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RESOURCE STEWARDSHIP DEPARTMENT

Creating Solutions for Our Future

Joshua Cummings,
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MEMORANDUM (3)

TO: Thurston County Planning Commission
Mineral Resource Lands Focus Group Members

FROM: Maya Bühler, Associate Planner
Allison Osterberg, Senior Planner

DATE: November 9, 2017

SUBJECT: Comprehensive Plan Update - Mineral Resource Lands: Floodplains

The questions outlined below were raised at the Mineral Resource Lands Stakeholder Group Meeting on September 19, 2017, in which initial drafts of the designation criteria and maps were discussed. Staff provided responses to some questions at the October 18 planning commission meeting; this memorandum is a continuation of that discussion.

One of the questions raised was regarding the compatibility of mining in floodplains. Stakeholders asked the following questions:

- What evidence is there that mining activities are not compatible with floodplains?

This memo addresses this question using existing literature. Currently, the data used to exclude the 100-year FEMA floodplain is FEMA's 100-year floodplain data, or the 1% chance of annual flooding. Approximately 2,604 acres are excluded from the mineral resource land baseline (Map 1) using the 100-year FEMA floodplain data, or less than 2%. An amount of this acreage does overlap with wellhead criteria, and may overlap with other exclusionary criteria being considered.

The 100-year floodplain area being considered for exclusion is one of five critical areas protected under the Washington State Growth Management Act. Currently, the 100-year floodplain is not identified as an exclusionary criteria for the designation of mineral resource lands. This criteria is currently addressed in the Critical Areas Ordinance, at the site-specific level (Table 24.20-1, TCC 24.20.080):

> Mineral Extraction is prohibited in floodways, frequently flooded areas, channel migration hazard areas, and coastal flood hazard areas. Mineral extraction is permitted, subject to a critical area review, in high ground water hazard areas.

One of the issues brought forward in *Weyerhaeuser et al. v. Thurston County* (2010)[1] was the preclusion of critical areas from co-designation with mineral lands. The GMA addresses overlapping designations in WAC 365-190-040(7)(a) and WAC 365-190-020(7), which state in part (emphasis added):

> WAC 365-190-040(7): Overlapping designations. The designation process may result in critical area designations that overlay other critical area or natural resource land classifications. Overlapping designations should not necessarily be considered inconsistent. If two or more critical area designations apply to a given parcel, or portion of a given parcel, both or all designations apply.
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> WAC 365-190-040(7)(a): "**If a critical area designation overlies a natural resource land designation, both designations apply.** For counties and cities required or opting to plan under the act, reconciling these multiple designations will be the subject of local development regulations adopted pursuant to RCW 36.70A.060."
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> WAC 365-190-020(7): "It is the intent of these guidelines that critical areas designations overlay other land uses including designated natural resource lands. For example, if both critical area and natural resource land use designations apply to a given parcel or a portion of a parcel, **both or all designations must be made**. Regarding natural resource lands, counties and cities should allow existing and ongoing resource management operations, that have long-term commercial significance, to continue. Counties and cities should encourage resource land managers to use the best management practices of their industry, especially where existing and ongoing resource management operations that have long-term commercial significance include designated critical areas. Future operations or expansion of existing operations should be done in consideration of protecting critical areas, and with special consideration for conservation or protection measures needed to preserve or enhance anadromous fisheries."

Is mining compatible with FEMA flood zones?

Floodplain mining has been a common source of fluvial resources over the past half century. Gravel resources are often plentiful near rivers, and therefore mining has often been located in the floodplain, and sometimes directly in the river channel. While mining in the floodplain may make obtaining resources relatively easy, floodplain mining has been shown to create adverse ecological conditions and can pose a threat to infrastructure. In Washington, floodplain mining and digging gravel pits near rivers is a common activity. Gravel pits have been located near rivers and excavated for material to use in highway projects, which can lower cost material.

[1] Weyerhaeuser et al. v. Thurston County (2010). Case No. 10-2-0020c. <http://www.gmhb.wa.gov/LoadDocument.aspx?did=2672>

Examples include I-90 along the Yakima River, I-5 where it crosses the Skookumchuck River at Centralia.[2]
The Mineral Lands Task Force (July, 2004) recommended that mineral lands may not be located within 100-year floodplains. This criterion was designed primarily to help prevent river avulsion, which research supports. At the time, one negative opinion of this option was that floodplains are not 100% accurately mapped. The FEMA flood zone data has been updated and accuracy has improved since this initial report in 2004.

***Channel Avulsion*.** Channel avulsion is commonly cited as a concern with mining in the floodplain. A 2005 report from the U.S. Department of Interior[3] discusses findings from the effects of floodplain mining and potential rehabilitation along the Yakima River in central Washington. Dikes and levees are often constructed for mining pits in active floodplains, disconnecting the river from the floodplain and narrowing the river corridor. A narrow river corridor can result in higher velocity and increased depth, creating conditions of increased stress, channel incision, increased bed material and erosion. Additionally, temporary storage of flood waters may be prevented. Channel avulsion may be an unintended consequence if a pit is captured by channel migration; this can result in sediment trapping for decades or even longer, affecting the river in the area. A channelized river has far-reaching effects on transportation, irrigation, wastewater, infrastructure, habitat complexity, and other processes.[3]

According to Schnitzer (2004), once a pit is captured, nearby pits within the same floodplain and river corridor are at greater risk for avulsion.[4] Table 1 (below), an excerpt from the U.S. DOI (2005) report and Gindeland & Hadley (2003)[5], illustrates potential risks and concerns upstream, locally, and downstream of a pit.

