Salmon River Delta

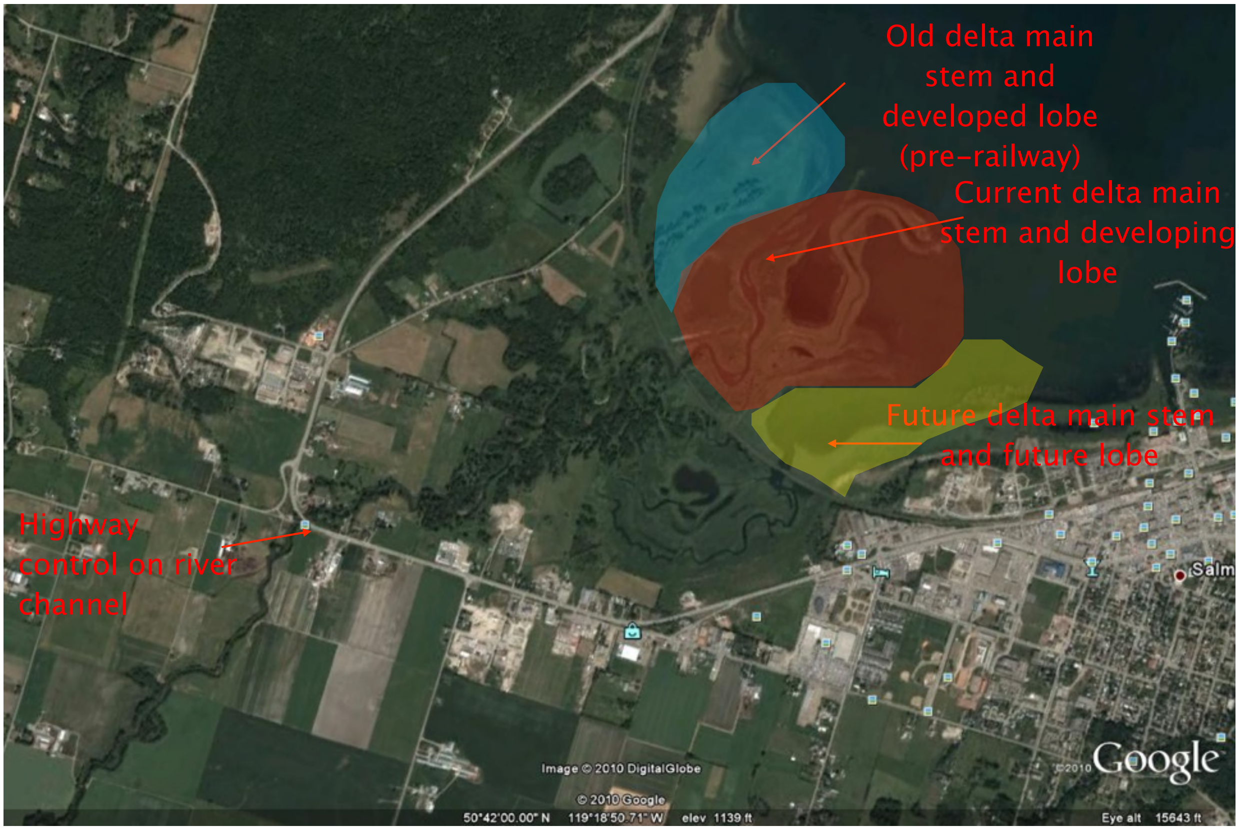
Over the past several years there has been significant discussion surrounding development proposed adjacent to the Salmon River west of Salmon Arm. Most of this discussion has been focused on flooding, riparian areas and fish habitat. However, there has been little to no acknowledgement of the landform in which the development is proposed. This landform is an integral portion of the Salmon River Delta. It is not a floodplain. Floodplains exist adjacent to streams and rivers and develop in response to lateral migration of the river and periodic overbank flooding and sedimentation. Deltas develop where rivers and streams enter standing water bodies such as lakes and oceans. The delta represents the terminal point of sediment transport and the end of the fluvial process.

