



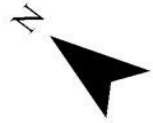
The Lower Watershed Ecosystem Services in Coastal Areas with a focus on the Courtenay River Floodplain

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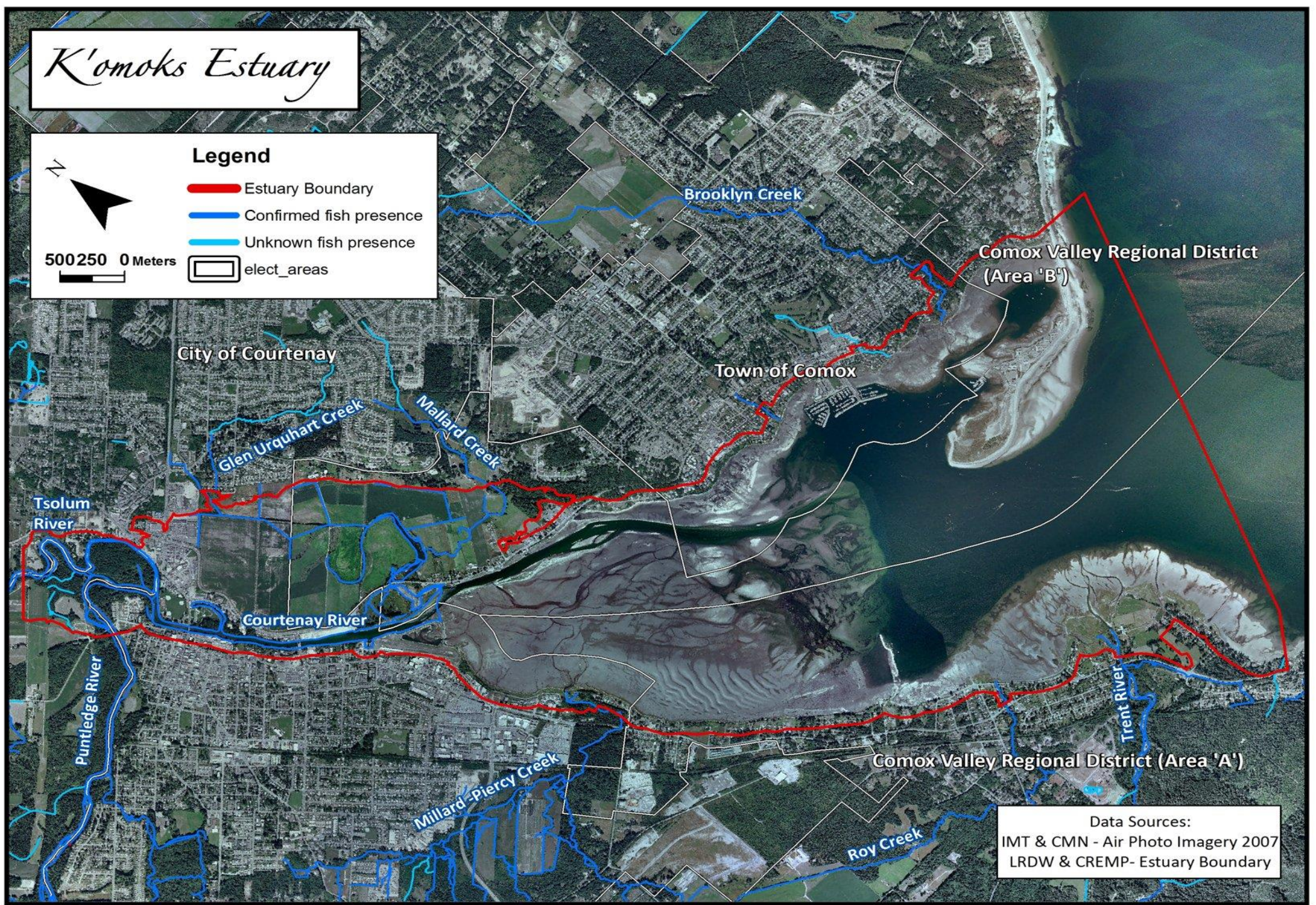
K'omoks Estuary



500 250 0 Meters

Legend

- Estuary Boundary
- Confirmed fish presence
- Unknown fish presence
- elect_areas



