Appendix E Update Letter - Flood Damage Reduction 2015

PARK RIVER
JOINT WATER RESOURCE DISTRICT

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Cavalier, ND 58220

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May 1, 2015

Advisory Group
VIA E-Mail

Subject: **North Branch Park River Watershed Comprehensive Flood Damage Reduction Project Update & February 4, 2015 Meeting Summary**

NRCS Regional Conservation Partnership Program (RCPP)

Since beginning this project, potential funding through the Farm Bill has been finalized. Funding will be made available by the NRCS through a new program known as RCPP. A total of $12 million has been secured for the Red River Basin for flood water retention. The Red River Retention Authority (RRRA) has been working with NRCS to determine funding eligibility for potential projects. RRRA has decided that financial assistance through RCPP will be used to assist in project development and planning efforts. This is largely due to a lack of "shovel ready" projects, and a maximum 5-year timeline to expend RCPP funds. Given the scale and complexity of many retention projects, it seemed unlikely that many projects could move from concepts to completed construction within the required 5-year timeline.

With additional funding opportunities for project planning through RCPP, the Park River Joint Water Resource District (PRJWRD) has temporarily slowed progress on the North Branch Park River Watershed project to investigate how these funds could reduce state and local funding requirements. Because watershed planning would have to be completed based on NRCS Standards, additional tasks would be required. While these additional tasks would result in additional costs, potential for significant RCPP funding contributions would likely result in substantial reductions to state and local funding requirements. The NRCS and the RRRA are expected to have an agreement in place in early to mid-May. Agreements between the NRCS and eligible projects, such as the North Branch Project, would likely occur in early to mid-summer 2015.

The following is a summary of the February 4, 2015 Watershed Stakeholder's Meeting:

The North Branch Park River Watershed Stakeholder's Committee held a meeting on February 4, 2015 in Cavalier, ND. This was the second meeting for the Watershed Stakeholder's Committee, and included continued discussion from topics the December 18, 2014 initial meeting. Topics of discussion included roles and expectations of the Stakeholder's Committee and Advisory Group, the Purpose and Expected Outcomes document, the Strategy Evaluation table, and review of initially selected alternatives.

Purpose and Expected Outcomes

The Draft Purpose and Expected Outcomes document (**Exhibit A**) is intended to provide clear definition of the existing flooding issues, as well as clearly define locally desirable future conditions within the North Branch Watershed. Problems and Expected Outcomes document was drafted based on public comment provided by landowners and residents that are impacted by flooding in the project area. The primary focus of the project is to provide benefit to flooding experienced within the North Branch/Cart Creek watershed, with secondary goals of flow reductions to the Park River mainstem and Red River mainstem.

The Draft Purpose and Expected Outcomes document was initially discussed with the Watershed Stakeholders Committee during the December 18, 2014 meeting, with a request to provide any additional comment. During the February 4, 2015 meeting, there was little comment on the current draft, however comments on this document are still being accepted. Any comments received will be discussed and potentially incorporated during the next Watershed Stakeholder's Meeting. The Watershed Stakeholder's Committee would like to finalize the Purpose and Project Outcomes document during their next scheduled meeting (date and time to be determined). A copy of the current Draft Purpose and Project Outcomes document is available in **Exhibit A**. Additional information pertaining to this topic during the December 18, 2014 meeting was also previously provided in the summary letter.

Strategy Evaluation Table

The Strategy Evaluation Table (**Exhibit B**) was further discussed during the February 4, 2015 meeting. The table focuses on methods for attaining flood damage reduction benefit, and not on specific project alternatives. The purpose of the Strategy Evaluation Table is to determine method(s) of flood damage reduction that align with the Purpose and Expected Outcomes document. Several methods are reviewed and grouped into four categories:

- Increase Temporary Flood Storage
- Increase Conveyance Capacity

- Reduce Flood Volume
- Protection/Avoidance

Each method is evaluated based on ability to meet the Expected Outcomes objectives and "Practicability", or the ability to reasonably implement and manage. Each method was then ranked to determine which methods to further evaluate. These ranks were broken down into three categories and are defined as follows.

- *Primary* – These methods were selected for further detailed technical analysis. Additional technical analysis includes selection of alternatives, modeling to determine flow reduction benefit, and preliminary cost estimates.
- *Secondary* – This category recognizes that benefit would be provided by these methods, however the ability to implement and manage on a scale needed to attain the Expected Outcomes is not be a reasonable assumption. Secondary alternatives will not be carried forward for more technical analysis.
- *Not Applicable* – These methods are not considered to be a reasonable means of attaining the Expected Outcomes for the North Branch Watershed, and will not be carried forward for further technical analysis.

