North Branch Park River Watershed
Comprehensive Flood Damage Reduction
Strategy Evaluation Worksheet
February 4, 2015 - DRAFT

		Expected Outcome No. 1 – Reduce Flood Risk for Communities in the North Branch Watershed	**Expected Outcome No. 2** – Reduce Flood Risk for Rural Residences	**Expected Outcome No. 3** – Reduce Flood Risk for Rural Infrastructure	**Expected Outcome No. 4** – Reduce Impacts to Agriculture	**Expected Outcome No. 5** – Regional	**Expected Outcome No. 6** – Basin-wide	**Practicability** - Ability to implement and reasonably manage	Locally desirable for additional evaluation (Primary, secondary, or not applicable)	Reasoning and Justification Locally Desirable Determination
Increase Temporary Flood Storage	Dams and Impoundments	5	5	5	5	5	5	4	Primary	Selected as a primary alternative for further analysis based on logistics of consolidating runoff storage into larger impoundments or dry dams. A reasonable expectation to implement and manage a smaller number of larger sites as compared to a large number of smaller distributed sites (wetlands).
	Create or Restore Wetlands	3	3	3	2	2	2	1	Secondary	While this strategy would provide storage for runoff within the watershed, it has been ruled out for future analysis based on practicality. Unreasonable expectation to implement sufficient number of wetland restorations to make a meaningful difference to problem areas. Wetland enhancements that would provide additional flood storage should be encouraged on a voluntary basis.
	Alter ground water through drainage	1	1	1	4	1	1	1	Not Applicable	This strategy was ruled out based on practicality. Topography west of Highway 32 would likely not allow for sufficient residence time for runoff to infiltrate into subsurface drainage systems before running off.
	Culvert sizing to meter runoff	2	2	1	2	1	1	1	Not Applicable	Using culvert sizing recommendations has been ruled out due to a Technical Feasibility. Many culverts within the watershed are already under sized, resulting in substantial road overtopping and wash-outs during severe floods. Topography in the upper watershed would not allow for substantial storage before overtopping.
	Overtopping Levees	1	1	1	4	1	1	2	Secondary	Set-back or overtopping levees could be used to benefit ag lands for smaller rainfall events. However, during severe floods minimizing or reducing overland breakout flows would likely result in substantial adverse impacts for communities and rural residences along water ways. Detaining runoff would likely be required to mitigate adverse impacts.
Increase Conveyance Capacity	Channelization of existing water ways and flowages	2	2	4	4	1	1	2	Not Applicable	This strategy was ruled out due to potential of downstream adverse impacts. While ditching and channelizing would likely reduced the amount of overland flooding, reducing floodplain storage would likely result in higher flows experienced downstream, where flooding issues already exist.
	Drainage	2	2	4	4	1	1	2	Not Applicable	Ruled out for same issues described in "Channelization of existing water ways and flowages" strategy above.
	Diversions	5	2	2	2	1	1	4	Primary	Selected as primary alternative to carry forward to further technical analysis because this will likely be required to provide Crystal, ND with 100-year flood protection. Increased conveyance will likely need temporary flood storage to mitigate downstream impacts.
	Set-back Levees	1	1	1	4	1	1	2	Secondary	Set-back or overtopping levees could be used to benefit ag lands for smaller rainfall events. However, during severe floods minimizing or reducing overland breakout flows would likely result in substantial adverse impacts for communities and rural residences along water ways. Detaining runoff would likely be required to mitigate adverse impacts.
	Increasing road crossing capacity	4	4	4	4	1	1	4	Not Applicable	This strategy was ruled out due to potential of downstream adverse impacts. While increasing capacity would likely reduced the amount of overland flooding, allowing flows to move quicker downstream would likely result in higher flows experienced downstream, where flooding issues already exist.
Reduce Flood Volume	Create or Restore Wetlands	3	3	3	2	2	2	1	Secondary	While this strategy would provide storage for runoff within the watershed, it has been ruled out for future analysis based on practicality. Unreasonable expectation to implement sufficient number of wetland restorations to make a meaningful difference to problem areas. Wetland enhancements that would provide additional flood storage should be encouraged on a voluntary basis.
	Cropland BMPs	1	1	1	3	1	1	1	Secondary	Cropland BMPs would provide localized benefit to ag land, however implementation of sufficient BMPs to attain Expected Outcomes is considered impractical. Therefore, this strategy was eliminated for future consideration but should be encouraged on a voluntary basis.
	Cropland Conversion	1	1	1	1	1	1	1	Not Applicable	Conversion of sufficient cropland to attain the Expected Outcomes was determined to be Not Applicable due to Practicability to implement.
	Other Beneficial Uses	1	1	1	3	1	1	1	Secondary	Another beneficial use that could be explored as a secondary benefit for Increasing Temporary Flood Storage strategies would be irrigation. Potatoes are a commodity crop extensively grown in the portions of the region, and typically require irrigation.
Protection/Avoidance	Urban Levees	5	1	1	1	1	1	2	Not Applicable	Urban Levee's have been ruled out due to practicability to implement. Encroachment on the floodplain would likely require floodplain evacuation in order to provide a sufficient cooridor to construct levees.
	Farmstead Levees	1	5	1	2	1	1	2	Secondary	This alternative was ruled out for further analysis due to inconsistency with the Expected Outcomes. Where applicable, Farmstead Levees should be pursued on a case-by-case basis if desired by a landowner.
	Agricultural Levees	1	1	1	4	1	1	2	Secondary	Set-back or overtopping levees could be used to benefit ag lands for smaller rainfall events. However, during severe floods minimizing or reducing overland breakout flows would likely result in substantial adverse impacts for communities and rural residences along water ways. Detaining runoff would likely be required to mitigate adverse impacts.
	Evacuation of the floodplain	4	4	1	1	1	1	1	Not Applicable	Evacuation of Floodplain was ruled out based on inconsistency with the Expected Outcomes and impracticality to implement. Flooding the watershed is characterized by breakout flows and overland flooding. Severe flooding is not contained to the river floodplain cooridor.
	Flood proofing	4	4	1	1	1	1	2	Secondary	This alternative was ruled out for further analysis due to inconsistency with the Expected Outcomes. Where applicable, Farmstead Levees should be pursued on a case-by-case basis if desired by a landowner.
	Flood warning system	2	2	1	1	2	2	2	Not Applicable	Early warning systems would benefit the watershed, however flooding typically happens very quickly within the North Branch Watershed and advanced warning would likely only allow for evacuation of at risk areas. Temporary protection of communities, rural residences, and infrastructure would likely not be realistic, therefore this alternative was ruled out based on practicability to implement.

Houston Engineering Inc.

EXHIBIT B