Data Sources:
IMT & CMN - Air Photo Imagery 2007
LRDW & CREMP- Estuary Boundary

Lower Watershed and Estuary Ecosystem Services

- River floodplains, estuarine and coastal ecosystems are some of the most populated and most threatened landscapes in the world.
- It is important to understand what is at stake in terms of critical benefits and values that these ecosystems provide.
- Services provided by these ecosystems can be grouped into three main categories:
 1. Ecological Services – habitat services and functions. These are fundamental life-support processes upon which all organisms depend.
 2. Economic Services – Protecting healthy watersheds and estuaries can reduce capital costs for water treatment plants, reduce damages to property and infrastructure due to flooding, and generate revenue through property value premiums, recreation and tourism.
 3. Community Services – Culturally important, recreational opportunities physical and mental health benefits.

Lower Watershed / Estuary Ecosystem Services

- Lower Watershed / Estuary area is the area which includes the lower reaches of the river mouths – where they meet the sea and salt water mixes with fresh as the tide goes in and out.
- This is an extremely productive ecosystems and, although, estuaries make up less than 3% of BC's coastline, 80% of our wildlife depend on estuaries at some point in their life history.
- Prevent or reduce pollutants entering into the environment.
- Provide storm protection. They stabilize shorelines and protect coastal areas, inland habitats and human communities from floods and storm surges.
- The K'omoks Estuary is an internationally recognized Important Bird Area, contains the remnants of ancient fish traps, and supports 5 species of Pacific salmon.

Coastal Shoreline Ecosystem Services



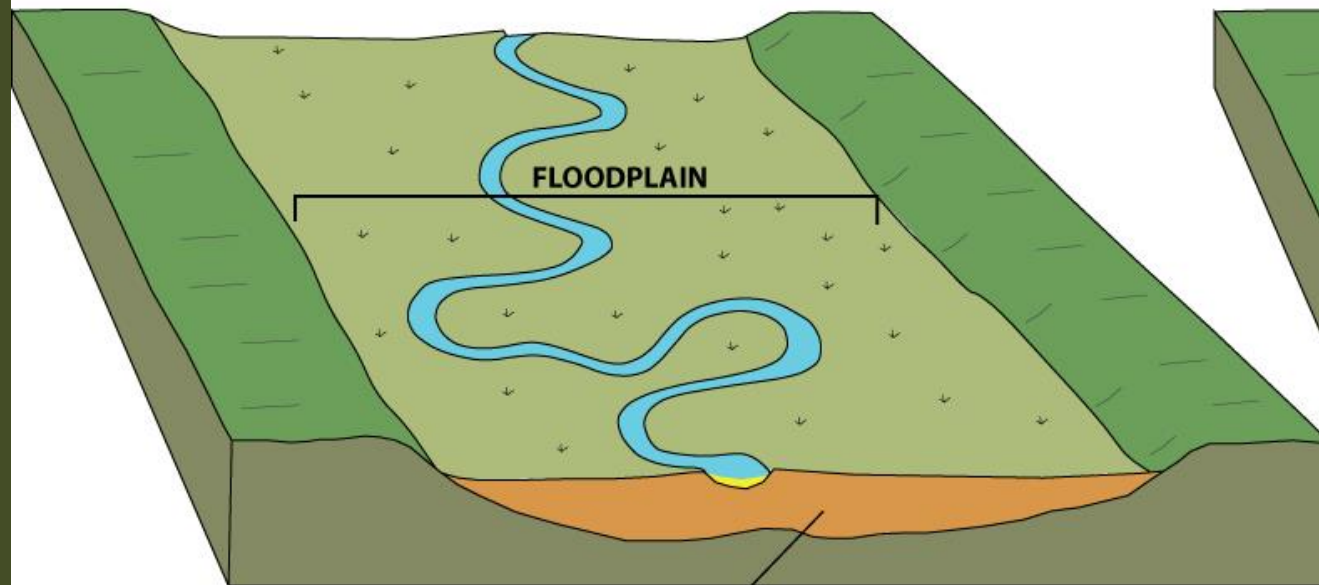
- Preserve physical processes - the natural actions of water and sediment movement that maintain healthy shorelines, sediment transport process.
- Maintain habitat diversity and function along the shoreline and create natural areas.
- Sequester carbon.
- Dissipate wave energy, reduce erosive forces.
- Offer a resilient approach to climate change adaption.
- Ecosystem Services are nearly always undervalued.

