willow and Reed Canarygrass) grows into streams and decreases capacity.
      1) What has *already been proposed* to address the problem?
         a) Removal and long term management of Pacific Willow- may be at different scales- site specific or throughout the watershed (i.e. for some distance upstream and downstream of bridges on Wide Hollow has a more aggressive Willow control program.)
         b) Alteration of the hydrologic regime - eliminate/reduce conveyance of irrigation water in Wide Hollow and tributaries-Lower Wide Hollow and Ahtanum Creek are influenced by the water table of the Yakima River, which also has a non-normative hydrograph.
      2) Are there any *new solutions* that have not already been proposed?
         a) Changes in regulations or region-wide permits for management of the undesirable riparian plant communities
         b) As part of mitigation for piping of irrigation waters, create a more normative conveyance schedule.
      3) What *still needs to be studied*?
         a) Other types of vegetation that can be substituted for Pacific Willow over the long term - may include non-native plant communities

B. Branches and debris from vegetation pile up on impediments, causing flooding. Breakdown products of this debris also causes stream to lose conveyance, etc.
   1) What has *already been proposed* to address the problem?
      (i) See a and d
   2) Are there any *new solutions* that have not already been proposed?
   3) What *still needs to be studied*?

C. Lack of riparian vegetation causes greater variation in temperature throughout the year, which can result in more and/or anchor ice formation. Lack of riparian vegetation allows for increased bank erosion.
   1) What has *already been proposed* to address the problem?
   2) Are there any *new solutions* that have not already been proposed?
      a) Regulations that protect or encourage restoration of riparian vegetation (Critical Areas Code)
      b) Incentive programs to protect riparian vegetation (i.e. Conservation Reserve Enhancement Program, YTAHP (Yakima Tributary Access and Habitat Program), Open Space taxation incentives)
      c) Acquisition/legal protection of riparian zones (easements, agreements, Fee Simple, etc.). This is most often done with multiple objectives-Fish and Wildlife habitat protection, Open Space, parks, trail and other non-motorized transportation corridors, public access.
      d) Other landowner assistance programs (i.e. Conservation Districts)
      e) Public education and examples of the values and esthetic appeal of riparian corridors/open space
      f) Stream relocation away from high-intensity uses, or restoration of incised stream channels to allow for natural riparian/flood function.
      g) Distinguish between areas that should be natural functions and processes (Ahtanum), as opposed to areas that should be managed for high intensity land use (much of Wide Hollow Creek). Refer to "Fish and Wildlife" for identification of these alternatives.
   3) What *still needs to be studied*?
      a) Appropriate plant communities for denuded riparian areas

D. Natural rates of large wood inputs are essential for habitat development and reduction of stream energy. Even in the natural environment, large wood can reduce conveyance, cause flooding, and increase bank erosion. In addition, large wood can accumulate or negatively affect infrastructure such as bridges and irrigation diversions and conveyance systems (from "Debris" Parking Lot).
   1) What has *already been proposed* to address the problem?
      a) Riparian setbacks and buffers
      b) Site-specific response to log jams
      c) Improve design of bridges and irrigation diversions to reduce potential for debris accumulation.
   2) Are there any *new solutions* that have not already been proposed?

a) In some locations, addition of wood to stream to "catch" wood debris- this accomplishes multiple objectives - would benefit habitat as well as reduce the volume of woody debris that accumulates on bridges, diversions, and other structures.
b) Reduce or minimize the number of bridges and irrigation diversions that can accumulate debris
c) Distinguish between areas that should be natural functions and processes (Ahtanum), as opposed to areas that should be managed for high intensity land use (much of Wide Hollow Creek). Refer to "Fish and Wildlife" for identification of these alternatives.

3) What *still needs to be studied*?

#11) Fish and Wildlife (Draft 3/12/07)

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1. **Problem** - What is the problem? (Problem Statement)

A. Beavers create dams that can aggravate flooding, and can make it difficult to reestablish riparian zones.
B. Elk populations contribute to erosion and may change flood timing in higher elevations
C. Channel, riparian and floodplain processes have been drastically altered in the watershed. Habitat quality and quantity have been reduced or eliminated. Native fish and wildlife were dependent on these natural processes. These resources are managed as a trust for the benefit of the citizens of Washington State and the treaty Indian Tribes. Riparian areas play an important role in sustaining wildlife species by supplying unique or limited habitats, or acting as migration corridor (i.e. birds)
D. Some creeks have sources that aren't natural- Distinguish between areas that may not have the sources of water in the future for fish and wildlife, and areas that will have water for the long term.

2. **Causes** - What is causing the problem?

A. Beaver populations are rebounding (expanding). Yakama Nation and WDFW are encouraging this expansion, because they provide critical ecosystem functions, and the beaver population was once depleted due to over-trapping.
B. Beaver dams are a site-specific problem. In some situations they are beneficial, but they are often in conflict with infrastructure or the built environment, resulting in increased flood risk.
C. There is an unnaturally large concentration of elk in the high elevation areas of the Ahtanum and Wide Hollow watershed. Grazing animals (elk and cattle) may contribute to erosion, and therefore aggravate flooding in the upper reaches of Wide Hollow Creek.

D. People commonly think that fish and wildlife conservation is in conflict with flood control, when in fact, good flood management and fish and wildlife conservation are generally mutually compatible.