An additional narrative is also given for each strategy to further document Stakeholder thought process in evaluating each method. This table is also discussed in more detail in previously provided the Advisory Group Letter that summarized the December 18, 2014 meeting. The Watershed Stakeholder's Committee would like to finalize the Strategy Evaluation Table during their next scheduled meeting (date and location to be determined).

Concerns were raised by the ND Department of Health representative that enhanced drainage may be a cause of the existing flood damages, and that evaluation to determine pre-settlement hydrology may indicate that agricultural BMPs may be a means of attaining project goals. Discussion among the Watershed Stakeholders Committee indicated that the ability to alter existing agricultural drainage systems and implement sufficient BMPs as a means to partially restore the pre-settlement condition for the purposes of attaining Expected Outcomes is not a reasonable assumption. The Strategy Evaluation Table indicates these practices as *Secondary.* While these practices may not sufficiently meet Expected Outcomes for this project, they should still be further pursued with individual landowners on a voluntary basis.

The Watershed Stakeholders Committee has determined that Increasing Temporary Flood Storage through dams and impoundments appears to be the most practical was of attaining watershed goals outlined in the Purpose and Expected Outcomes document. Also, in order to attain goals outlined for the community of Crystal, ND, a diversion channel may be required. Rational for primary methods are documented in the Strategy Evaluation Table.

Additional feedback on the current Strategy Evaluation Table is welcome from the Advisory Group. The Watershed Stakeholders Committee would like to finalize this table during their next scheduled meeting.

Initial Alternative Selection

An initial selection of alternatives was reviewed with the Watershed Stakeholders Committee. Initial alternatives focused methods determined to be Primary methods based on the Strategy Evaluation Table (**Exhibit B**). Increasing Temporary Flood Storage through dams and/or impoundments were most alternatives initially selected and analyzed. In total, four sites were selected and used in various combinations to analyze seven scenarios. Two sites were identified in the Cart Creek watershed, and the remaining two are located in the North Branch watershed. Additionally, one scenario was analyzed that included ten small on-channel dams located across water courses west of Highway No. 32. Refer to **Exhibit C** for a watershed map showing the locations of each of the analyzed impoundments, and their corresponding drainage areas.

Statistics were also developed for each of the initially selected alternatives, and is available in page one of **Exhibit D**. Storage and geometric data for each of the selected sites was developed using LiDAR topography data collected by the International Water Institute and is presented in the green columns. Additional information was compiled related to potential environmental and land use impacts. These impacts should be considered approximate, and are representative of available GIS information. Impacts were calculated at the assumed maximum spillway depth. This information is presented in the orange columns in page one of **Exhibit D**. Each impact area and the source data is summarized as follows:

- *Cropland* - 2006 National Land Cover Dataset
- *Hay and Pasture* – 2006 National Land Cover Dataset
- *Forested Land* – 2006 National Land Cover Dataset
- *Wetlands* – National Wetlands Inventory (US Fish and Wildlife Service)
- *Conservation Reserve Program* – Natural Resources Conservation Service
- *Wetland Reserve Program* – Natural Resources Conservation Service

This information was discussed at the Watershed Stakeholders Committee meeting as a means of finding balance between local acceptability and potential environmental impacts. While alternatives that predominantly impact high value crop land may not be locally acceptable, alternatives that have very high environmental impacts may result in a project that involves a high environmental mitigation cost and/or difficulty in permitting. This information, along with any provided guidance from the Advisory Group, will be used to assist the Watershed Stakeholder's Committee in finding an acceptable balance of local acceptability and environmental suitability. It should be noted that all concepts discussed at the February 4th, 2015 meeting are in preliminary stages, and are likely to continue changing as discussions with impacted landowners take place.

<u>Scenario Evaluation</u>

In total, eight scenarios were analyzed using various combinations of the initially selected sites to determine flow reduction benefit for the North Branch/Cart Creek Watershed. Sites used in each scenario are indicated in the blue columns on page one of **Exhibit D**. Reductions to runoff were determined using watershed HEC-HMS hydrologic model. Because of the complexities of overland flows throughout the Cart Creek Watershed, a HEC-RAS hydraulic model was developed to route runoff hydrographs generated with the HEC-HMS hydrologic model. Scenarios were compared to the existing condition for flow reduction benefit during the modeled 10-year, 25-year, 50-year, and 100-year synthetic events. **Exhibit E** illustrates peak flows at several locations in the region for each of the modeled events for the existing conditions and the eight analyzed scenarios.

Individual site impacts and storage statistics were also quantified for each scenario in a similar manner as previously described. This information is available on pages two through five of **Exhibit D**.

<u>Crystal, ND – Small Community Flood Control</u>

Initial review of a diversion channel around the community of Crystal, ND was analyzed with the HEC-RAS hydraulic model. Existing conditions modeling results indicates that an approximate 10-year flood could be conveyed through the community with minimal structural impacts. In order to provide Crystal with 100-year flood protection (Expected Outcome No. 1, **Exhibit A**), a diversion channel with sufficient capacity to convey flows in excess of the 10-year event during the 100-year event. Preliminary modeling results indicates that this may be technically feasible, but would result in some downstream impact suggesting that storage may be required to mitigate adverse downstream impacts.