River and Floodplain Ecosystem Services

What is a Floodplain?

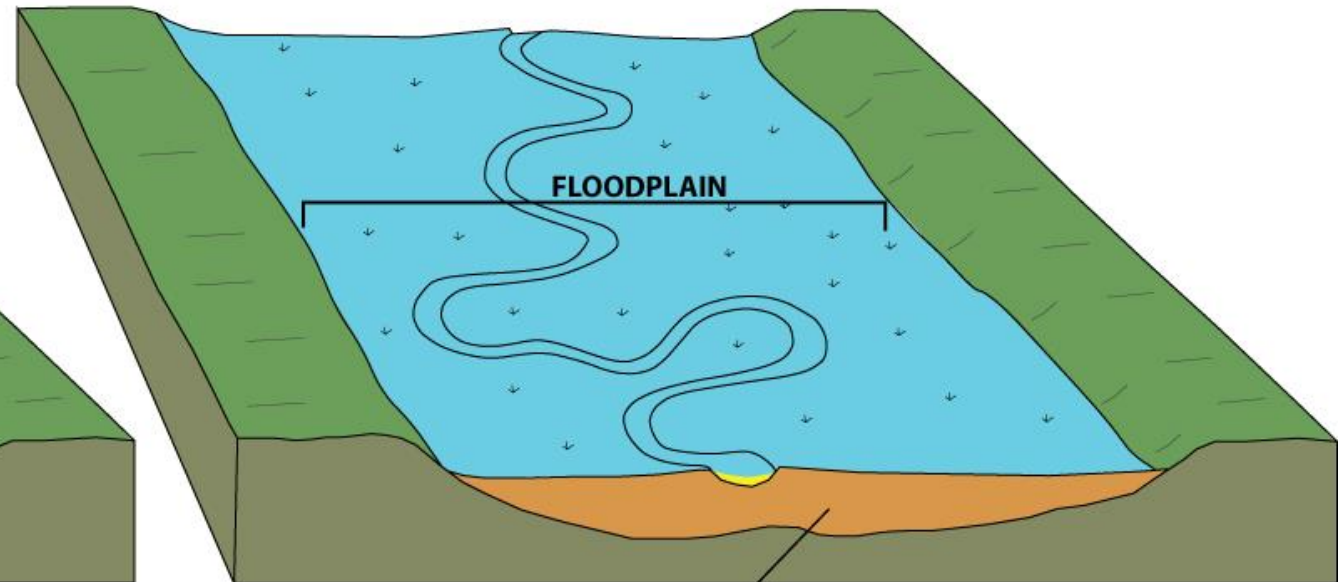
A floodplain is the lowland adjacent to a river, lake, creek, or ocean. When floods occur water flows onto these nearby low-lying lands.

NORMAL CONDITIONS



older river channel and floodplain sediments

FLOOD CONDITIONS



older river channel and floodplain sediments

What Services does a Floodplain Provide?

1. Biological functions

- Floodplains enhance biological productivity by supporting a high rate of plant growth;
- Floodplains provide excellent habitats for wildlife;
- In particular they create diverse habitat for fish production in surface waters;
- They provide waterfowl habitats, and help to protect habitats for rare and endangered species.

2. Societal resources and functions

- Floodplains benefit communities through:
 - Food production;
 - Recreational and cultural opportunities;
 - Opportunities for scientific research;
 - Flood and erosion control...

3. Natural flood and erosion control functions

- Flood storage and
- Flood conveyance - reducing the number and severity of floods
- Reduce erosion impacts and sediment loading. A naturally vegetated floodplain slows the rate of overland flow.

4. Surface Water Quality Maintenance

- Natural controls on flooding and erosion help maintain water quality by:
 - Filtering nutrients and impurities from runoff. The natural vegetation filters out impurities and uses excess nutrients.
 - Minimizing non-point source water pollution. By allowing floodwater to slow down, sediments settle out.
 - Moderating temperature.

5. Groundwater Recharge

- A healthy floodplain provides for infiltration of surface runoff and aquifer recharge,
- Reduce frequency and duration of low surface flows.