3. **Alternatives** - What Alternative solutions will address the problem?

A. Beavers create dams that can aggravate flooding, and can make it difficult to reestablish riparian zones.

1) What has *already been proposed* to address the problem?

a) Deal with beavers on a case by case basis - use discretion based on situation (is the floodplain function provided by the beaver a good thing or a bad thing?)

b) Lethal trapping or relocation of "problem beavers."

c) Removal of "problem" beaver dams, under permits from the Department of Fish and Wildlife (CAO, Cities, Yakama Nation).

d) Beaver proof culverts (don't normally function well during floods). Alternatives for water passage through beaver dams.

e) Regulatory measures (buffers, setbacks, etc.) to allow for localized flooding/changes in water surface level or the channel.

f) General WDFW Adaptive Management procedure- if people affected by a dam can deal with it by hand, they don't need a permit. If it needs more work to remove, a permit is required.

g) Critical Areas Ordinance- vegetative buffers should address beaver dams

2) Are there any *new solutions* that have not already been proposed?

3) What *still needs to be studied*?

a) Are there areas where beavers should not be allowed? (i.e. dense urban areas, irrigation, artificial ditches)

b) Who is responsible? Identify protocols for beaver management.

B. Unnaturally dense concentrations of elk contribute to erosion and may change flood timing in higher elevations

1) What has *already been proposed* to address the problem?

2) Are there any *new solutions* that have not already been proposed?

a) (Coordinated Resource Management Group) (i.e. similar to the Wenas working group)

b) Incorporation of watershed management when managing elk (i.e. Maintain a good sized buffer to prevent elk from entering the stream, appropriate carrying capacity, etc.). Recognize this issue as a high priority.

c) Move elk feeding stations to other areas

d) Feeding station management - apply similar management standards to feeding operations as livestock operations, alter locations, etc.

3) What *still needs to be studied*?

C. Channel, riparian and floodplain processes have been drastically altered in the watershed. Habitat quality and quantity have been reduced or eliminated. Native fish and wildlife were dependent on these natural processes. These resources are

managed as a trust for the benefit of the citizens of Washington State and the treaty Indian Tribes.

1) What has *already been proposed* to address the problem?
   a) Federal, State and local regulations attempt to;
      (i) Limit rates of habitat loss (i.e. Endangered Species Act, Growth Management Act, and Hydraulic Code).
      (ii) Maintain watershed and channel processes (i.e. Clean Water Act, In-stream flow rules).
   b) Dedicated habitat restoration protection and restoration programs (i.e. Salmon Recovery Funding Board, Northwest Power and Conservation Council). Other programs and funding sources that encourage habitat protection (i.e. YRBWEP, FCAAP, Centennial Clean Water, FEMA, Federal Highways).
   c) Landowner incentive programs (i.e. Conservation District, Cost- Shares, Open Space taxation and other tax breaks - these programs can be very rigid, which may discourage participation)
   d) Private habitat restoration organizations (i.e. Land trusts, Greenway, other non-profit programs).
2) Are there any *new solutions* that have not already been proposed?
   a) Encourage beavers in areas where their presence could restore degraded watershed function.
   b) Being more proactive in planning for these needs.
   c) Create a program that is prepared to educate landowners before and after a flood event.
   d) Develop pre and post-disaster program for implementation of habitat goals in flood hazard reduction/recovery projects/programs.
   e) Environmental benefits should be considered in funding processes.
   f) Encourage organizations (neighborhoods, County/City/Yakama Nation or others) to purchase floodplain areas
   g) Inform people about the importance of the functions of streams, rivers, and natural drainage ways. Public education about how riparian and flood hazard management goals complement each other.
   h) Address maintenance of drainage easements-establish who is going to enforce maintenance
   i) Public education programs, such as stream cleanup programs and volunteer monitoring.
3) What *still needs to be studied*?
   a) How to integrate with Yakama Nation policies or plans for parcels adjacent to Ahtanum Creek?

#12) Flood Fight / Flood Response (Draft 3/6/07)

1. **Problem** - What is the problem? (Problem Statement)

   A. Even with the best planning, floods are a normal and regular occurrence. Predicting the behavior of any given future flood is impossible, so communities need to be prepared to protect life and property before, during, and after flood events.

   B. Floods can result in deaths, injuries, economic and significant personal hardship, as well as inconvenience to many people.

   C. Effective flood response involves many levels of government, and requires that government agencies be prepared to respond in a coordinated fashion. Programs are in place at the local, state and federal level to respond to different levels of emergencies and disasters. Local government personnel, such as law enforcement officers and public works employees, as well as first responders, are on the front lines of the "flood fight" and protection of life and property. The most significant and pressing issues facing those responsible for responding to floods are keeping people safe, and preventing chaos. A coordinated, well planned effort is required.

   D. What actions can be taken during a flood? Even during flood emergencies, actions by agencies or individuals need to comply with regulations. Actions taken during a flood that do not comply can result in the subsequent need to remove, alter, or mitigate for actions taken during the flood. These post-flood actions are often not eligible for funding related to the disaster.

2. **Causes** - What is causing the problem?

   A. Complex natural processes interact unpredictably with the built environment. Changes or growth in the built environment in floodplains increases unpredictability of these interactions.