<u>Meeting Conclusions</u>

The Watershed Stakeholder's Committee generally seemed to be in agreement with the four sites used in Scenarios 1 through 7. It was recognized that Scenario 8 may not provide a reasonable expectation to fully implement and manage to attain the Expected Outcomes. Small on-channel sites would also likely face many environmental hurdles and would likely have technical issues during further design and construction. The engineer will develop more information for the proposed sites including a preliminary cost evaluation to implement the four sites used for analysis in Scenarios 1 through 7. Additionally, a cost evaluation will be used for a representative site used in Scenario 8.

Since conclusion of this meeting, impacted landowners for Cart Creek Site 2 have been engaged. This will likely lead to modifications to the geometry of this storage location. These changes will be discussed with the Watershed Stakeholders Committee once an acceptable solution is developed with the impacted landowners.

We request that you review the information provided in this letter and provide comments or concerns. We ask that comments and be in the capacity of your advisory role on behalf of the agency in which you represent. The Watershed Stakeholders Committee plans to begin meeting again after NRCS RCPP funding determinations have been made. We encourage your presence and participation as this project progresses. More information on the time and location of future meetings will be provided at a later date.

Sincerely,

Park River Joint Water Resource District

North Branch Park River Watershed
Comprehensive Flood Damage Reduction
Purpose and Project Goals
December 16, 2014 - DRAFT

Prepared by:
Park River Joint Water Resource District
North Branch Park River/Cart Creek Stakeholders Committee

In cooperation with Houston Engineering, Inc.

1. Watershed Background

The Park River Watershed encompasses approximately 990 square miles of the Red River Basin, and resides primarily in three North Dakota counties; Cavalier, Pembina, and Walsh. This area in relation to the Red River Basin is illustrated on **Attachment 1**. Much of the Park River Watershed is comprised of three branches, combining near the community of Grafton, ND. The area contributing to the South Branch and Middle Branch encompasses approximately 403 square miles. A structure was recently completed along the Middle Branch that detains approximately 3.2 inches of runoff when combined with other existing upstream flood water impoundments. The South Branch has limited capacity to detain runoff in impoundment structures, and often contributes to flooding experienced on lower portions of the Park River. The area contributing to the North Branch encompasses 258 square miles, including the flood prone Cart Creek tributary. Currently, there are no impoundments in the North Branch Watershed. Substantial flood damages in this region often occur during both spring runoff and summer rainfall events, as was evident during the spring of 2013. Refer to **Attachment 2** for an illustration of the three branches of the Park River Watershed and the locations of existing impoundment structures.

2. Public Comment Solicitation

On July 1, 2014, the Park River Joint Water Resource District (PRJWRD) hosted a public comment meeting in Mountain, ND for residents and landowners in the North Branch Watershed. This meeting focused on gathering information to better define the existing flood problems and potential solutions. Information was also gathered with regard to locally perceived causes and solutions to flooding in the region. Approximately 80 people were in attendance at this meeting. Questionnaires were provided at the meeting, as well as direct mailed to invited landowners. Approximately 35 completed questionnaires have been provided back to the PRJWRD. This information was used to better define the *Problem Statement* discussed in Section 3 and *Expected Outcomes* discussed in Section 4. These comments are summarized in **Attachment 4**.

EXHIBIT A

3. Problem Statement

The North Branch of the Park River and its tributaries has long been recognized as an area of concern for flooding by the Walsh, Pembina, and Cavalier County Water Resource Districts. Flooding within this region was especially problematic during the spring and summer of 2013. Above average spring and early summer runoff was experienced throughout the watershed. Widespread flooding was experienced by those residing along the North Branch, Cart Creek, and at points further downstream along the Park River. Flooding impacted rural residents in the area as well many of the communities within the region. This area lacks a comprehensive flood mitigation plan to reduce flood risks for impacted residents.

3.1. Local Scale Problems – *North Branch Park River Watershed*

Both spring and summer flooding results in a multitude of problems within the North Branch watershed. Steep slopes in the upper portions of the watershed result in runoff traveling quickly to the lower portions of the watershed, where slopes begin to flatten out. This often results in expansive areas becoming inundated with excessive runoff. High flows also cause substantial damages to the landscape as a result of erosion. In the last 10-years, FEMA declarations for the townships in question have occurred in 2004, 2005, 2006, 2009, 2011, and 2013. More specific information on problems within the North Branch watershed are summarized as follows. **Attachment 3** illustrates the FEMA regulatory floodplain extents as well as the drainage boundary for the North Branch Park River Watershed.

