ATTACHMENT 4

Memorandum

To: W. Calvin Horton, Town Manager

Through: George Small, Engineering Director

From: Fred Royal, Stormwater Management Engineer

Subject: Report on Creekside Development Stream Determination

Date: April 9, 2003

This report describes the methodology used by the Engineering Department to determine the beginning point of the intermittent stream along the western side of the Creekside development parcel in accordance with the intermittent stream definition in the Land Use Management Ordinance (LUMO).

Background and Discussion

The Engineering Department performed a preliminary site review of the Creekside property in January 2003 and identified two existing drainageways on the property, one on the east side and one on the west side, draining in a southeasterly direction toward Morgan Creek. We found no reference to or indication of these drainageways during our review of the applicable parcel information, the Town's Geographic Information Systems stream coverage, the Chapel Hill United States Geological Survey quadrangle map or the Orange County Soil Survey maps.

We again visited the Creekside property in February 2003 to determine and identify the ephemeral, intermittent and perennial segments of the drainageways in accordance with the definitions and evaluation criteria in the LUMO.

The eastern drainageway was inspected and met the LUMO threshold definition of an intermittent stream between its confluence with Morgan Creek and the Creekside property line. Having met the threshold definition, we then applied the pertinent field verification criteria and verified that this segment of the eastern drainageway is an intermittent stream consisting of a natural channel or depression that conveys water more than 48 hours after a storm event.

The western drainageway was inspected from its confluence with Morgan Creek through the Creekside property to Morgan Creek Road. A portion of the drainageway above Morgan Creek consists of a continuous natural channel or depression. Both perennial and intermittent segments were identified using the LUMO verification criteria including, but not limited to the presence of a continuous natural channel and associated

geomorphological characteristics such as sinuosity, riffle/pool sequences, fluvially weathered bed materials and areas of alluvial deposition.

Above the point of origin of the intermittent stream segment, the drainageway is discontinuous, consisting of a mix of "sub-segments" showing intermittent segment characteristics in some segments and ephemeral stream characteristics in other segments.

As a matter of procedure, we investigate the entire length of the drainageway(s) on each property on which we are requested to perform a stream determination. We first investigate the characteristics described in the LUMO definitions. Then, if a drainageway meets the threshold definition of perennial or intermittent or ephemeral, we apply the LUMO field verification criteria to confirm the determination of the stream category. On the Creekside property, the western drainageway (above the intermittent point of beginning noted on the attached map) is discontinuous and does not meet the definition of an intermittent stream.

