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Riverbed Gravel Removal

Vermont's policy regarding gravel removal from the beds of rivers and streams during the aftermath of Hurricane/Tropical Storm Irene has generated a great deal of controversy—gravel removal is banned in Vermont except in times of emergency.¹ During the post-Irene cleanup the state temporarily loosened its stance on a 25 year old ban on the process.² Supporters of the action have argued that the removal of gravel would alleviate flooded rivers and streams. Opponents, however, have cited the damage caused to river systems following Hurricane Irene as a result of excessive gravel mining that occurred directly after the storm.³

In this report we seek to examine Vermont state policy regarding the issue of riverbed gravel removal and compare it with other state laws and national recommendations. Further, we will look at the potential side effects of this type of gravel removal and how they have affected Vermont and its river systems.

Side Effects of Gravel Removal

There are a number of documented negative side effects of removing gravel from river beds. The removal of gravel from riverbeds creates what is called 'Hungry Water' or water that is sediment starved.⁴ When a river becomes sediment starved due to gravel mining, several things happen. The riverbed starts to incise, or cut down deeper due to the lack of sediment to protect

¹ The Vermont Statutes Online, "Title 10: Conservation and Development, Chapter 41: Regulation of Stream Flow, 10 V.S.A § 1021. Alteration prohibited; exceptions," accessed February 2, 2012, <http://www.leg.state.vt.us/statutes/fullsection.cfm?Title=10&Chapter=041&Section=01021>.

² Watershed Management Division, "River Gravel and Flooding," Vermont Department of Environmental Conservation, January, 2004, accessed January 26, 2012, http://www.vtwaterquality.org/rivers/docs/rv_gravel-flooding.pdf, p.1.

³ Candace Page, "Hard Lessons of the Tweed: Leaving Lives Upended, a River Reshapes, Chapter 3," *Burlington Free Press*, December 11, 2011, accessed March 14, 2012, <http://www.burlingtonfreepress.com/interactive/article/20111211/NEWS07/312110004/Hard-lessons-of-the-Tweed-Chapter-3-Leaving-lives-upended-a-river-reshapes>.

⁴ G. Mathias Kondolf, "Hungry Water: Effects of Dams and Gravel Mining on River Channels," *Environmental Management* Vol. 21, No. 4, 1997, accessed February 2, 2012, http://wou.edu/las/physci/taylor/g407/kondolf_97.pdf, p. 1.

the bed – this causes the river to become steeper. River banks also start to erode, causing the channel to become straight, as opposed to meandering. These two effects in tandem cause the river flow rate to increase, and as a result the river becomes much more powerful and creates further flooding problems downstream from where the actual gravel mining took place.⁵ While the immediate reaction to a flood may be to remove gravel in order to deepen the river, experts agree that such actions are not only temporary and perceived, but that it actually causes *further* risk of flooding.⁶ Figure 1, copied from a report by the Vermont Agency of Natural Resources, illustrates the damage caused to a river by this type of mining.

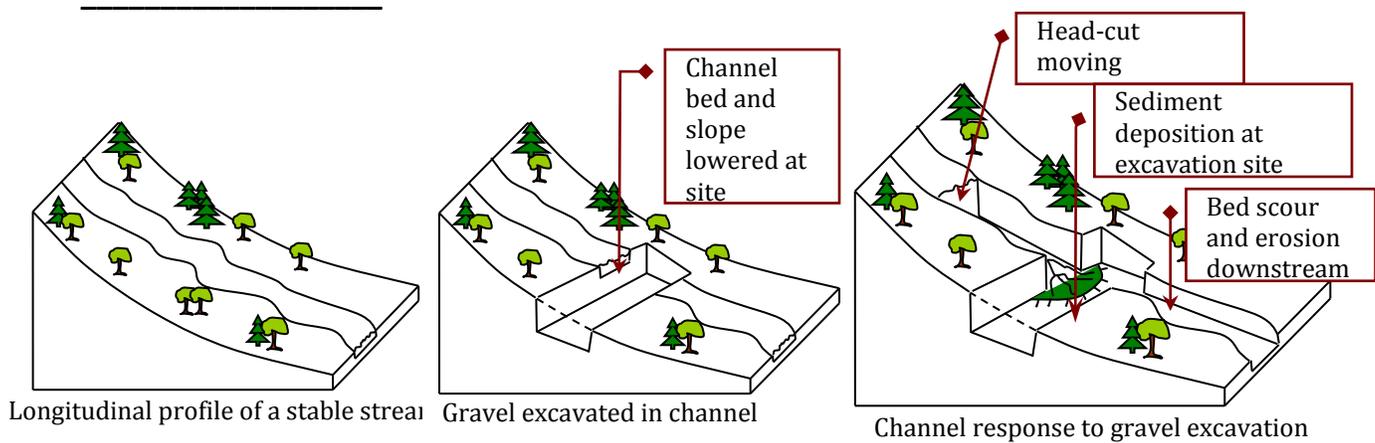


Figure 1: Channel Response to In-Stream Gravel Removal

Source: River Management Program, “Gravel Extraction and Bar-Scalping Fact-Sheet,” Vermont Agency of Natural Resources, June 14, 2005, accessed February 2, 2012, p.2.