3.1.1. Communities

The community of Crystal, ND is within the North Branch watershed and currently lacks adequate flood protection. This increased flood risk results in impacts to residential, industrial, and infrastructure within Crystal, ND.

3.1.2. Rural

3.1.2.1. Residences

In addition to the communities previously described, risk for flood damages exist for residents living within flood prone areas along the North Branch and its tributaries. This flood risk has potential to result in loss or damage to personal property, and in extreme events, potentially loss of life.

3.1.2.2. Infrastructure

Flooding along the North Branch Park River and Cart Creek has resulted in substantial damages to rural infrastructure, such as existing drainage systems, roadways, and stream crossings. This was extremely apparent during the spring and summer of 2013, where the region was impacted by rapid spring snow melt and severe spring rains. Increased flows resulted in roads overtopping in many location, with several of these locations “washing out”. The increased flows also resulted in damages to many public and private drainage systems in the region. These damages are not limited to the spring of 2013 and are experienced frequently during periods of high flows.

EXHIBIT A

3.1.3. Agricultural

Flooding of agricultural lands along the North Branch of the Park River and its tributaries is a frequent problem. Prolonged inundation of cropland leads to delayed planting dates in the area resulting in reduced yields for area producers. Additionally, high flows result in large amounts of erosion occurring on agricultural land within the area.

3.2. Regional Scale Problems – *Park River Watershed*

Flooding within the Park River Watershed, particularly in Walsh and Pembina Counties, has been a persistent problem for residents in the region. The community of Grafton, ND is located downstream of the confluences of the three Branches of the Park River watershed. A substantial portion of Grafton is located in the regulatory 100-year flood plain, and has led to the evaluation of several potential solutions to alleviate flood risk for the community. While these potential solutions have focused on reducing flood risk for residents within Grafton, ND, they haven't evaluated potential comprehensive solutions to reduce flood risk for area residents living outside of the community of Grafton, ND. Other communities, such as Crystal, Mountain, and Hoople, also deal with flooding during periods of high runoff. With the primary industry of the region consisting of agriculture, losses experienced as a result of flooded agricultural lands are also felt by the area. **Attachment 3** illustrates the FEMA regulatory floodplain extents within the Park River Watershed.

3.3. Red River Basin Wide Scale Problems

Runoff produced from the Park River Watershed contributes to the Red River Basin. The Red River Basin is an international, multi-jurisdictional watershed of approximately 45,000 square miles, with 80% of the Basin contained within the United States, and the remaining 20% of the Basin located in Canada. Flooding along the Red River and its tributaries is a prolonged issue for the region. Substantial damages are often experienced during periods of excessive runoff. Impacts experienced along the Red River mainstem are a result of combined tributary subwatershed contributions (including the Park River Watershed).

4. Project Purpose & Expected Outcomes

The North Branch Park River project will focus on primary benefit to local scale problems outlined in Section 3.1. Any benefit provided to the problems outlined in Sections 3.2 and 3.3 will be considered secondary, and not a primary focus for alternative analysis. Rather, potential alternatives will be recognized if secondary benefit is given to these problems. Strategies or alternatives that will result in potentially more severe downstream flooding along the Park River and potential to increase contributions to the Red River will not be considered.

4.1. Local Scale Purpose – *North Branch Watershed*

Project components of the North Branch Park River Flood Damage Reduction project will reduce flood risk for local communities, rural residences and infrastructure, and the agricultural community within the project watershed. The provided benefit is directly related to the locally acceptable amount of flood risk.

4.1.1. Expected Outcome No. 1 (Primary) – *Reduce Flood Risk for Crystal, ND*

- *Provide 100-year flood protection.*

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4.1.2. Expected Outcome No. 2 (Primary) – *Reduce Flood Risk for Rural Residences*

- *Reduce flows along Cart Creek to minimize breakouts and overland flooding.*

4.1.3. Expected Outcome No. 3 (Primary) – *Reduce Flood Risk for Rural Infrastructure*

- *Reduce the frequency of road overtopping and washouts.*

4.1.4. Expected Outcome No. 4 (Primary) – *Reduce Impacts to Agriculture*

- *Reduce peak flows and duration of flooding along Cart Creek to reduce flooding and erosion of land in agricultural production*

4.2. Regional Scale Purpose

The North Branch Park River project will provide benefits to the Park River Watershed downstream of where the three branches of the Park River combine. The project will not incorporate any features that could increase the rate of runoff from the North Branch Park River, and potentially increase the severity of downstream flows.

4.2.1. Expected Outcome No. 5 (Secondary) – *Regional*

The project will reduce the magnitude of flooding from the North Branch Park River to the Park River mainstem. No alternatives will be considered that will result in increased downstream flows and potential adverse impacts as a result of the project. This will provide impacted interests along the Park River mainstem, including the community of Grafton, ND, reduced impacts as a result of flooding in the North Branch Watershed.