   B. Major flooding occurs on an infrequent basis in the Yakima area. Many individuals (residents, public employees, and decision-makers) are unfamiliar with or unaware of the hazards and potential responses to conditions during a flood.

   C. Lack of predictive power (in the form of models and monitoring of watershed conditions) before and during flood events, specifically in the Ahtanum-Wide Hollow basin.

   D. Some areas are more prone to flooding and flooding damage than others. In areas subject to repetitive flood damage, insufficient programs (or use of those programs) to reduce or eliminate the flood hazard, increases the frequency of costly flood fight/flood response, damage, etc.

   E. Changes in government programs and how they are administered (i.e. the role of FEMA in the Department of Homeland Security) can reduce the effectiveness of response.

   F. Insufficient communication between agencies, public, etc.

3. **Alternatives** - What Alternative solutions will address the problem?

A. Even with the best planning, floods are a normal and regular occurrence. Predicting the behavior of any given future flood is impossible, so communities need to be prepared to protect life and property before, during, and after flood events.

1) What has *already been proposed* to address the problem?

a) Parking Lot - See Regulations Discussion

b) Yakima County has both policy and structures for Emergency Management, and has faced natural disasters before (Mt. St. Helens, 1996 flood). *More discussion of the effects of the Katrina disaster.*

c) Comprehensive Emergency Management Planning effort- The Yakima County Flood Response Plan has been adopted as part of the Emergency Management Plan.

2) Are there any *new solutions* that have not already been proposed?

a) Individual preparation for floods - public education directed to residents, farms and businesses.

3) What *still needs to be studied?*

B. Floods can result in deaths, injuries, economic and significant personal hardship, as well as inconvenience to many people.

1) What has *already been proposed* to address the problem?

a) Warning systems (mass media)

b) Public education about potential flood hazards on their property, and means of responding to a flood.

2) Are there any *new solutions* that have not already been proposed?

a) Designation and notification of the public and first responders of evacuation routes.

3) What *still needs to be studied*?

C. Effective flood response involves many levels of government, and requires that government agencies be prepared to respond in a coordinated fashion. Programs are in place at the local, state and federal level to respond to different levels of emergencies and disasters. Local government personnel, such as law enforcement officers and public works employees, as well as first responders, are on the front lines of the "flood fight" and protection of life and property. The most significant and pressing issues facing those responsible for responding to floods are keeping people safe, and preventing chaos. A coordinated, well planned effort is required.

1) What has *already been proposed* to address the problem?

a) Emergency Response Plan (Get Ready – Set – Go - Recover procedures)

b) Infrastructure or technology in place for better communication between agencies (EOC)

c) Recognition of potential flood hazard during a flood (Flood Control Zone District's primary function during a flood event).

d) This plan involves all agencies that may be involved during a flood emergency in Yakima County, such as (for example) Yakima County

Emergency Management, Cities, the Bureau of Reclamation, the Yakima County Health District, and the Irrigation Districts.

e) The Flood Control Zone District is currently developing databases containing information on all parcels that may be affected by different level flood events. These models correspond to re-mapping FEMA flood maps: therefore, the Ahtanum-Wide Hollow area is next in line.

2) Are there any *new solutions* that have not already been proposed?

a) Open contract for aerial observation during floods

b) Special phone line for public to call in and provide intelligence

c) Volunteer program – flood watchers provide information

d) Interagency coordination, including WDFW, Irrigation Districts, and Yakama Nation Natural Resources, Fisheries and Engineering

3) What *still needs to be studied*?

D. What actions can be taken during a flood? Even during flood emergencies, actions by agencies or individuals need to comply with regulations. Actions taken during a flood that do not comply can result in the subsequent need to remove, alter, or mitigate for actions taken during the flood. These post-flood actions are often not eligible for funding related to the disaster.

1) What has *already been proposed* to address the problem?

a) Under State and County regulations, procedures exist for expedited permit issuance during a flood event.

b) Ahtanum-Wide Hollow CFHMP recommendations, since they require approval by WDFW and Ecology, provide a good basis for deciding whether to take emergency actions, which will be consistent with regulations.

c) Permitting agencies are a component of the Emergency Management Plan, and are present in the EOC during a declared emergency. General guidelines for taking action during a declared or non-declared emergency are:

(i) permitting personnel do a site visit

(ii) choose minimum action, or action that will meet the intent of the regulations - i.e. better protect/enhance the resources

(iii) follow up- 6 months after a declared disaster to come into compliance

2) From Parking Lot: Ice jams - who responds to whom?

#13) Urban Union Gap - Lower Wide Hollow (3/1/07)

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1. **Problem** - What is the problem? (Problem Statement)

A. Flooding of Wide Hollow Creek in Union Gap can affect a large area of existing industrial, commercial and residential uses.

B. Areas of low intensity land uses (i.e. pasture, grazing) have recently been converted to industrial, residential and commercial uses, in flood prone areas, and this trend is likely to continue.

C. Inaccurate floodplain mapping makes it unenforceable for Union Gap

2. **Causes** - What is causing the problem?

A. Union Gap is subject to flooding even at low flows, because of its location near the mouths of both Ahtanum and Wide Hollow Creeks, and its proximity to the Yakima River.