In addition to these environmental hazards, a number of ecological risks also come to light with the removal of riverbed gravel. This type of removal has been deemed by the U.S. National Marine Fisheries Service (NMFS) to result in the degradation of the riverbed fish habitats.⁷ According to the National Oceanic and Atmospheric Administration (NOAA), the impacts caused by the extraction of gravel include,

- ...loss or degradation of spawning beds and juvenile rearing habitat; migration blockages; channel widening, shallowing and ponding; loss of hydrologic and channel stability; loss of pool/riffle structure; increased turbidity and sediment transport;

⁵ Louis Porter, “Water Also Always Finds a Way,” *Burlington Free Press*, September 25, 2011, accessed February 2, 2012, <http://www.burlingtonfreepress.com/article/20110925/GREEN01/110923018>.

⁶ Scottish Natural Heritage, “Gravel Working in the River Tay System: A Code of Good Practice,” University of Stirling, 2005, accessed February 2, 2012, http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=CASS_Good_Practices.pdf, pp. 10-11.

⁷ National Marine Fisheries Service, “NMFS National Gravel Extraction Policy,” Southwest Regional Office: NOAA, accessed January 26, 2012, <http://swr.nmfs.noaa.gov/hcd/gravelsw.htm>, Section 1.

increased bank erosion and/or stream bed downcutting; and loss or degradation or riparian habitat.⁸

It is in light of these potential hazards to the environment as well as species who reside within these rivers that many states and national agencies have undertaken efforts to curb the mining of gravel from streams and rivers. Below we will outline Vermont's own policy on gravel extraction, and further outline initiatives taken by other state and federal agencies on the issue of gravel removal.

Vermont Policy

Commercial gravel excavation from Vermont rivers and streams was a common occurrence prior to 1986.⁹ It became evident in recent years that gravel mining can cause serious threats to the stability of these rivers, and thus restrictions have been put in place for this process.¹⁰ Currently, the state of Vermont relies on the Agency of Natural Resources (ANR) to implement its policy on gravel removal.¹¹ 10 VSA, § 1021 states that, "No person shall remove gravel from any watercourse primarily for construction or for sale."¹² Exemptions are defined under § 1021 (b), 1021 (d), and 1021 (f), which account for "emergency protective measures," removal of 50 cubic yards or less excavated by landowners (on their own property), and accepted agricultural practices, respectively.¹³ Further, the ANR will issue a permit under section 1023, "protecting public safety, fish and wildlife and rights of riparian owners," if the intent of removal is done principally for the purpose of alleviating flooding or erosion conditions, as indicated by a professional in the field.¹⁴ Any other proposal for excavation, even if not intended for commercial purposes, must be deemed appropriate by the ANR to provide said relief.¹⁵

Nationwide Gravel Removal Policies

On a nationwide level, the National Marine Fisheries Service has developed a gravel policy to limit the negative effects that this extraction process has on populations of fish including their rearing, spawning, and migration patterns. This policy was designed with the hope that it would maintain fish populations and prevent the numbers of fish that are anadromous¹⁶ from

⁸ National Marine Fisheries Service, "NMFS National Gravel Extraction Policy," Section 3.

⁹ Watershed Management Division, "River Gravel and Flooding," p.2.

¹⁰ Water Quality Division, "River Gravel Excavation: When, Where or Why it Should or Should Not Be Done," Vermont Department of Environmental Conservation, January, 1999, Accessed January 26, 2012. http://www.vtwaterquality.org/rivers/docs/rv_gravel-excavatewhere.pdf, p.1-2

¹¹ Water Quality Division, "River Gravel Excavation: When, Where or Why it Should or Should Not Be Done," Vermont Department of Environmental Conservation, January, 1999, Accessed January 26, 2012. http://www.vtwaterquality.org/rivers/docs/rv_gravel-excavatewhere.pdf, p.1

¹² Watershed Management Division "Stream Gravel Removal Policy." p.2.

¹³ Watershed Management Division, "Stream Gravel Removal Policy," pp.1-2.

