Executive Summary

AWR Engineering, LLC (AWR) is assisting the Municipality of Anchorage (MOA) Project Management and Engineering (PM&E) department with evaluation of flood relief alternatives for the Chester Creek corridor from A Street to the Westchester Lagoon outlet into Cook Inlet. This area has experienced repeated flooding over the past several decades, particularly through the Valley of the Moon Park area. The purpose of this report is to discuss the causes of flooding and present alternatives identified to reduce impacts of flooding along this corridor.

Creek Overview. Chester Creek is an urban stream that runs through the heart of Anchorage. It is a groundwater-fed stream with a drainage basin of approximately 30 square miles, much of which is developed and urbanized. The Chester Creek channel has been significantly altered from its natural condition by development activities in the creek drainage basin. The creek has been straightened and steepened along most of the project area, resulting in higher flow velocity, bank erosion, and unstable banks. The creation of Westchester Lagoon also altered the creek's flow hydraulics and its sediment transport balance, particularly in the lower portions of the creek, downstream of Arctic Boulevard.

Existing Flooding. Flooding along Chester Creek in the project area occurs as a result of several inter-related factors including increased peak flows over the past several decades, lack of conveyance capacity at road crossings, erosion and sedimentation, and channel icing. Flooding that impacts residential structures is most prevalent in the Valley of the Moon Park area where the creek alignment is immediately adjacent to residential houses.

System Hydraulics. The hydraulics of the existing creek in the project area were evaluated using two HEC-RAS models in conjunction with a level-pool routing analysis completed for Westchester Lagoon. The existing system performance was evaluated for the 10-year, 50-year, and 100-year flood events using varying tide elevations in Cook Inlet. Proposed improvements to the system were generally evaluated by modifying the existing conditions models to reflect the proposed conditions. Existing flood limits were compared to proposed flood limits to demonstrate the benefit of proposed alternatives.

Alternatives. This study identified three alternatives to relieve flooding upstream of Arctic Boulevard, and a set of four alternatives to relieve flooding between Arctic Boulevard and Spenard Road.

<u>Upstream of Arctic Boulevard.</u> Flooding upstream of Arctic Boulevard is the most widely reported flooding in the project area, with most of the flooding occurring near the Arctic Boulevard culvert crossing.

- Alternative 1 includes a large box culvert at the Arctic Boulevard crossing and the addition of heat trace to the existing channel. This alternative is expected to relieve summer flooding issues and improve winter flooding issues as a result of channel icing. This alternative is not expected to eliminate channel icing or improve erosion and sedimentation problems. The estimated project cost of Alternative 1 is $2.1 Million. This alternative is expected to be able to be funded through the PM&E capital improvement program, which is funded by municipal bonds.
- Alternative 2 involves realigning Chester Creek from A Street to downstream of Arctic Boulevard. The new channel would be constructed with a sinuous pathway and a stable cross-sectional channel to balance sediment transport and minimize icing. The channel floodplain would be designed to carry the 100-year discharge without impact to adjacent properties. This alternative includes reconstruction of much of the Chester Creek Trail in the project area, including the addition of a fly-over bridge at West 17th Avenue to

replace the existing pedestrian tunnel at Arctic Boulevard. This alternative requires reconfiguration of Valley of the Moon park. The estimated project cost of Alternative 2 is $18.0 Million. This alternative could be constructed in phases. Phasing would require a designed phasing plan and is expected to increase the project cost by approximately 15 to 25%. The cost of this alternative exceeds what is expected to be fundable through PM&E's capital improvement program in the near-term future. The project team considered several other funding sources for this alternative but did not find a viable option.

- Alternative 4 was developed based on input received during this project's public outreach process for the Draft DSR. Project stakeholders expressed a preference for Alternative 2, but understood that the cost of Alternative 2 is prohibitive. Stakeholders asked the project team to consider a merge of Alternatives 1 and 2 that would essentially construct only the western portion of Alternative 2 and continue to seek funding for the full-build option in the future. Alternative 4 was developed to evaluate that concept. Compared to Alternative 2, the scope of improvements for Alternative 4 is limited to the minimum amount needed to successfully relocate the Chester Creek crossing at Arctic Boulevard to the north and maintain connectivity of the Chester Creek Trail. This includes realigning a short section of Chester Creek on the east and west sides of Arctic Boulevard, installing a new box culvert in the general location of the existing pedestrian tunnel, the addition of a fly-over pedestrian bridge at West 17th Avenue to replace the pedestrian tunnel, and park and trail modifications to accommodate these improvements. The estimated cost of Alternative 4 is $9.4 Million. Similar to Alternative 2, this alternative is not expected to be fundable through PM&E's capital improvement program in the near-term future, and an alternate source of funding was not identified.