*Such natural processes **cost far less money than it would take to build infrastructure to correct flooding, handle storm-water, deal with water quality and other community problems. Therefore a natural functioning floodplain is an eco-asset.***

Impacts to floodplains

- Human development and industrialization has taken a toll on the natural functions of the floodplain.
 - Development in the floodplains causes:
 - Decreases in water quality
 - Loss of wildlife habitats
 - **Increase in the severity and frequency of flood losses.**
- Why?**
- *Hydrological function of the floodplain has been altered.*

Disruption of the Water Cycle



- When development occurs, the land alteration can lead to dramatic changes to the hydrology, or the way the water is transported and stored.
- Impervious surfaces associated with development block water and little rainfall is absorbed by the soil.
- Surface runoff increases and groundwater infiltration decreases.

Changes to the floodplain function



- Many developments are built within the floodplains of rivers and streams. By filling these areas, important flood storage capacity is removed.
- When a floodplain is filled, water cannot spread out. Displaced water must go somewhere; usually flooding is forced into other areas.
- Building in the floodplain may also constrict the area where water can flow. Water velocity increases causing additional erosion problems.

Physical Changes to the Floodplain



- Reduced floodplain area and formation of channelized floodway.
- Armoring of banks to control erosion.
- Loss of instream and substrate habitat diversity.
- Construction of dams – disrupt hydrology as well as fish passage and habitat diversity.

Reduced stream length (loss of meanders), increase in gradient and water velocity



1949



1982

Photograph of Okanagan River where it drains into Skaha lake.
Source: Province of B.C.

How did we get here?

- Goal has been to reduce flood losses;
- Natural processes in floodplains have not been taken into consideration or are less of a priority;
- Development-centered uses such as agriculture, municipal and road infrastructure have taken precedence over protection of floodplain function.

Working with the Natural Floodplain

- We need to work with the natural floodplain – to recognize the **natural flood relief infrastructure – of this ‘eco-asset’**.
- **We need to ensure floodplains are used and managed in ways that enable them to provide ecological services, while maintaining or even improving flood protection and / or flood relief.**
- We need to identify locations to reclaim natural floodplain habitat and function.

How to restore floodplain functioning...

Floodplain attributes:

1. **Connectivity** –A functional floodplain is physically accessible by water from its adjacent river or stream to allow an exchange of water, nutrients, sediment, and organisms.
2. **Hydrology** - A functional floodplain is connected to a river capable of producing flows with magnitudes large enough to inundate the floodplain. Additionally, a river must produce such flows at specific times of the year, for adequate spans of time, and at variable return frequencies to maximize a full range of ecological functions.
3. **Geomorphology** - A floodplain must have the space to accommodate inundation and the resulting habitat and landscape forming processes that occur.
4. **Riparian vegetation** - Riparian vegetation moderates flooding by slowing flood water and allowing it to recharge shallow aquifers. Riparian ecosystems also function to filter sediment and nutrients, naturally improving the water quality.

What does this all mean?

- Make sure water can get on the floodplain at the right time, in the right amount, and for the right duration to support a natural floodplain habitat.
- The result will be a more naturally functioning river and floodplain that maximizes floodplain and river benefits including:
 - habitat for fish and wildlife,
 - improved water quality,
 - Improved groundwater supplies, and
 - the ability to safely convey floodwater and makes communities more resilient to flooding.

Room for the River

Refocus on the Comox Valley Floodplain



Flooding is not a new problem.



***“Floods are
'acts of god',
but flood
losses are
largely acts
of man.”***

Gilbert White,
Geographer

Downtown Courtenay flooding, 1939.

Field Sawmill Site

Development in the Lower floodplain;
Loss of flood attenuation capacity, river channelized.



Natural Floodplain Boundaries



Aerial photo shows the flood plain zone where development has been allowed.



Potential flood relief connections



Dec. 2014 Flooding on Hwy 19A





Dec. 2014 - English Car Centre



Possible flood relief connection on Green Slough behind Simms Park



Concerns with Diking Options

Results of all options modeled, in City of Courtenay 2012 report, show that the flood is pushed upstream with less use of the floodplain.