B. Wide Hollow Creek has been modified to allow for operation of the water wheel at the mill, which has existed since the 1860's. (Its original location is not known). In the existing residential and commercial areas of Union Gap, the creek is channelized, and has lost its floodplain.

C. Wide Hollow Creek backs up at the mill dam just below Main St. Bridge, frequently causing levee failure on the south side of the creek.

D. The Fines diversion dam raises the water surface elevation over five feet, and has caused channelization.

E. Lands near Union Gap are desirable due to their location near Union Gap and its (expanding) transportation and utility infrastructure. Floodplain areas are under development pressure. Large capitol inputs are required to make these areas suitable for high intensity use.

F. Vegetation problems (See Vegetation).

G. Union Gap is located is surrounded by the Yakima River, Ahtanum Ridge, and the City of Yakima- where can it expand?

3. **Alternatives** - What Alternative solutions will address the problem?

A. Flooding of Wide Hollow Creek in Union Gap can affect a large area of existing industrial, commercial and residential uses.

1) What has *already been proposed* to address the problem?

a) Retention of overflow path along the railroad right of way.

b) Maintain open areas near the mouth of Ahtanum creek for inevitable flooding (i.e. Fulbright Park and adjacent areas).

c) Incorporation of floodplain/open space/retention into site plans (e.g.. La Salle High School)

d) National Flood Insurance Program (See also "Inundation")

e) Critical Areas Code (See also "Inundation")

f) Re-mapping, so that standards and maps are more accurate (See also "Inundation")

g) Stormwater design standards (See also "Inundation")

h) More stringent development standards (i.e. prohibit land divisions in the floodplain). (See also "Inundation")

i) Buy people out/provide incentives for landowners who provide floodplain storage (See also "Inundation")

j) Structural flood control measures either by individuals or government (See also "Inundation")

k) Flood–proof, elevate, make existing structures less flood damage-prone. (See also "Inundation")

2) Are there any *new solutions* that have not already been proposed?

a) Relocation of Wide Hollow Creek into Ahtanum Creek at some point upstream of urbanized Union Gap.

b) Removal or modification of the mill dam

c) Include areas of high water table in the floodplain maps. (See also "Inundation")

d) Improve sediment transport along the Yakima River (Refer to the Upper Yakima CFHMP) (See also "Inundation")

e) Modify Wapato Dam (See also "Inundation")

f) Preservation and restoration of floodplain in places, while allowing development in others. (See also "Inundation")

g) Relocation of residents in areas subject to inundation (See also "Inundation")

3) What *still needs to be studied*?

B. Flood prone areas of low intensity land uses (i.e. pasture, grazing) have recently been converted to industrial, residential and commercial uses, and this trend is likely to continue.

1) What has *already been proposed* to address the problem?

2) Are there any *new solutions* that have not already been proposed?

a) Special land use standards for industrial uses relating to hazardous materials, storage, use, disposal- are they flood proofed?

b) Limit service extension to flood prone areas

C. What *still needs to be studied*?

#14) Roads, Bridges and Culverts (Draft 4/26/07)

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1. **Problem** - What is the problem? (Problem Statement)

A. In many places in the watershed, bridges constrict the channel, which restricts flood flow with the potential for bridge failure, increasing levels and area of inundation, or directing flow in undesirable directions.

B. In some locations, bridges and roads affect channel processes, creating channel instability upstream and downstream. This may also cause failure or damage to adjacent infrastructure or private property. Construction of new roads and bridges will, in most instances, change flooding patterns and flood hazard. These changes may be desirable or undesirable to agencies, adjacent property owner, etc.

C. Roads act as either conveyances or dams, causing increase in flow velocity and associated damage, or ponding.

D. Historically, many roads were constructed adjacent to creeks and drainage ways, and act as levees. For the most part, these structures were not designed as levees and are subject to failure.

E. Culverts can be washed out or plugged during flood events - they are undersized for those events. Private Driveway culverts are property owner's responsibility. "Bridge culverts" are bridges with a span of less than 20 ft. - these are classified under state bridge classification systems, and are public culverts.
F. When bridges and culverts are inundated, it creates a direct safety threat and economic impact, as well as hindering access to homes and businesses by residents, employees, school buses and emergency services.
G. Altering and building new transportation infrastructure is very expensive for government and private citizens. Improving flood conveyance capacity, building more effective drainage systems, and designing and constructing the roadway to be able to pass/withstand flood events increases this expense in the short term, but may reduce expense and damage over long term.
H. In the future, the extent and capacity of transportation infrastructure will increase due to increased human population and development pressure. Reducing or eliminating future flood hazard associated with this expansion will require careful design of the transportation network (from small, private roads to major highway systems) and the density and intensity of land uses served by the network.

2. **Causes** - What is causing the problem?

