STATE OF NEW HAMPSHIRE
INTER-DEPARTMENT COMMUNICATION

DATE: June 30, 2006

NEWHAMPSHIRE
DEPART'MENJ OF
Environmental
Services

FROM: Chad Wittkop, Ph.D.
Hydrogeologist

AT (OFFICE):
NH Geological Survey

SUBJECT: Suncook River Initial Assessment

TO: Steve Couture
Rivers Coordinator

Watershed Management

In response to your request of June 23, 2006, this document summarizes our preliminary findings regarding the Suncook River avulsion in Epsom, NH, of May 14-15, 2006. Our staff visited the site several times to collect photographs and observations of the geology of the new and abandoned channels. Differential GPS data were collected on May 20, 24 and June 9 to precisely locate points of interest including the banks of the new channel, areas of significant erosion, and high water marks. These data were compiled into a GIS database and utilized to construct maps of the new channel. GPS and field data were compared with aerial photography, topographic maps, digital elevation models, and surficial geologic maps in effort to reconstruct the conditions surrounding the avulsion event and determine its cause. It is important to note that, with the exception of the high resolution aerial photography and the GPS data, our analysis is based on best-available 1:24,000-scale data, and such data is generally not intended for site-specific studies at the scale of the events discussed here.

The Suncook River now flows through a gravel pit to the northeast of Bear Island before rejoining a portion of a preexisting secondary channel that formed the eastern margin of Bear Island. 1.97 miles of former channel lay abandoned, including 1.52 miles of the primary channel that formed the western margin of Bear Island. Aside from small pools and seeps, and contribution from a small tributary, the abandoned portions of the Suncook are not expected to maintain significant year-round flow. The new channel is 1.03 miles long, of which 0.44 miles is newly eroded valley. As a consequence of the overall shortening of the Suncook's course, the average gradient of the river increased to 23 feet per mile from 16, or 44%. In addition, the flow of the Suncook is now concentrated into a single channel where it had previously split into two around the perimeter of Bear Island-an effect which will likely increase the average velocity of the river up and downstream.

Inspection of the abandoned channel revealed near surface bedrock around the northern tip of Bear Island, which created a rocky substrate unique to this reach of the Suncook. The new channel flows through sandy to silty glacial lake sediments and wetlands with no significant areas of shallow bedrock evident. This change in channel substrate will significantly alter the aquatic habitat for this reach of the Suncook, and combined with

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the increase in gradient and concentration of flow significantly increases the river's ability to erode laterally and vertically.

By comparing the location of the new channel with aerial photos, topographic maps, digital elevation models, surficial geologic maps, field evidence such as high water marks and patterns of erosion, and eyewitness accounts, the likely causal factors driving the avulsion can be determined. High water marks indicated that water had pooled to depths as much as 5 feet in the floor of the gravel pit. The avulsion began when water flooding the gravel pit found an outlet at the southern comer of the pit via an access path. Driven by the large volume of floodwater, head ward erosion initiated from this point and proceeded northeastward through a wetland before intersecting the main channel of the Suncook in a matter of hours.

The avulsion initiated in an area that a 1967 topographic map indicates is a natural gap through a glacial ridge. This glacial ridge acted as a natural levee responsible for the unusual east-northeast course of the Suncook above Bear Island. The gap in the ridge may have been an erosional feature formed by large floods occurring through the postglacial period. Digital elevation model analysis of high water marks suggests floodwaters would have reached within a few feet of this natural gap during the May 2006 flood. Gravel mining operations in the area further widened and lowered the gap while also artificially expanding the floodplain of the Suncook. Less than 10 feet of excavation near the gap would have allowed the avulsion to occur during the flooding that took place in May 2006. Such alteration of the landscape in an area that was naturally sensitive to disturbance allowed the avulsion to initiate.

Erosion of the new channel through the gravel pit and adjacent wetlands introduced an estimated 150,000 cubic yards of sediment into the Suncook River. Much sediment was deposited downstream of the avulsion channel in silt and sand sheets up to 5 feet thick. The large volume of sediment introduced downstream is expected to decrease channel depth and increase the frequency of overbank flooding. In the avulsion area and upstream, the Suncook continues to downcut in response to the increase in gradient and convergence of flow. This downcutting is expected to increase rates of bank erosion in the avulsion area and upstream as the river attempts to create a new floodplain. The sandy to silty glacial lake and stream sediments at the avulsion site and upstream will offer little resistance to erosion, and can be expected to continue to supply large amounts of sediment to the river.

Attached is a one page map highlighting the new channel, the abandoned channel, and areas now prone to frequent flooding near the Epsom public water supply north of Round Pond.

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