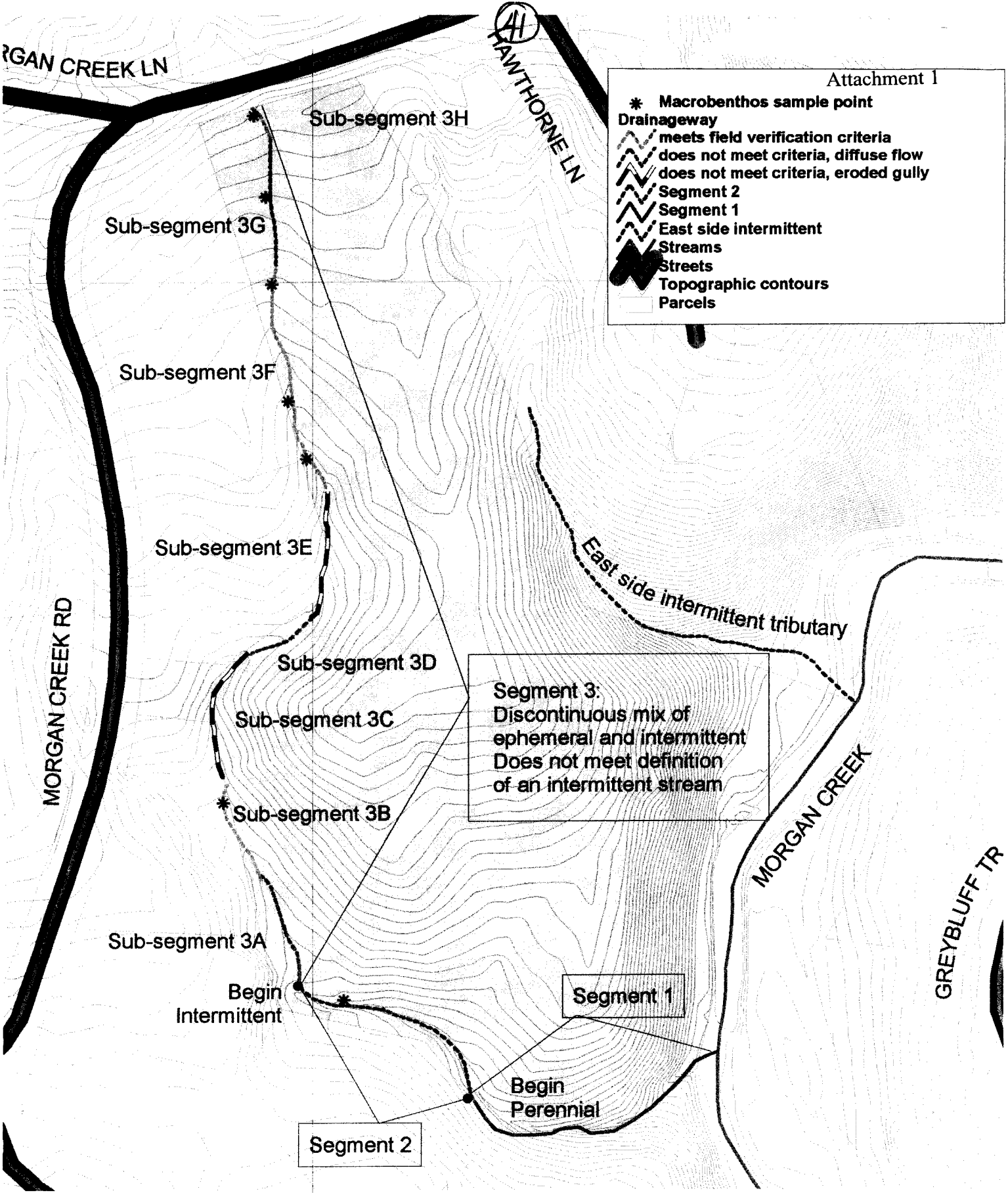
We have prepared the attached map and drainageway segment descriptions for the western drainageway on the Creekside property. The map notes the origin and terminus of the perennial and intermittent stream segments, and shows the discontinuous drainageway segment described above.

Conclusion

The Engineering Department believes that the origins of the intermittent and perennial stream segments identified on the attached map of the Creekside property are correct according to the definitions and field verification criteria in the Town's Land Use Management Ordinance.

Attachments

1. GIS map of the Creekside western drainageway
2. Descriptions of Drainageway Segments Along Western Drainageway of Creekside Parcel
3. Photographs of drainageway segments
4. Definitions from Land Use Management Ordinance



Creekside Parcel Western Drainageway

200 0 200 400 600 Feet

N
W E

Attachment 2

Description of Drainageway Segments Along Western Drainageway Of Creekside Parcel

Segment 1
Approximate Length: 350 feet (20% of total drainageway)
Description: Continuous natural channel. Begins at bedrock grade control point with strong groundwater source. Fluvially weathered bed material, strong geomorphology, facultative and "wetter" vegetation, etc. This segment **does meet** the minimum field verification criteria for a perennial stream. (Note: This segment terminates at its confluence with Morgan Creek)

Segment 2
Approximate Length: 260 feet (15% of drainageway)
Description: Segment includes continuous, well-defined natural channel. Origin (beginning point) at head-cut and grade control point. Natural channel with strong sinuosity, bankfull bench, alluvial deposition and other geomorphological features. Evidence of groundwater flows supplemented heavily with stormwater flows. This segment **does meet** the minimum field verification criteria for an intermittent stream. (Note: This segment terminates at a bedrock control point that the Town has identified as the origin of the continuous, perennial segment of this drainageway.)