Between Arctic Boulevard and Spenard Road. Several private parcels downstream of Arctic Boulevard and upstream of Spenard Road are expected to experience flooding during high flow events. However, community reports of flooding in this area as part of this project are limited to the condominium complex at the intersection of Arctic Boulevard and West 19th Avenue. Surface flooding in that area was reported when water from upstream of Arctic Boulevard overtopped the roadway and spread to that parcel. Channel flooding downstream of Arctic Boulevard is generally controlled by the conditions of Westchester and Eastchester lagoon. Alternative 3 is one primary alternative separated into four sub-alternatives. Each sub-alternative presents improvements to manage the lagoon's water surface elevation during high flow events and mitigate upstream flooding.

- Alternative 3a would install a second subsurface overflow pipe at the Westchester Lagoon outlet. This pipe would be controlled by an electronic gate that would be opened during high flow events to rapidly lower the water surface elevation of Westchester Lagoon. Alternative 3a is expected to relieve flooding of private parcels for events up to and including the 50-year discharge. The estimated project cost of Alternative 3a is approximately $2.4 Million.

- Alternative 3b would install a 24' x 5'9" pipe arch under Minnesota Drive to allow water to move from Eastchester to Westchester lagoon more quickly than it does under existing conditions. Alternative 3b is expected to relieve flooding of private parcels for events up to and including the 50-year discharge. The estimated project cost of Alternative 3b is approximately $2.0 Million.

- Alternative 3c would install a smaller 7'9" x 6'0" pipe arch culvert under Minnesota Drive and remove approximately 10,000 cubic yards of deposited sediment from the area around the Spenard Bridge. Sediment from this area is expected to be contaminated and require out of state disposal. Alternative

3c is expected to relieve flooding of private parcels for events up to and including the 50-year discharge. The estimated project cost of Alternative 3c is approximately $9.4 Million.

- Alternative 3d would install a large 29'1" x 6'4" pipe arch culvert under Minnesota Drive and remove approximately 10,000 cubic yards of deposited sediment from the area around the Spenard Bridge. Sediment from this area is expected to be contaminated and require out of state disposal. Alternative 3d is expected to relieve flooding of private parcels for events up to and including the 100-year discharge. The estimated project cost of Alternative 3c is approximately $10.7 Million.

These options were developed based on data indicating that sediment around the Spenard Road bridge is contaminated and will require out-of-state disposal. Testing should be done to confirm contamination and determine pollutant levels prior to completing work in this area. The feasibility of funding this alternative is generally dependent on further evaluation of the sediment contamination and on the MOA's preferred approach to long-term sediment management in this area.

Recommendations. Prioritization of flood relief upstream of Arctic Boulevard is recommended. This area has experienced repeated flooding that impacts private structures and Arctic Boulevard, and is an ongoing issue for Street Maintenance. The recommended alternative to provide immediate improvement of flooding along Chester Creek upstream of Arctic Boulevard is Alternative 1. Alternative 1 provides flood relief and is expected to be fundable in the near-term future.

Alternative 2 is a good option for long-term flood mitigation, resolution of bank stability issues, and habitat restoration, but because this alternative is not expected to be currently fundable, it does not meet the immediate need to resolve ongoing flooding problems. Alternative 4 provides a way to phase construction of Alternative 2 and initially focus only on the Arctic Boulevard area, but the cost of this option is still expected to exceed what is currently fundable.

Improvements to relieve flooding between Arctic Boulevard and Spenard Road are recommended for consideration in the future. The selected alternative for flood relief between Arctic Boulevard and Spenard Road should be based on the results of sediment contamination testing and implementation of a sediment management plan for this area. Generally, Alternative 3c is expected to provide a balance between benefit and cost while simultaneously beginning to correct the sediment accumulation problem in the Spenard Road bridge area.