¹⁴ Watershed Management Division, "Stream Gravel Removal Policy," pp.1-2.

¹⁵ Watershed Management Division, "Stream Gravel Removal Policy," pp.1-2.

¹⁶ Anadromous refers to fish species that reside in salt water though migrate to fresh water for the purpose of breeding. Examples include Salmon, Sturgeon, and the Striped Bass. Source: Merriam-Webster Dictionary, "Anadromous," Merriam-Webster Inc., accessed February 15, 2012, <http://www.merriam-webster.com/dictionary/anadromous>.

dwindling.¹⁷ This policy establishes a set of loose and flexible recommendations designed to limit the amount of degradation associated with the practice of extracting gravel from rivers. Among the most pertinent recommendations are to limit gravel extraction to the bigger streams and rivers that are “braided” in nature over smaller systems. When managing gravel mining procedures, the focal point should be the protection of habitat. The impacts that the mining could have on anadromous fish populations should be analyzed by local, state, and federal stakeholders. Furthermore, restoration practices should be integrated into the overall management plan including the initiation of a program aimed at monitoring the environmental impacts throughout the project. Before the initial gravel extraction, experts should look for any potential contamination in the sediment. Lastly, when mining takes place in a floodplain, a buffer zone should be placed between the river and the floodplain.¹⁸

The NMFS also recommends that an assessment of the starting levels of environmental health should be evaluated and documented before extraction of the gravel begins. After doing this, it is recommended to maintain documentation of the health of the environment throughout the process of extraction. Finally, when the extraction of gravel is complete, the NMFS highlights the importance of formulating “a long-term monitoring and restoration program.”¹⁹ Because of the environmental and ecological risks associated with this type of sediment removal, many states have also taken initiatives to curb or regulate its use, outlined below.

In the state of Washington, a study on the effects of gravel extraction from rivers took place, focusing on the South Fork Snoqualmie River. As a result of this plan, the King County Flood Hazard Management Plan was established to deal with the issues deemed to be associated with gravel extraction in this region.²⁰ According to this management plan, it is only acceptable to extract gravel from streams and rivers to manage potential floods if there is evidence that the accumulation of gravel presents an actual increase in the risk of potential flooding and the endeavor must also be associated with an overarching management plan for flood prevention maintaining the same data as current experts.²¹

Similar to the initiatives in Washington, Oregon has developed a Comprehensive Conservation Management Plan for the Tillamook Bay region to deal with sedimentation, erosion, flooding, habitats, and the quality of water resulting from gravel extraction.²²

¹⁷ National Marine Fisheries Service, “NMFS National Gravel Extraction Policy,” Section 1.

¹⁸ National Marine Fisheries Service, “NMFS National Gravel Extraction Policy,” Section 4.

¹⁹ National Marine Fisheries Service, “NMFS National Gravel Extraction Policy,” Section 5.

²⁰ Department of Natural Resources and Parks, “South Fork Snoqualmie River Gravel Removal Study,” River and Floodplain Management Section, January, 2011, accessed January 26, 2012, <http://your.kingcounty.gov/dnrp/library/2011/kcr2216.pdf>, pp. 4-5.

²¹ Department of Natural Resources and Parks, “South Fork Snoqualmie River Gravel Removal Study,” pp. 12-13.

²² Tillamook County Board of Commissioners, “Stream Corridor Management Plan,” Tillamook County Oregon, March 25, 2000, accessed January 26, 2012, <http://www.co.tillamook.or.us/gov/bocc/STREAM%20CORRIDOR%20MANAGEMENT%20PLAN.htm>, pp. 1-3.

While the state of Missouri recognizes the convenience and economic benefits of gravel removal, it is also aware of the associated negative impacts. In light of these impacts, Missouri has banned direct in-stream mining; they do however allow gravel removal from floodplains and riverbanks with permits.²³

Meanwhile, the Pinal County Department of Public Works in Arizona has developed a floodplain management plan that encompasses a broader scope of protection when dealing with river gravel mining. It is in this county that the following policies have been established to maintain the health of the Arizona floodplains: when possible, mining sites should be placed out of the floodplain; areas prone to erosion should be avoided when siting mines; and “a reclamation plan” must be included in the initial planning of the extraction to ensure that the river and surrounding floodplain are protected in the long term. It is through a culmination of these policies that the Pinal County officials are attempting to ensure the protection of Arizona floodplains from the effects of gravel extraction.²⁴