Segment 3

This segment of the western drainageway consists of a discontinuous mix of ephemeral and intermittent stream sub-segments, channels and conveyances. Each sub-segment is described below and is shown on the map (Attachment 1). See Attachment 3 for sample photographs.

Sub-segment 3A
Approximate Length: 140 feet (8% of drainageway)
Description: Diffuse flow through woody vegetation. Gentle sloping gradient. No natural channel or depression. No significant geomorphology or hydric soils found. No evidence of ground water flow. Evidence of stormwater flow as a direct result of a rain event. This segment **does not meet** the minimum field verification criteria for an intermittent stream. (Note: This segment terminates at a head-cut and grade control point that the Town has identified as the origin of the continuous, intermittent (Segment 2) of this drainageway as described above.)

Sub-segment 3B
Approximate Length: 130 feet (8% of drainageway)
Description: Modified natural stream (channelized). Evidence of groundwater flow and weak geomorphology features. This segment **does meet** the minimum field verification criteria for in intermittent stream.

Sub-segment 3C
Approximate Length: 175 feet (10% of drainageway)
Description: Deeply eroded alluvial gulley or channel. No evidence of groundwater flow present. No significant geomorphological features indicating intermittent flow. Evidence of stormwater flow as a direct result of a rain event. No hydric soils. Angular rock. This segment **does not meet** the minimum field verification criteria for an intermittent stream.

Sub-segment 3D
Approximate Length: 80 feet (5% of drainageway)
Description: Diffuse flow through wooded, aggraded area. No stream channel or depression. No evidence of ground water flow present. Light scour of top-soil layer. Evidence of surface stormwater flow as a direct result of rain event. No hydric soils found. This segment **does not meet** the minimum field verification criteria for an intermittent stream.

Sub-segment 3E
Approximate Length: 150 feet (8% of drainageway)
Description: Deeply eroded alluvial gulley or channel. No evidence of groundwater flow present. No geomorphological features indicating intermittent flow. Evidence of stormwater flow as a direct result of a rain event. No hydric soils found. Angular rock. Water becomes sub-surface, likely through rock fractures. Deep (2-4') alluvial sedimentation in bed covering bedrock found. This segment **does not meet** the minimum field verification criteria for an intermittent stream.

Sub-segment 3F
Approximate Length: 275 feet (15% of drainageway)
Description: Shallow stream channel or depression and weak groundwater flow present. No other significant geomorphology found. Rooted vegetation and ivey in channel. Testing by others* indicates presence of microbenthos. This segment **does meet** the minimum field verification criteria for an intermittent stream.

Sub-segment 3G
Approximate Length: 145 feet (8% of drainageway)
Description: No stream channel or depression present. Gentle sloping gradient. Diffuse flow occurs through woody vegetation. Evidence of stormwater flow as a direct result of a rain event. No groundwater evidence present. Light scour of top-soil layer, rooted vegetation throughout segment. This segment **does not meet** the minimum field verification criteria for an intermittent stream.

Sub-segment 3H
Approximate Length: 50 feet (2% of drainageway)
Description: Modified natural stream (ditched & straightened) beginning at a scour hole adjacent to Morgan Creek Road. Presence of water. Weak alluvial deposition and channel exists. No other significant geomorphological features. Testing by others* indicates presence of macrobenthos. This segment **does meet** the minimum field verification criteria for an intermittent stream.

*Note: Macrobenthic sampling was performed by Dr. Seth Reice, UNC-Chapel Hill, Department of Biology and by the North Carolina Department of Environment and Natural Resources, Division of Water Quality staff. Sampling stations are shown on Attachment 1.