***Ecological Concerns*.** Ecological concerns of floodplain mining area also relevant. Floodplains support diverse plant and animal populations, including salmon, and help to protect human life and health, minimize property damage and other flood-related hazards. Flood plain recovery and river sediment transportation could take millennia; the time of recovery is highly dependent on the availability of sediment, particle size, gradient, and the size of excavations to be filled. Removal of gravel from the floodplain and river can result in an excess of sand and other fine materials in the river bed.[6] Increased volume and velocity, combined with erosion and sedimentation can result in habitat loss and degradation (VSP, 2017). Habitat loss from sedimentation has been identified as a major water quality issue for streams within Thurston

[2] Norman, D.K., Cederholm, C.J., and William Lingley. (1998). "Flood Plains, Salmon Habitat, and Sand and Gravel Mining." *Washington Geology 26(2/3).* <http://www.northcoastresourcepartnership.org/files/managed/Document/7608/agg-10%20norman%20et%20al%20fldplain.pdf>.
[3]Bureau of Reclamation. (Sept. 2005). Rehabilitation of Floodplain Mining Pits: Interim Report Detailing Initial Plans and Procedures. *Department of Interior*. <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&ved=0ahUKEwilmPWFtdrWAhUW2WMKHVDMAu4QFggxMAI&url=https%3A%2F%2Fwww.usbr.gov%2Fresearch%2Fprojects%2Fdownload_product.cfm%3Fid%3D158&usg=AOvVaw3uguWl4Y7V6LzvfkIqCk2Z>.
[4] Schnitzer, E.F. (2004). "Rogue River Stakeholder Project – Phase 2: Completion Report and Year One Monitoring Report", State of Oregon Department of Geology and Mineral Industries, Open File Report OFR O-04-14.
[5] Grindeland, T.R. and Hadley, H. (2003). "Floodplain gravel mine restoration: Peril or opportunity?", in: World Water and Environmental Resources Congress, Philadelphia, Paul Bizier and Paul DeBerry (Eds.).
[6] Simmang, Cody. (2006). Effects of Floodplain Gravel Mining on the Colorado River, Texas. *Texas State University*. <http://www.seas.virginia.edu/research/curran/GravelMining.htm>.

County (Thurston County Water Resources Monitoring Report). Streambed sediment condition is frequently cited as a major habitat limiting factor for salmon and steelhead (VSP, 2017).

According to Brookes (1989), habitat complexity is also lost when a river becomes channelized, resulting in habitat that is not beneficial to many native species. Natural processes such as channel migration, bar building, accumulation of woody debris, and side channel development can no longer take place.[7] Side channels and other off-channel habitat has been shown to be ecologically important to the salmonid species because they provide refuge from high-flow events and spawning areas as well as habitat for juvenile development.[6,8]

Table 1: Summary of potential impacts caused by floodplain gravel pit capture (DOI, 2005; taken from Grindeland and Hadley, 2003)

Elements of Avulsion	**Nature of Impact**		
	Upstream	**Local**	**Downstream**
Geomorphic Characteristics	• Incision of channel • Increased gradient • Coarsening of bed • Undercutting and erosion of banks • +/- lateral migration rates	• Alluvial fan development • Reshaping of pits • Loss of natural channel geometry • Increased open water area	• Increased lateral migration • Increased channel width
Sediment Transport	• Increased sediment transport capacity • Reduction in bed load deposition	• Deposition of sediment pits • Short-term increase in turbidity • Erosion of gravel pit banks	• Reduced sediment supply • Erosion of bed • Coarsening of bed • Increased bank erosion • Short term increase in fine sediment supply
Hydraulics	• Increased slope • Increased velocity • Decreased normal depth • Increased bed roughness	• Decreased slope • Increased channel depth • Increased channel width • Reduced bed roughness	• Increased bed roughness

[7] Brookes, A. (1989) Channelized Rivers – Perspectives for Environmental Management, John Wiley and Sons, p. 23.
[8] NOAA. 2014. The importance of Healthy Floodplains to Pacific Salmon and Steelhead. <http://www.westcoast.fisheries.noaa.gov/publications/habitat/fact_sheets/floodplains_fact_sheet_031114.pdf>.

Hydrology		• Increased flood storage • Increased evaporation • Altered groundwater flow patterns	• Reduction of flood levels • Attenuation of flood peaks • Changes in summer low flows • Lower riparian groundwater levels due to bed lowering
Water Quality		• Temperature increase • Short-term increase in turbidity • Alteration of hyporheic zone	• Temperature increase • Short-term increase in turbidity
Aquatic Habitat	• Habitat disruption or loss due to channel incision • Potential conversion of habitat type/quality • Short and long term habitat instability	• Conversion of free flowing habitat to still water habitat • Potential capture of fish following floods • Potential release of non-native species from captured pit(s) • Alteration of hyporheic zone • Short and long term habitat instability	• Habitat disruption or loss due to erosion of bed • Habitat loss due to altered sediment supply • Potential conversion habitat type/quality • Short and long term habitat instability

Conclusion

Several concerns exist around mining in the floodplain, including channel avulsion and ecological concerns. Studies on mining pits along the Yakima River have highlighted that there are many concerns with floodplain mining, including but not limited to: pit capture, channel incision, channel migration, avulsion, and sedimentation. Other risks include impacts on nearby infrastructure (roads, bridges, water, wastewater treatment plants, and irrigation) and public and private property that may be impacted due to river avulsion.

Because gravel mining on floodplains can have both short- and long-term impacts and significant implications to anadromous fish and other species, understanding the geomorphic characteristics of a proposed project site is necessary to characterize risk. Appropriate reclamation and conservation measures are essential to maintaining and restoring the floodplain after use for mineral extraction.[5]