Courtenay River – upstream of 5th St. Bridge – Property at Risk



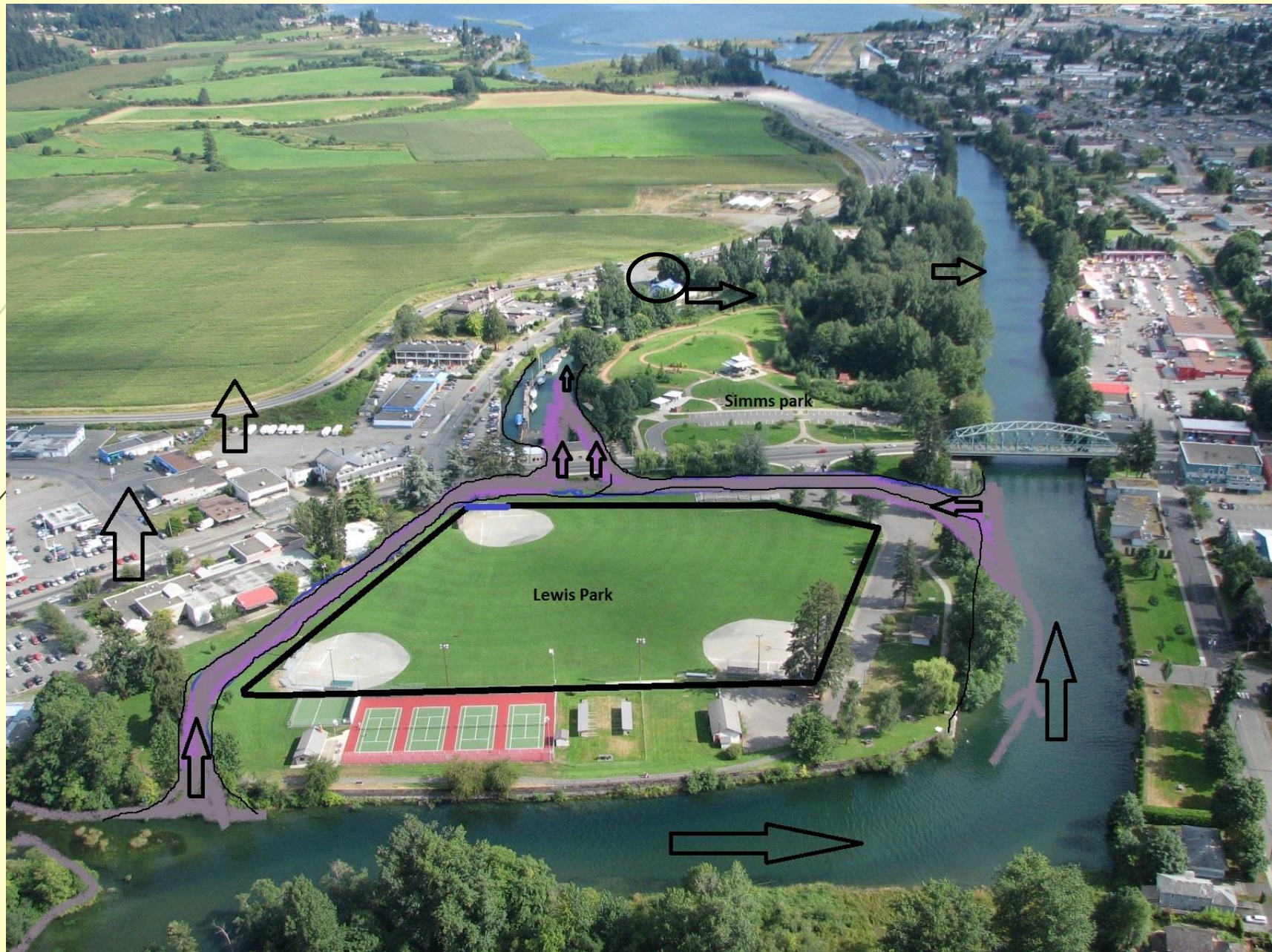
Short-term fixes are expensive and can cause more problems



- Tsolum River 'Tall Wall'.



- Courtenay Youth Hostel riprap



Benefits of a Functioning Floodplain:

1. Uses the services provided by the ecosystem rather than adding to infrastructure.
2. Provides natural flood relief and ensures any flood protection needed will be the minimum required.
3. A functioning floodplain be the best preventative for minimizing the anticipated effects of climate change.

Thank you.