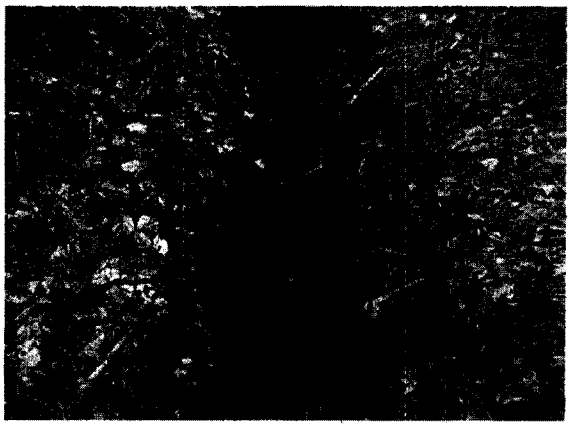
Sub-segment 3A

Sub-segment 3A

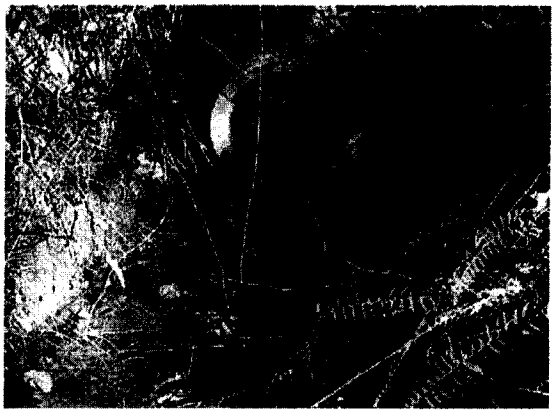
Sub-segment 3D

Sub-segment 3E

Sub-segment 3F



Sub-segment 3F



Sub-segment 3H

Attachment 4

The following definitions may be useful as a reference to the report material.

Land Use Management Ordinance Definitions:

Modified Natural Stream: An on-site channelization or relocation of a stream channel and subsequent relocation of the intermittent or perennial flow, as evidenced by topographic alterations in the immediate watershed. A modified natural stream must have the typical biological, hydrological, and physical characteristics commonly associated with the continuous conveyance of water.

Intermittent Stream: A stream that flows only during wet periods of the year and flows in a continuous, natural channel or depression (including natural springs). The flow may be heavily supplemented by stormwater runoff. Intermittent streams include those that are shown on the Town's Geographic Information System (GIS) coverage, the USGS 7.5 Minute Quadrangle, or the USDA Orange County Soil Survey (subject to field verification), and/or those shown as a dashed blue line on the USGS maps, in addition to streams confirmed to be intermittent by field verification by the Town Manager.

Intermittent Stream Field Verification Criteria: An intermittent stream shall be confirmed by the Town Manager by at least two (2) of the following:

(a) The presence of water during periods of wet weather or more than forty-eight (48) hours after a storm event of at least 0.5" rainfall.
(b) The presence of geomorphological features that are characteristic of a fluvial system, such as:
    1. Riffle/pool sequences
    2. Areas of alluvial deposition (ie point bars)
    3. Sinuosity
    4. Fluvially weathered bed materials (i.e., cobbles, gravels, boulders)
(c) The presence of a channel or depression (including natural springs) created by topographic features that is hydrologically connected to surface waters through surface flow or a pipe.
(d) The presence of amphibian larvae or benthic marcoinvertebrates.

Stream: A body of concentrated water in a natural low area or natural channel on the land surface.

Stream Bank: The points where the wetted perimeter of a stream's cross section has the highest elevation (as referenced to mean sea level) during normal stream flow.

Stream Channel: A natural water-carrying trough cut vertically into low areas of the land surface by erosive action of concentrated flowing water; or a ditch or canal excavated for the flow of water.