A. General under-capacity of existing bridges and culverts, due to:
   1) Outdated/inappropriate design standards for conveyance and/or changes in levels of service of the road.
   2) Lack of knowledge or consideration of flooding patterns when building/rebuilding roads and culverts
B. The physical conditions of streams and floodplains are altered by new infrastructure. Due to the inherent complexity of stream channels and floodplains (natural and anthropogenic variability), forecasting and predicting future physical conditions (flood frequency and magnitude, channel erosion and migration) at a given site is not an exact science. Therefore, there is always some degree of risk associated with new projects.
C. The nature of Ahtanum Creek, with its multiple overflow channels, causes floodwater to utilize roads as flood channels. East-west running roads move floodwater down the roadside ditches at high velocities, eroding driveways and often the roads themselves.
D. Streams are not static environments. Over time, channels adjacent to bridges and culverts change. These changes may reduce flood capacity or damage the bridge.
E. Floodplains are not static environments. Development in the floodplain may alter drainage patterns, overwhelming existing drainage systems.
F. The population of the Yakima area is growing. The Wide Hollow and Ahtanum areas contain urban cores where uses will change and intensify. Existing developments are mixed with areas of remaining agriculture/open space. Demand is high for residential and commercial development within the Ahtanum-Wide

Hollow watershed. Utilities and transportation services are also expanding to service current and future demand.

3. **Alternatives** - What Alternative solutions will address the problem?

A. In many places in the watershed, bridges constrict the channel, which restricts flood flow, creating potential bridge failure, and/or increasing levels and area of inundation and/or directing flow in undesirable directions.

B. In some locations, bridges and roads affect channel processes, creating channel instability upstream and downstream. This may also cause failure or damage to adjacent infrastructure or private property. Construction of new roads and bridges will, in most instances, change flooding patterns and flood hazard. These changes may be desirable or undesirable to agencies, adjacent property owners, etc.

(These problems (a and b) combined for alternatives)

1) What has *already been proposed* to address the problem?
   a) State hydraulic code requires that "new" bridges convey 100 year flow over state waters.
   b) The process of remapping the floodplains will generate more accurate hydrology and hydraulics for bridge and roadway design.
   c) Inventory and ranking of problem bridges throughout the watershed, incorporate into Capitol Improvement Plans of local and state jurisdictions. [(County Roads currently has an inventory, Surface Water is currently working on as part of FEMA re-mapping). The rate of replacement of infrastructure is limited by funding, and to some extent standards in the funding programs.]
   d) Active monitoring and management of channels adjacent to bridges to improve and maintain bridge capacity. (Armor or sediment removal in poorly functioning bridges, and management of vegetation debris.)
   e) For new structures, include in-stream actions to maintain conveyance as part of the design and construction.
2) Are there any *new solutions* that have not already been proposed?
   a) Design new bridges to allow natural channel processes where they occur. In areas where natural channel processes have been lost or altered, or where natural processes are highly unpredictable, design conservatively?
   b) New standards and policies for bridges in the floodplain, specifically the effect of the bridge relative to floodplain width and function. Successful implementation of such standards and policies will require the development and sharing of tools and data between agencies and the public at large.
   c) Monitoring of channel and floodplain conditions post construction. If significant unforeseen problems develop, respond to them.
   d) Limit/restrict/reduce the number of bridges and bridge crossings, especially small private bridges and culverts. [This can be accomplished through road

standards, combining existing access points or limiting development density on land that must be accessed by a bridge.]

3) What *still needs to be studied*?
   a) Integrating existing or new funding programs into strategic program for addressing problem bridges. See (i.3) above.
   b) Inventory of channel process problems

C. Roads act as either conveyances or dams, causing increase in flow velocity and associated damage, or ponding.
1) What has *already been proposed* to address the problem?
   a) Better floodplain mapping and modeling to allow for better infrastructure design.
2) Are there any *new solutions* that have not already been proposed?
   a) New road design standards and policies for infrastructure in floodplains. Issues addressed should include roadway flood passage, level of service, access to critical facilities, and access to residences.
3) What *still needs to be studied*?
   a) The cumulative effect of new policies and standards.
   b) What should the level of service standard for designing roads be?

D. Historically, many roads were constructed adjacent to creeks and drainage ways, and act as levees. For the most part, these structures were not designed as levees and are subject to failure.
1) What has *already been proposed* to address the problem?
   a) More armoring of roads which are acting as levees.
2) Are there any *new solutions* that have not already been proposed?
   a) Inventory and rank potential road failure.
   b) Design site-specific solutions based on the inventory and current and future road classification; solutions may include armoring or changes to road configuration, or elimination of the road and selection of alternate route. Incorporate findings into transportation planning.
   c) Consider putting in roads at grade
   d) Lower some roads
3) What *still needs to be studied*?
   a) Inventory of private roads

E. Culverts can be washed out or plugged during flood events - they are undersized for those events. Private Driveway culverts are property owner's responsibility. "Bridge" culverts are bridges with a span of less than 20 ft. - these are classified under state bridge classification system, and are public culverts.
1) What has *already been proposed* to address the problem?
   a) Increased maintenance and debris cleanout of culverts and ditches on public roads.
2) Are there any *new solutions* that have not already been proposed?
   a) Recognize the limitations of culverts.

b) Armor or redesign road prism to withstand flood damage adjacent to culverts.
c) Identify road ditches that serve as flood conveyance, thus placing them at a high priority for maintenance (i.e. Rutherford Rd).
d) Public education about maintaining driveway culverts, and correct sizing and maintenance of culverts.
e) Replace old culverts with higher capacity culverts depending on level of risk.
f) New public and private culverts should be designed with adequate volume capacity to minimize the risk of the culvert blowing out, or should be designed to overtop or be bypassed without failure.