The Salmon River is a highly constructive elongate or “birds foot” delta. Natural delta forming processes in constructive deltas involve the periodic migration of the main stem river channel, which is the primary source of sediment to construct the delta, across the delta surface. The deposition of sediment within the channel and the outward extension of the channel into the standing water body gradually decrease the capacity of the channel to carry water and sediment. It is this reduction in capacity that ultimately results in the main river channel shifting to another part of the delta where the water flows to the standing water body are shorter resulting in a steeper stream gradient and improved sediment transport. Development on deltas typically does not consider these natural land-forming processes and channel shifting. As a result, costly dyking, dredging and other flood control measures are required to safeguard development. Examples of these requirements can be found throughout the world. In addition, disasters associated with development on deltas are all too common.

Natural processes within the Salmon River delta have been influenced by the construction of the CP Rail line in the late 1800’s. This embankment construction has resulted in only two potential channels for the Salmon River to use in its ongoing construction of the delta (the current river channel crossing and the crossing currently used by Hobbs Creek). The construction of the highway to the southwest of the railway line has also had a significant effect on delta activity, by restricting the river to a single channel.

Natural sediment sources exist within many areas of the Salmon River watershed. Road construction, land development, farming and forest operations undoubtedly have increased the sediment load within the Salmon River. This in turn has likely increased the rate of delta development. The delta activity will eventually shift its path over to the Hobbs Creek outlet beneath the railway, a place that it has most certainly been before. Trying to stop this eventual shift would require extensive dike construction and dredging all at the expense of the taxpayer and the environment. Allowing the river to shift would create new habitat and alter the use of existing habitat, all of which are natural processes.

Development on the delta of the Salmon River without a detailed analysis and understanding of the delta forming process, the influence of existing development (roads, railways and upstream sediment load) and impact of the proposed development is irresponsible.



Definition of Delta and Floodplain (from Mollard)

DELTA A body of sediment deposited by a stream flowing into the standing water of a lake or the sea. The name is derived from the similarity of a delta's plan view to the triangular outline of the Greek capital letter delta. As sediment is deposited in a deltaic environment, it becomes easier for the river to divide and flow to each side. Each new branch forms new banks, and these eventually divide and subdivide. In this way the main delta, as well as subdeltas, grow outward and are characterized by a branching network of main passes and smaller distributary channels. Small deltas may be formed where meltwaters discharge into a temporary glacial lake, where modern rivers enter a lake, or at the confluence of two rivers – especially where a swift stream heavily laden with sediment joins a much slower and more sluggish larger river. According to details of their shape and origin, various types of deltas can be recognized, such as arcuate, bayhead, birdfoot, cuspate, digitate, esker, estuarine, fan, glacial, inwash, kame, lobate, outwash, tidal and washover deltas. Changes in the configuration and surface morphology of deltas fall into three categories: 1) those associated with continuing deposition of fluvial sediment, 2) those related to shore processes on the delta margin, 3) those affecting the surface of the delta generally. Fluvial deposition takes place at the mouths of rivers where horizontal accretion tends to prograde natural levees offshore as sedimentary jetties. Shoals flanking deeper outflow distributary channels indicate the probable pattern of future growth of sedimentary jetties as subaerial forms. Once established, they develop as natural levees and are built up and broadened by deposition from floodwaters. Modern deltas display great variety in size, shape, structure, composition (clay, silt, sand, or gravel), and genesis. The coarsest particles settle out first in shallow-water channel beds and on levees, and the finest sediments settle farther out in slackwater and deep offshore waters. The mingling of salt and fresh waters causes individual clay particles to cluster into larger aggregates. Some of the major factors that influence the character of deltas include 1) geologic setting and sediment sources in the drainage basin, 2) climatic conditions in both the drainage and depositional basin, 3) tectonic stability of the sedimentary basin, 4) gradient and regime of the stream carrying sediment to the delta, 5) depositional and erosional processes and their intensities within the delta, and 6) tidal range and offshore hydrologic conditions. Many large deltas in lakes and the sea show several distinguishable depositional environments, yielding different textural and stratigraphic patterns. Among these are the environments of channels, including main passes; subaqueous and subaerial levees; interdistributary troughs and mudflats; marshes and swamps; freshwater lakes and ponds; and crevasse splays.