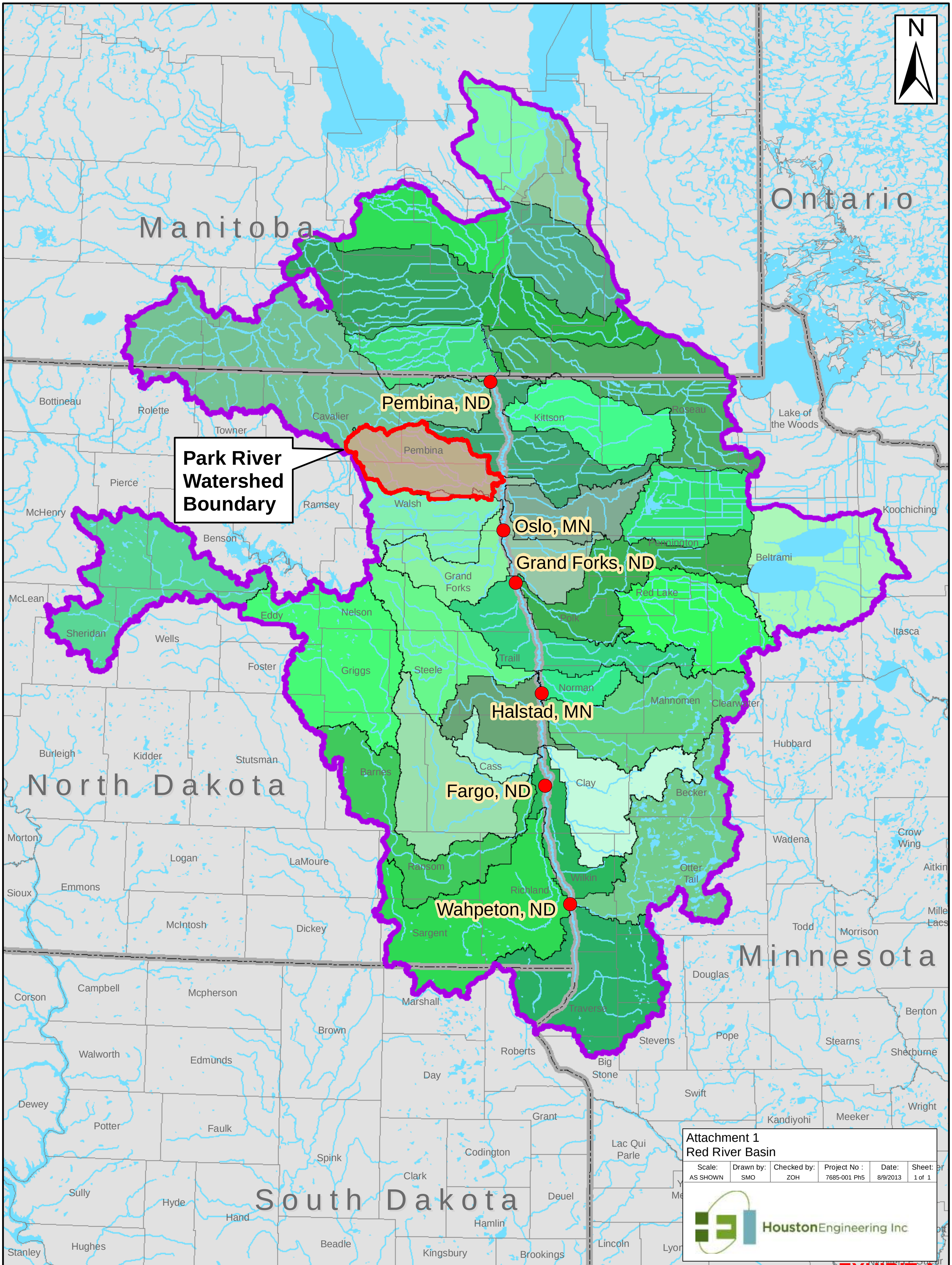
4.3. Red River Basin Wide Scale Purpose

As part of the Red River Basin Commission's Long Term Flood Solutions for the Red River Basin (RRBC LTFS), peak flow and runoff volume reduction goals were established to reduce Red River main stem flooding by approximately twenty percent. To achieve this goal, individual tributary goals were generally to provide 35%± peak flow reduction and 15-20%± overall volume reduction.

4.3.1. Expected Outcome No. 6 (Secondary) – *Basin-wide*

Alternatives considered in the North Branch Park River watershed will attempt to work towards providing peak flow and volume reductions as specified in the RRBC LTFS. The total peak flow and volume reductions recommended for the Park River watershed are 35% and 20% reductions, respectively. Projects will not be considered with this as primary objective, rather will be recognized if alternatives can assist reducing the Park River's contribution to downstream flooding.