Impacts in Vermont

The issue of gravel removal is a point of contention in Vermont politics. One side argues that gravel excavation has a negative impact on the rivers’ habitat and will actually make future floods worse. Others argue that gravel excavation will help with infrastructure and jobs, in addition to alleviating flood risks.²⁵ This issue came to the forefront shortly after Tropical Storm Irene caused extensive flooding and infrastructure damage in the state. Many Vermont citizens who live in close proximity to affected rivers decried the states policy on gravel removal in this circumstance. Following the storm, Governor Shumlin relaxed regulations relating to gravel extraction. In an interview with Vermont Public Radio on September 3rd, 2011, Shumlin stated, “You still need to call ANR to get approval. But we have asked all levels of state government to relax regulations where necessary to get us through this crisis. And the example is: we have literally highways and roads that have washed into rivers. And it makes the most sense to extract that gravel and extract that fill and put it back into the roads.”²⁶

²³ Land Reclamation Program, “Pollution Prevention and Compliance Guide for Sand and Gravel Removal,” Missouri Department of Natural Resources, accessed February 23, 2012, June 2007, <http://dnr.mo.gov/pubs/pub1056.pdf>, pp. 3-5.

²⁴ Pinal County Department of Public Works, “Sand and Gravel Mining Floodplain Use Permit Guidelines,” Sand and Gravel Floodplain Use Permit Application Guidelines, May 2006, accessed February 21, 2012, http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&ved=0CDIQFjAC&url=http%3A%2F%2Fpinalcountyaz.gov%2Fdepartments%2Fpublicworks%2Fdocuments%2Fmanuals%2Fsgguidelines.pdf&ei=EctDT6u0DYeM0QHfqiDoBw&usg=AFQjCNG4xoC1V6TPCPyOmXnM63xZFR4W_w, p. 1-2.

²⁵ John Dillon, “Environmentalists Ask State to Halt River Dredging”, Vermont Public Radio, September 29, 2011, accessed January 30, 2012, http://www.vpr.net/news_detail/92128/environmentalists-ask-state-to-halt-river-dredging.

²⁶ VPR Staff, “Shumlin Relaxes Environmental Rules for Flood Cleanup,” Vermont Public Radio, September 3, 2011, accessed January 30, 2012, http://www.vpr.net/news_detail/91850/shumlin-relaxes-environmental-rules-for-flood-clea.

This was done for several reasons. Firstly the state had a large demand for gravel following Irene in order to repair damaged roads. Property owners also reasoned that removing gravel from rivers would allow greater water flow through the river, and thus less flooding.²⁷ These decreased regulations included a temporary policy in which written permits for streambed alteration (gravel removal) were no longer needed and verbal permits were deemed sufficient.²⁸

However, the initiation of verbal permits caused miscommunication and often led to more extensive excavation than planned.²⁹ Jim Ryan, a state watershed coordinator who was called into service as an additional river management engineer following Irene, noted that in over one quarter of the 60 excavation sites he had visited in the period post Irene, more excavation took place than was authorized by the state. These sites included: Lilliesville Brook, Ottauquechee Water Shed, Locust Creek, and the Tweed River; some of which had excavation initiated with no authorization.³⁰ In the case of the Tweed River, over one third of a mile of the river had to be completely resculpted in order to repair damage caused by over excavation of gravel, at a cost to both property owners and the state.³¹

Conclusion

Riverbed gravel removal is a contentious issue in the state of Vermont. There are those who both support and oppose it in Vermont, for reasons as varied as environmental, ecological, and economic. Research on this issue has shown that this type of gravel removal has an overall negative effect on river systems and wildlife habitats. Research has also shown that flood alleviation caused by gravel removal is minimal and it could lead to the exact opposite, causing greater flooding downstream. In the state of Vermont, experts have argued that approved emergency gravel removal often went beyond what was necessary, and in many cases had a negative effect on the river systems from which the gravel was removed.

This report was completed on March 15, 2012 by Jordan White, Ali Van Baars, and Adam Elias under the supervision of graduate student Kate Fournier and Professor Anthony Gierzynski in response to a request from Representative Sarah Buxton.

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²⁷ Candace Page, "The Tweed After Irene, How to Repair a Ruined River," *Burlington Free Press*, January 15, 2012, accessed February, 23 2012. <http://www.burlingtonfreepress.com/article/20120115/GREEN01/201150301/The-Tweed-after-Irene-How-repair-ruined-river>, p. 1.

²⁸ Krista Langlois, "Mining Vermont's Rivers," *Valley News*, November 20, 2011, accessed January 30, 2012. <http://www.vnews.com/11202011/8163985.htm>.

²⁹ Krista Langlois, "Mining Vermont's Rivers."

³⁰ Krista Langlois, "Mining Vermont's Rivers."

³¹ Page, Candace, "The Tweed After Irene, How to Repair a Ruined River," pp. 3-5.

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