ABSTRACT

THESIS: Soil Temperature as a Variable in Curve Number Runoff during Cold Seasons

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Impacts from flooding can be life altering, with high costs of damages, displaced lives, and lasting effects on communities providing cause for further investigation into flood prediction and mitigation practices. Hydrologic models simplify complex physical processes in an effort to predict flooding, yet some models do not factor important considerations such as seasonal impacts on flood behaviors. Studying this seasonal response is important to watersheds that experience frozen soils during cold seasons, as the overall effect from snow and frozen soils can have a greater impact on infiltration and runoff during cold season floods than may be experienced during warm season floods. Michigan's Grand River watershed has mixed land covers, including agricultural, forested, and urban types, and was chosen as the study area to investigate 1) the flooding associated with cold season conditions against warm season conditions, and 2) four historically significant floods in this area, two during cold season and two during warm season. The purpose of this analysis was to use hydrologic modeling and geographic information systems to simulate flooding in various Grand River sub-watersheds to understand the effects of dominant land cover and frozen versus unfrozen soil on past flood events. The four selected flooding events were used to model runoff from each sub-watershed for

each event, comparing the percentage difference in runoff for frozen or unfrozen conditions in each sub-watershed to gain perspective on the influence of land use/ land cover type and seasonality on the severity of flooding. Results demonstrate that the use of Soil Conservation Service Curve Number for runoff timing and magnitude prediction can be successful when the conditions are at or near average watershed conditions, including saturated conditions, and less successful with watershed conditions that have frozen soils.