EXHIBIT A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North Dakota
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Park River Watershed Boundary
Pembina, ND
Oslo, MN
Grand Forks, ND
Halstad, MN
Fargo, ND
Wahpeton, ND
Bottineau
Rolette
Towner
Cavalier
Pembina
Kittson
Roseau
Lake of the Woods
Pierce
McHenry
Benson
Ramsey
Walsh
Koochiching
Pennington
Beltrami
Grand Forks
Red Lake
McLean
Eddy
Nelson
Polk
Sheridan
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Foster
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Lac Qui Parle
Clark
Sully
Hyde
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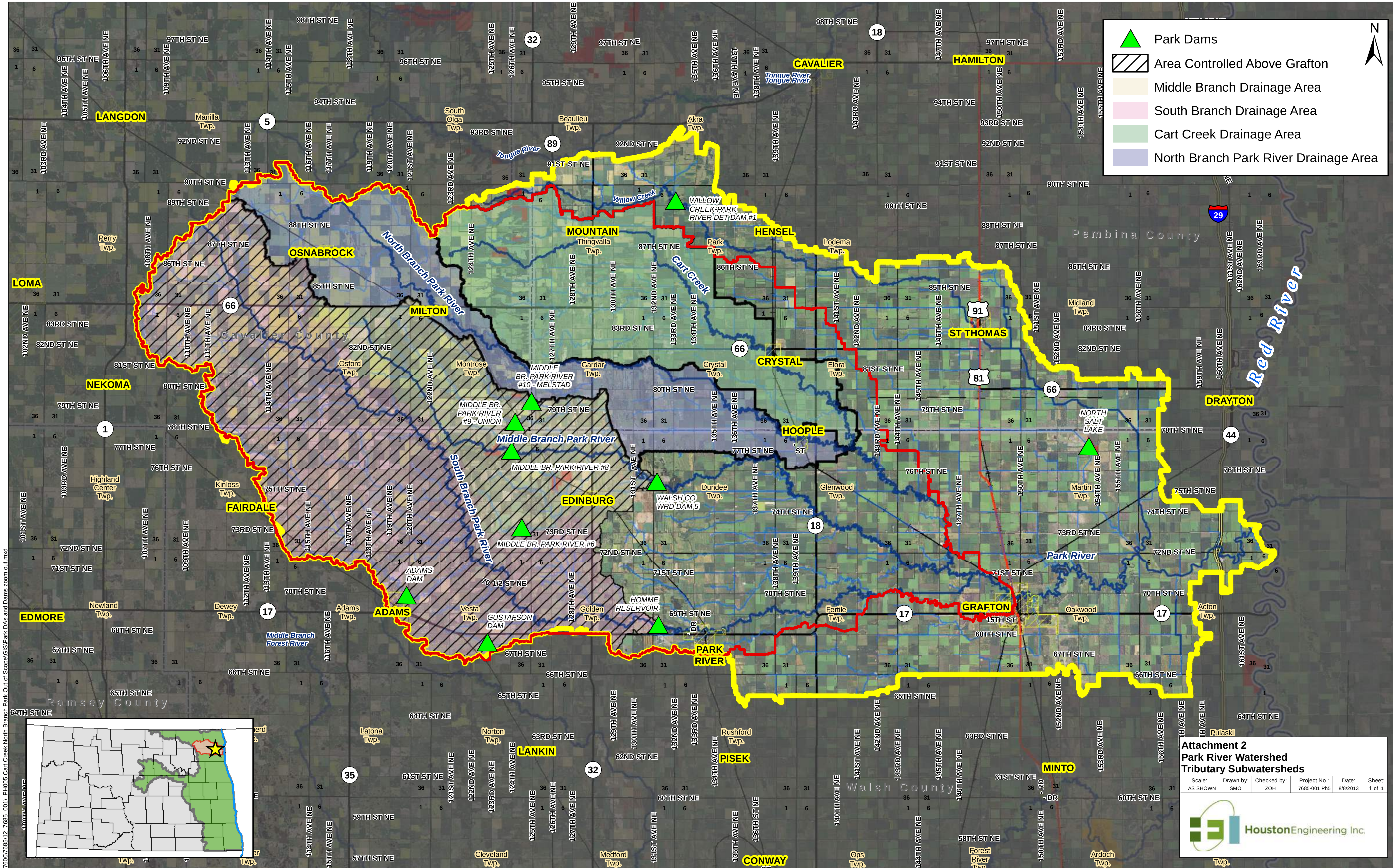
Deuel
Hamlin
Stanley
Hughes
Beadle
Kingsbury
Brookings
Lincoln
Attachment 1
Red River Basin
Scale: AS SHOWN
Drawn by: SMO
Checked by: ZOH
Project No : 7685-001 Ph5
Date: 8/9/2013
Sheet: 1 of 1
HoustonEngineering Inc