3) What *still needs to be studied*?
a) Private road culvert inventory
b) Private driveways built to grade, where culverts are not preferable.

F. When bridges, culverts and roads are inundated, it creates a direct safety threat and economic impact, as well as hindering access to homes and businesses by residents, employees, school buses and emergency services.

1) What has *already been proposed* to address the problem?
a) Flood responders concentrate patrol and response on known problem bridges and roads.
b) More maintenance at known problem bridges

2) Are there any *new solutions* that have not already been proposed?
a) Standards and policies for critical access routes
b) Develop alternative access routes and incorporate into transportation planning
c) Flood response planning

3) What *still needs to be studied*?
a) Future development and critical access routes

G. Altering and building new transportation infrastructure is very expensive for government and private citizens. Improving flood conveyance capacity, more effective drainage systems, and roadway flood passage increases this expense in the short term, but may reduce expense and damage over long term.

1) What has *already been proposed* to address the problem?
a) Improved flood mapping and modeling to assess risk to new and existing infrastructure and designing new infrastructure.
b) Flood Control Zone District providing technical assistance and comments regarding flood hazards and infrastructure design.
c) Identify overflow paths and critical bridges.
d) Existing and amended floodplain and critical areas codes.

2) Are there any *new solutions* that have not already been proposed?
a) When transportation infrastructure is damaged during flood events, it should be replaced in a manner that reduces vulnerability to future flood hazard.

b) Federal and state funding programs to reduce or mitigate the environmental effects (including flooding) of existing road systems do exist- explore ways to take better advantage of these programs.

c) Place higher priority on these issues at the federal, state, tribal and local level.

d) Funding sources or incentives for private drainage infrastructure

e) Work with landowners up and downstream of new infrastructure to appropriately design their access to property.

3) What *still needs to be studied*?

H. In the future, the extent and capacity of transportation infrastructure will increase due to increased human population and development pressure. Reducing or eliminating future flood hazard associated with this expansion will require careful design of the transportation network (from small, private roads to major highway systems) and the density and intensity of land uses served by the network.

1) What has *already been proposed* to address the problem?

a) Stormwater management standards for new and reconstructed roads.

b) Growth Management and Capitol Facilities planning processes should ensure that expansion of the transportation network is consistent with CFHMPs.

2) Are there any *new solutions* that have not already been proposed?

a) Monitor the effects of transportation system expansion changes to the characteristics (runoff, time of concentration, water quality) of the watershed over time. Take action to mitigate for negative watershed scale effects.

b) Take larger scale affects to the watershed into account when designing new transportation systems:

(i) Minimize number of roads - maximize efficiency.

(ii) New major arterials and new traffic-generating developments should be located outside of floodplains (See also Land Use).

(iii) Limit access to major arterials where they cross or are adjacent to floodplains.

(iv) Encourage the retention of open space in floodplains with the development of non-motorized transportation systems.

c) Special standards by road functional type and private road classification for roads in floodplains. Matrix - functional classification by stream or floodplain type.

d) There are areas (e.g. Emma Lane, towns of Ahtanum and Wiley City) in the watershed that are composed of “islands” of non-floodplain surrounded by floodplain areas. Transportation networks in these areas (even if they are zoned as low density) should be planned to take into account surrounding properties, rather than a standard site-specific approach. See also “Land Use”

e) ID and maintain critical access routes at 10, 25 and 100 year events. These roads should be designed to be elevated and accessible using design standards with minimal effect on flood flows.
f) Roads that are not identified as critical access routes should be built at grade to avoid altering flood patterns.
g) County (and Cities?) evaluate access needs on a case by case basis.

3) What *still needs to be studied*?

PARKING LOT - Private Levees

To PARKING LOT - development in areas with floodplain "islands"

Require increased elevation of new structures in the floodplain and flood-proofed utilities.

#15) Land Use Draft 5/30/07

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1. **Problem** - What is the problem? (Problem Statement)

A. If flooding issues are not taken into account in the development of the Ahtanum-Wide Hollow area, residents, businesses and infrastructure (present and future) will be at increased risk for damage from flooding. This is especially true of high-intensity urban development located within the floodplain, which has a strong tendency to result in filling in the floodplain, and diverting flood flows onto other properties (including properties that are not normally flood prone).

B. There are known high hazard areas where development is occurring or proposed. [i.e. Bachelor and Ahtanum Creek floodplains from 42nd Ave. to 3rd St., Wiley City, town of Ahtanum and areas east to 64th, area around Meadowbrook and Rutherford Road (Hatton Creek and Ahtanum) south of Wiley City.]

C. In existing urbanized and rapidly urbanizing areas, the design/effectiveness/maintenance of stormwater systems can significantly affect flood hazard

2. **Causes** - What is causing the problem?

A. The Ahtanum-Wide Hollow watershed has topography that makes it unusually flood-prone. This is due to:
1) Extensive, widespread, unpredictable flooding patterns.
2) Minor changes to watershed resulting in major changes in flooding (Downstream impacts from small changes in creek)
3) Lack of knowledge of changes in flooding patterns in the watershed
4) The narrow flood corridors within the study area make the consequences of hi-intensity development within them more pronounced.

B. There is considerable development pressure for single family homes in West Valley, and for light industrial development in the floodplain, within the city

limits of Yakima and Union Gap. Increase in density of development in the Ahtanum-Wide Hollow watershed will potentially exacerbate flooding patterns.