FLOODPLAIN 1) Flat land bordering a stream and subject to periodic flooding by the stream. Two or more levels of flooding may be present. 2) That flat land bordering a stream which is being constructed by the depositional processes of the present stream, and is not therefore a terrace (q.v.). In this sense, a floodplain may be relatively active – say, flooded once every one or two years; or virtually inactive – say, flooded only once every ten or twenty years – in which case it may be referred to as a low terrace, inactive high-level floodplain or, less commonly, a fossil floodplain. Frequency of flooding suggests an interrelationship among the height of a floodplain, the thickness of overbank sediments, and the geometric and hydraulic characteristics of the stream that build the floodplain. In most places, local relief of the inactive floodplain consists of widely spaced channels of tributary streams and vestigial channel-like landforms. Relatively flat interchannel areas are formed by repeated flooding and overbank deposition, the increments of which commonly tend to be thin (small fractions of an inch), patchy in distribution, and relatively fine (fine sand, silt, clay) in texture. The role of vegetation in floodplain deposition and the resulting surface configuration may also be important. In general, the texture of surface materials composing floodplains decreases with increasing distance from the stream channel. Somewhat coarser-textured materials tend to occur more extensively nearer the stream channel. The proportionate extent, however, depends importantly on local conditions of flooding and the character of the sediment load. Thick floodplain deposits show rough stratification of soil textures, with the coarsest materials usually in the base of the sediments (substratum), including coarse sand and gravel and possibly even quite large boulders and progressing to finer soil textures at and near the ground surface (topstratum) where clay, silt, and find sand predominate. Floodplain sediments are commonly stratified in more or less horizontal layers of similar textural composition. Also, however, they may appear as a series of overlapping and interfingering lenses having different textural characteristics. These materials may show either poor or good sorting. There is a general relationship between meandering and braided patterns of stream channels in floodplains and their stratified and lenticular structures. Braided channel deposits are generally coarser (sand, gravel, cobbles) than the deposits of freely meandering streams, but this also depends on stream gradient and size of sediment available for transport. Coarser textures tend to concentrate toward the base of river bars and alluvial fills, with finer sediments occurring toward the top and toward the outer edges of the active channel and its floodplain. The rate of channel movement is related to bank stability, which is partly a function of the texture of the underlying alluvium. Cohesionless granular alluvium, for example, is easily eroded and generally forms more unstable banks than uniform, cohesive, silty and clayey alluvium having a higher shear strength. Stream banks and beds with a large proportion of silt and clay are cohesive and so tend to resist erosion. Streams with cohesive banks have narrower widths and higher banks than streams flowing in cohesionless sediments of clean sand and gravel. In other words, where the alluvium in the beds and banks of floodplains is sandy, or composed of sand and gravel with a low content of silt and clay, stream channels tend to form wide and shallow cross sections and to have relatively steep gradients. Sediment accumulation from overbank flooding and deposition seems to be a relatively minor component that adds to the height of a floodplain – probably seldom accounting for more than 10% of its thickness, with 90% or more being contributed by the bedload in the bottoms of sideways-shifting stream channels. The overbank flood deposits are found mainly in the topstratum of floodplains and are referred to as vertical-accretion deposits. They are usually finer in grain-size than any associated lateral-accretion deposits – for instance, point bars. The coarser fraction of the load in transit produces braided elongate river bars and consists chiefly of bedload deposits occurring below the active floodplain and beneath the finer topstratum deposits of inactive floodplains. Where the channel has stable banks, lateral channel movement is relatively slow and repeated additions of the overbank deposits are responsible for the development of natural levees whose textures vary from sand to clay, depending on regional geomorphic and hydrologic settings, but generally becoming finer in a downstream direction. Another source of sediment in the more remote areas of wide vertical-accretion floodplains comes from tributary flooding (laterally away from the stream). In many places this source of sediment may be a far more important factor in modifying the floodplain surface than floods from the parent, or main, stream. The finer texture of surface deposits (topstatrum) of the inactive floodplain, especially the more remote locations of extensive floodplains, means that this zone has relative poor surface and subsurface drainage. These regions are variously called backswamps, slackwater flood basins, ponded backlands, and marshy lacustrine basins.