EXHIBIT A



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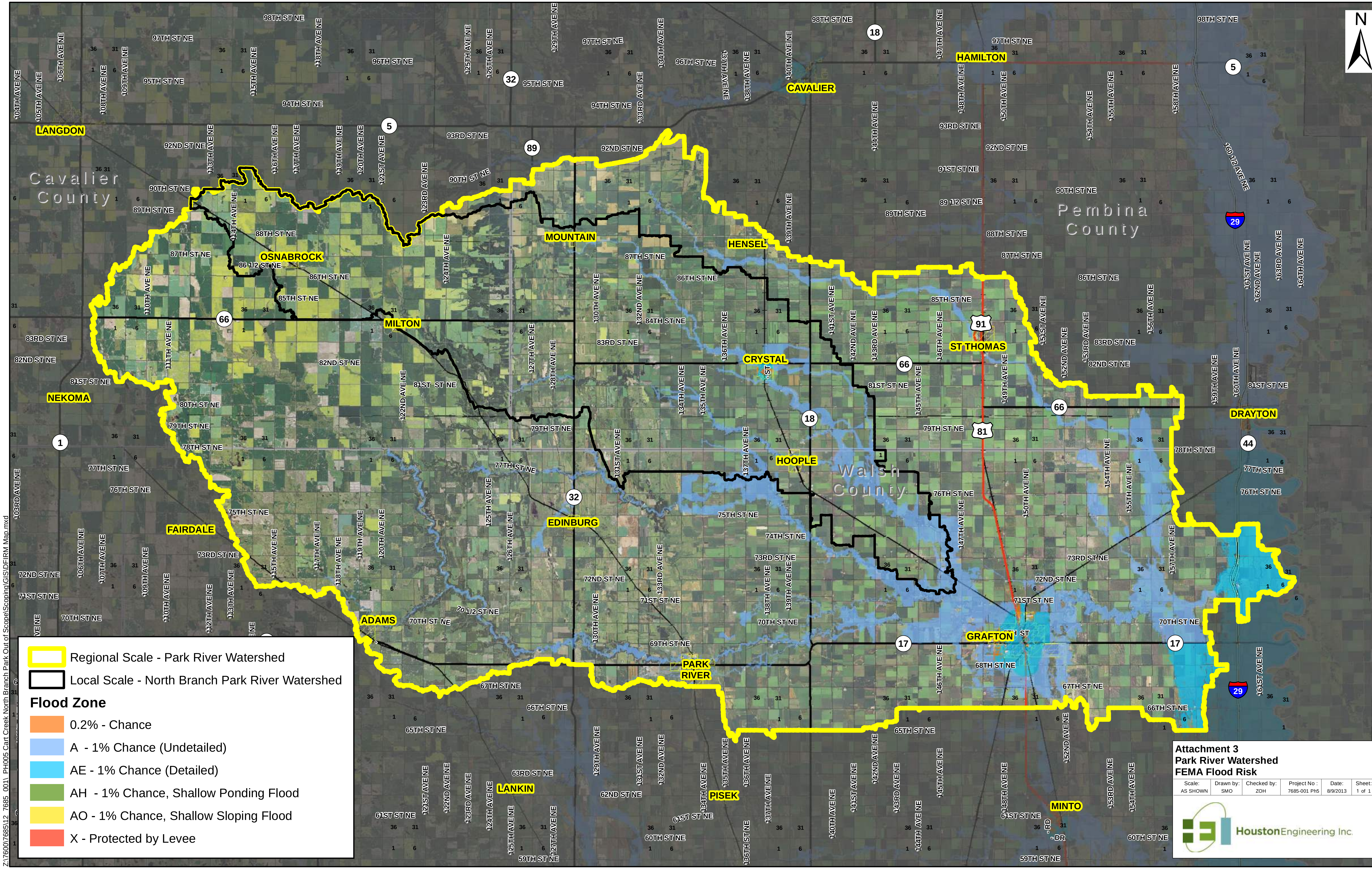