C. The historical approach to Land Use Planning has not taken floodplains into consideration when establishing broad "future land use" designations in planning and zoning documents within the Urban Growth Area. This has established an expectation in the public's mind that all land (including floodplain land) within the UGA can or will be developed to a high intensity of use.

3. **Alternatives** - What Alternative solutions will address the problem?

A. If flooding issues are not taken into account in the development of the Ahtanum-Wide Hollow area, residents, businesses and infrastructure (present and future) will be at increased risk for damage from flooding. This is especially true of high-intensity urban development located within the floodplain, which has a strong tendency to result in filling in the floodplain, and diverting flood flows onto other properties (including properties that are not normally flood prone).

1) What has *already been proposed* to address the problem?

a) Existing zoning (status quo) - Flood overlay district, open space designation

b) NFIP standards (Regulatory standards)

c) Parks in frequently flooded areas (Fulbright Park and West Valley Park)

d) Planning Policies. For example, the Yakima Urban Area Comprehensive Plan, Objective E7 is "Ensure development compatibility within the floodplain and frequently flooded areas." Furthermore, it goes on to say, "It is more costly to remedy property losses than to conserve and protect them." (Yakima Urban Area Comprehensive Plan, page IX-5)

2) Are there any *new solutions* that have not already been proposed?

a) Policies and standards for open space retention for expansion of UGA's and individual developments. Meet each local jurisdiction's open space and park needs (GMA) by identifying stream corridors.

b) Using Critical Areas update policies to establish open space

c) Incentives or bonuses for developers who actively protect these areas. (10% density bonus). Specificity in zoning ordinance.

d) Focus lower-intensity development within the floodplain corridors, while focusing higher intensity developments to the sides of the flood corridor. Lower density for subdivisions in the floodplain.

e) Consistency in zoning standards for developments and buildings. Information about properties up-front (no surprises).

f) Policies directing preferred locations for the siting of new infrastructure such as major and minor arterials, water and wastewater distribution mainlines, regional stormwater facilities, parks and greenbelts.

g) Make changes to comprehensive planning and zoning documents and maps to focus lower intensity development within floodplain corridors and focus higher intensity development outside floodplain corridors.

h) Local governments should establish specific comprehensive plan policies to use floodplains and other critical areas to meet their GMA requirements for providing Parks and Open Space. This can substitute for planning specific large blocks of private land for Parks and Open Space.

i) Policies for areas of existing dense development within the floodplain (such as Ahtanum and Wiley City)

j) Policies for retrofitting and re-development of stormwater facilities and flood water routing in existing urbanized areas.

k) Development moratoriums or high standards of proof- Is development outpacing knowledge or tools available to keep the public safe?

3) What *still needs to be studied*?

B. There are known high hazard areas where development is occurring or proposed. [i.e. Bachelor and Ahtanum Creek floodplains from 42nd Ave. to 3rd St., Wiley City, town of Ahtanum and areas east to 64th, area around Meadowbrook and Rutherford Road (Hatton Creek and Ahtanum Creek) south of Wiley City

1) What has *already been proposed* to address the problem?

a) Status quo- New developments must meet development standards and go through the planning process.

2) Are there any *new solutions* that have not already been proposed?

a) Recognize that in some places, the issues associated with larger scale proposed developments are not adequately addressed by current standards. This often results in an unpredictable and contentious hearings/approval process.

b) Special zoning designations for development in high flood hazard areas (flood overlay zone). Objectives of flood overlay zone should be to protect the public *and* retain flood storage.

c) Special incentives - (clustering, density bonuses, Transfer of Development Rights) for retention of floodplain function in development design.

d) Acquisition - fee simple or easement, for a variety of purposes consistent with floodplain function

e) Open space taxation - specifically including these problem areas in the public benefit rating.

f) Reconfiguration of the floodplain area (concentrating floodplain in one area and uplands in another) for purposes of flood storage or urban development.

3) What *still needs to be studied*?

a) Examples from other similar areas?

C. In existing urbanized and rapidly urbanizing areas, the design/effectiveness/maintenance of stormwater systems can significantly affect flood hazard

1) What has *already been proposed* to address the problem?

a) Regional Stormwater Program for the Yakima Urbanized Area.

b) Historically, Drainage Improvement Districts (DIDs) have also served as stormwater drainage systems [they were not sized or designed for this purpose].

2) Are there any *new solutions* that have not already been proposed?

a) Establish a relationship between stormwater standards and development standards in floodplains. (Stormwater systems don't work very well in most floodplains due to frequency of flooding, high water table and low gradient).

b) Site design to reduce stormwater runoff.

What *still needs to be studied*?**#16) Regulatory Issues**

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1. **Problem** - What is the problem? (Problem Statement)

A. Regulations surrounding flooding are necessary in order to keep people safe, but there is often resistance to stricter standards.

B. Classification of some waterways as to whether they are ditches or streams complicates management for flood risks. Some streams that flood are not identified on FEMA flood hazard maps, placing residents with no flood insurance at risk for flooding.

C. Lack of information and communication among permitting agencies and people trying to get permits causes confusion and frustration.

