APPENDIX H

Hydrology/Hydraulic Analysis

1.0 INTRODUCTION

1.1 Objective

The objective of this study is to evaluate the adequacy of the current roadway drainage system, the stability of the outfall at Juneau Street, and provide cost-effective design alternatives for proper drainage.

1.2 Project Description

MOA Street Maintenance has received numerous calls in the past regarding the storm drain outfall north of Juneau Street. Upstream erosion of the ditch caused routine maintenance to be required to clean sediment from the pipe inlet at Eastchester Park (24-inch corrugated metal pipe). In support of this project, Street Maintenance performed a visual inspection of the existing facilities and a video inspection to determine the condition of the existing storm drain system in the fall of 2005. The results of the video inspection confirmed that numerous manholes and catch basins are in need of repair, as well as the culvert across Eastchester Park. As a result of the analysis, it was determined that the existing storm drain will be removed and replaced including the culvert to Chester Creek.

The outfall is in close proximity to a trail used to access the park and for skiing and sledding in the winter. Due to the steep banks caused by the erosion, the trail is no longer groomed and is considered a safety hazard by the MOA.

1.3 Background

Previously, the storm drain outfall at Juneau Street prevented erosion of the steep slope through the use of a half culvert pipe to convey flows to the culvert at Eastchester Park. Over time, the half culvert pipe deteriorated and no longer contained the flows resulting in severe erosion of the hillside. The erosion has caused the banks to erode, trees to fall and maintenance of the culvert downstream. Although MOA Street Maintenance routinely removes the sediments at the culvert inlet, much of the sediments are conveyed to Chester Creek. This area has been identified as a source of sediment to Chester Creek by the Corps of Engineers in their Chester Creek 206 Study (HDR, 2000).

2.0 DRAINAGE ANALYSIS

A review of the existing drainage areas to the outfall at Juneau Street shows that there is a connection at a manhole west of LaTouche Street on Northern Lights Boulevard of two large drainage areas. There is a large drainage area south of Northern Lights Boulevard, including Fred Meyer and College Village, and another that includes most of the Rogers Park community (bound on the west by Ingra Street and the east by Crestwood Street). Flows from this manhole continue both west to the New Seward Highway and north to the outfall at Juneau Street.

A drainage area analysis of the Rogers Park community was performed using the MOA Street Maintenance Storm Water Collection System maps. Although no topographic information is provided on these maps, they provide a good approximation of the drainage area served by a storm drain system. The drainage area was determined to be 66 acres. For an area less than 200 acres, the Rational Method is appropriate; therefore it was used to compute the discharge from this area. A "C" coefficient of 0.5 was used for this residential area of mostly 0.2-acre lots. Rainfall peak intensities of 0.19 inch/hour (10-year, 3-hour storm event) and 0.28 inch/hour (100-year, 3-hour storm event) were used. An intensity factor (i_f) of 1.0 is appropriate for this area. The discharge of the 10-year event was computed to be 6.3 cubic feet per second (cfs), and the discharge of the 100-year event is 9.3 cfs.

The existing storm drain system contains pipes of different materials such as ductile iron pipe (DIP), corrugated metal pipe (CMP), reinforced concrete pipe (RCP) and corrugated polyethylene pipe (CPEP). The existing storm drain outfall consists of a 36-inch CPEP at a 12.5 percent slope. Immediately before this pipe in profile is a 30-inch RCP at a 0.5 percent slope, which yields a full flow capacity of 32 cfs. The pipe limits the flows of the storm system due to its size, slope and material (Manning's "n"). It will be replaced with a 36-inch CPEP to match the size of the existing pipes before and after it along the profile. The proposed pipe will increase the full flow capacity of this segment to 61 cfs using a slope of 0.5 percent. The capacity of this storm drain system (61 cfs) is much greater than the runoff flows that the Rogers Park community will generate (9.3 cfs for 100-year storm event) and

appears to have been sized to convey flows from the areas south of Northern Lights Boulevard as well.

Discussions with MOA street maintenance and area residents indicate that there are no known capacity concerns in the corridor. Existing drainage patterns will be maintained under the proposed conditions. The existing swales that drained to catch basins will be removed and replaced with curb and gutter. Any increases in flows due to upgrading the roadway to a closed roadway section (curb and gutter) will be insignificant. Water quality will be addressed through the use of an oil/grit separator and the upgrade of the storm drain outfall at Juneau Street.

2.1 Storm Drain Outfall

DOWL performed a visual inspection and provided two stabilization concepts for the eroded outfall to be discussed at the CAC (Citizens Advisory Committee) meeting. One concept consisted of extending the storm drain approximately 325 feet and grading and stabilizing the ditch to the culvert at the park, and another provided a step/pool sequence using large rock to provide energy dissipation to the culvert in the park. The pros and cons of both alternatives were discussed and the proposed storm drain and grading plan for the outfall and culvert replacement incorporates both concepts.

It was decided at that meeting to investigate the possibility of using the wooded area south of the soccer fields to route flows to increase the water quality and decrease the high flows to Chester Creek. Survey was requested in the area that included a profile of the Chester Creek Trail, extending the existing topography through the soccer fields and wooded areas and the elevations of the existing culverts and ditches to Chester Creek. This data determined that using this area for storm water detention was not feasible by itself, the culvert would be necessary.

For the proposed design, the culvert length will increase down the steeper portion of the hillside approximately 210 feet. Although the slope of the outfall pipe will be decreased from 12.5 percent to 8.5 percent, the velocities remain high (29 feet/second). A “plunge pool” of riprap will provide the necessary energy dissipation before entering the open

channel. The remaining section of the ditch (200 feet) will be graded, lined with geotextile and drainage rock.

It is recommended that the existing culvert under the soccer fields will be replaced with a new 24-inch CMP with headwalls. The existing slope of the pipe will not change, but the invert and outlet elevations will be decreased by 0.5 feet to allow the pipe to be covered, as the existing pipe is protruding through the turf.

2.2 Water Quality

Presently, erosion of the ditch causes sedimentation downstream. Any sediment that is not removed from the ditch near the 24-inch CMP at the park by MOA Street Maintenance enters Chester Creek. Stabilizing the ditch will result in less sediment entering Chester Creek, therefore increasing the water quality. Lining the ditch with geotextile and adding drainage rock on top will decrease the probability of future erosion problems. To decrease the sediments resulting from the storm drain system, an oil/grit separator will be placed along the storm drain at Juneau Street, which will provide an additional measure of water quality.

3.0 CONCLUSIONS

The existing storm drain system will be replaced as a result of this project. The capacity of the storm drain system will increase by replacing a section of 30-inch RCP with a 36-inch CPEP to match the existing storm drain. Through a hydrologic analysis, it appears that the storm drain system has been sized to convey flows from the areas south of Northern Lights Boulevard in addition to those of Rogers Park. Any increases in flows due to upgrading the roadway to a closed roadway section (curb and gutter) will be insignificant.

Erosion of the ditch to Chester Creek causes sedimentation downstream. The area will be stabilized by extending the storm drain at Juneau Street, regrading the ditch, line it with geotextile and drainage rock, and replace the culvert under the soccer field at Eastchester Park with new 24-inch CMP.

Stabilizing the ditch will increase the water quality of Chester Creek. Also as part of this project an oil/grit separator at the outfall will be used to provide an additional measure of water quality.