D. It is important for residents and businesses to understand their flood risk, and to understand what they can do about it, and which agencies they need to work with.

2. **Causes** - What is causing the problem?

A. Flood regulations are in place for the protection of life and property. In addition, development projects near waterways are subject to the Shoreline Management Act, the Critical Areas Ordinance, Land Use Regulations, and numerous other Federal and State statutes. The sheer number of regulations pertaining to waterways causes a problem with coordination of the permitting process.

B. Regulating development based on FEMA flood hazard management maps can be problematic, especially in a watershed like the Ahtanum-Wide Hollow, where small changes to the stream channel can create big changes in flooding patterns.

C. Political pressure to move floodplains on maps or allow exceptions can create major problems.

3. **Alternatives** - What Alternative solutions will address the problem?

A. What has *already been proposed* to address the problem?

B. Are there any *new solutions* that have not already been proposed?

1) From Parking Lot: Setting aside areas as flood storage/open space

2) Use of unnumbered A-zones (from Emma Lane Parking Lot)

C. What *still needs to be studied*?
D. Do these proposals address the causes of the problem?

4. List Alternatives- Proposals that address the causes of the problem are listed as Alternatives, as well as instances where further study is required. **Additional Regulatory meeting – Draft June 14th, 2007**

On-Screen Exercise
Local Regulations/Policies CFHMP Can Address
These may apply to all jurisdictions in the study area.

Parking Lot Issues:

1. Below is a list of regulatory measures we may want to address in the CFHMP. It is not comprehensive, so please bring up anything you think is being missed. All of these alternatives (and issues) listed are from the Parking Lot during other discussions (*listed in italics*).

A. There is a loss of floodplain capacity due to development (*from Channel Issues*)
B. Loss of floodplain capacity contributes to flooding (*from Channel Issues*)

2. Regulatory Tools:

A. Floodplain Ordinance (Flood Damage Prevention Ordinance)
1) Standards for development in areas with floodplain "islands" (*from Infrastructure*) define size of "island". – Examples - Road bed at grade? Implement standard for access- "Texas crossing," culverts, set a backwater standard. Emergency Access.
2) Require increased elevation of new structures in the floodplain and flood-proofed utilities. *(from Infrastructure)*
3) Stricter ordinances- (i.e. Base flood plus 2 or 3 feet) in floodplain areas of Union Gap *(from Union Gap)*
4) Policies for areas of existing dense development within the floodplain (such as Ahtanum and Wiley City) *(From Land Use*)- Better drainage- i.e. in Wiley City, water can't get out through drain-used to use the railroad ditch (which has been filled in) - this lack of drainage causes sheet flow. Study better ways to drain before development occurs *(Land Use).* Possible function of Flood Control Zone District.

B. International Building Code- International Residential Code - City and County Code
1) Early application of IBC standards to developments. Policies for disclosing information about properties up-front (no surprises). *(From Land Use)*
2) Standards in the IRC (International Residential Code) are not as strict as those in the IBC.

C. Zoning/Floodplain Overlay Zone - Yakima Urban Area Zoning Ordinance

1) Standards for development in areas with floodplain "islands" *(from Infrastructure)*
2) Incentives or bonuses for developers who actively protect flood hazard areas. (10% density bonus). Specific development standards in zoning ordinance. *(From Land Use)*
3) Reduce density in the floodplain through various methods -
   a) Focus lower-intensity development within the floodplain corridors, while focusing higher intensity developments to the sides of the flood corridor. Lower density for subdivisions in the floodplain. *(From Land Use)*
   b) Make changes to comprehensive planning and zoning documents and maps to focus lower intensity development within floodplain corridors and focus higher intensity development outside floodplain corridors. *(From Land Use)*
   c) Policies for areas of existing dense development within the floodplain (such as Ahtanum and Wiley City) *(From Land Use)*
4) Floodway fringe - standards for parking lots
5) Zero or 0.1 foot rise - specifying practice in IBC, amending code, writing it in the Floodplain overlay zone.

D. Subdivision Code-
1) Standards for subdivision in the floodplain - at the minimum require a buildable area outside of the floodplain. Standards for lot size and housing location.
2) Incentives or bonuses for developers who actively protect flood hazard areas. (10% density bonus). Specific development standards in zoning ordinance. *(From Land Use)*
3) Focus lower-intensity development within the floodplain corridors, while focusing higher intensity developments to the sides of the flood corridor. Lower density for subdivisions in the floodplain. *(From Land Use)*

E. Critical Areas Code
1) Standards for geologic hazard areas? Channel migration zones and alluvial fans - Emphasize keeping homes safe as well as environmental goals.
2) Using Critical Areas update policies to establish open space *(From Land Use)*
3) Policies and standards for open space retention for expansion of UGA's and individual developments. Meet each local jurisdiction's open space and park needs (GMA) by identifying stream corridors. *(From Land Use)*
4) Local governments should establish specific comprehensive plan policies to use floodplains and other critical areas to meet their GMA requirements for providing Parks and Open Space. This can substitute for planning specific large blocks of private land for Parks and Open Space. *(From Land Use)*

F. Open space taxation policies

G. Stormwater standards

H. Better system of checks and balances within local government for agencies to buy in.

I. Enforcement of policies - Enforce policies that already exist

J. Public notice/disclosure/consultation when projects are planned