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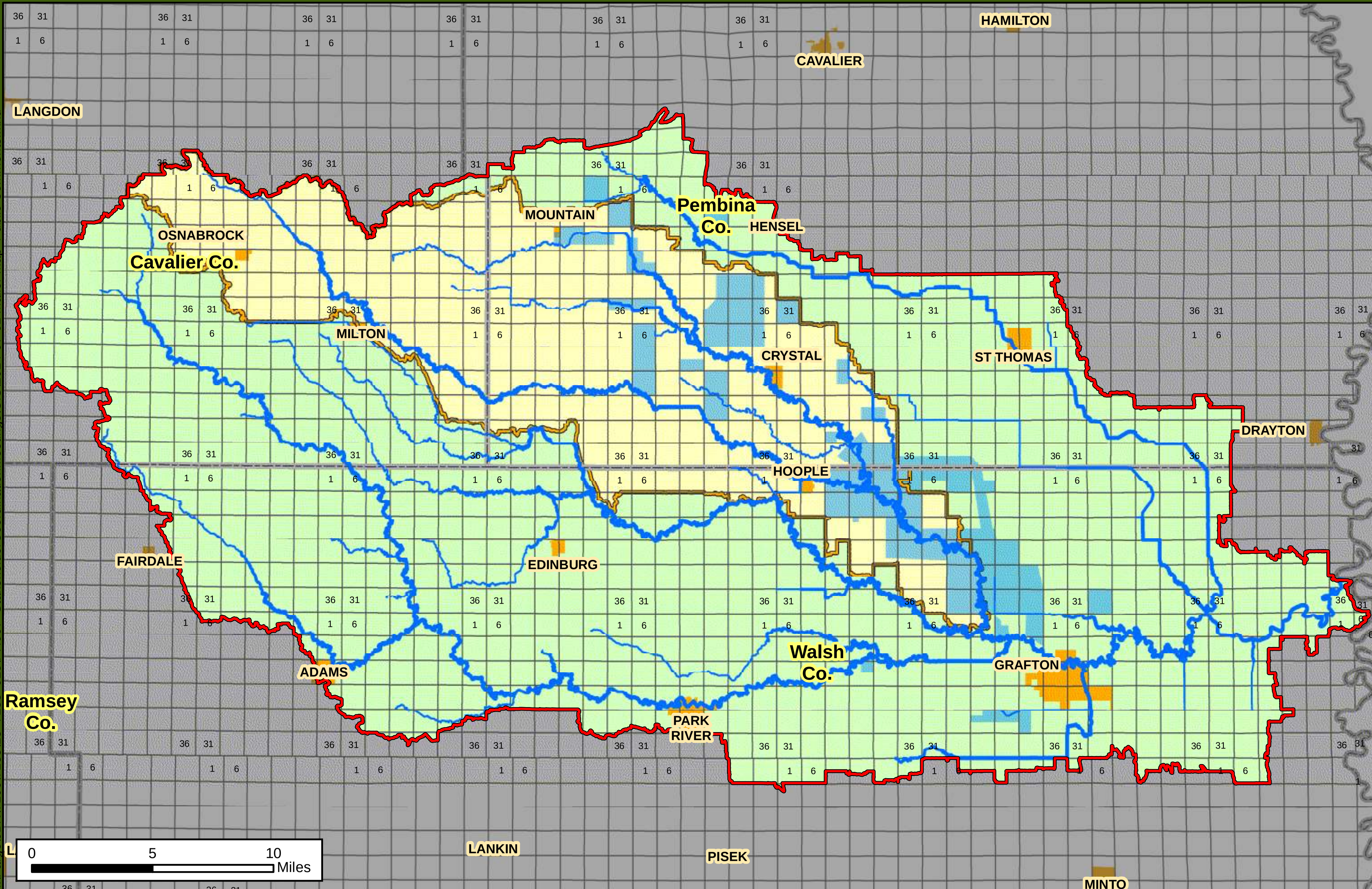

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Park River Joint Water Resource District

North Branch Park River
Comprehensive Flood Damage Reduction
Public Comment Form

- North Branch Watershed
- Park River Watershed
- Rivers and Streams
- County Boundary
- Township Boundary
- City Limits
- Received Problem Areas

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Prepared By:

Houston Engineering Inc.

EXHIBIT A

Name	Address	Impacts to Your Property as a Result of Flooding	Overland Flooding Observations	How to Reduce Flood Risk	Additional Comments
James Aasand	1221 Western Ave Grafton, ND 58237	Crop loss due to North Branch of Park River backing up onto land or slow drainage into N Branch or N Branch overflowing its banks onto farmland causing overland flooding crop & land damage	Around the Nash area large amounts of land has been underwater	By slowing down or diverting waters from entering North Branch	
J. G. Beattie	8345 142nd Ave NE Crystal, ND 58222	Crop loss	There is so much water that comes into Elora Twp, over flow from willow creek, cart creek, the coulee south of Crystal along with local water. The water flows into the Twp so fast from the west & northwest & our Twp is flatter and doesn't have the elevation advantage that the Twp's west and northwest have.	Slow down the flow of water coming into Elora Twp before it gets here.	
Richard A Brabakken Sr	14180 77th St NE	All of the above. Last year I was flooded 3 times	It has been getting worse but there has been more heavy rains and more drainage	It would be nice if the water could be held upstream and slow the water down. It is pretty flat to hold much water where I live	We can handle are own water but we can not handle the water from upstream
Ray Brubakken	PO Box 307 Hoople, ND 58243	Loss of crops after a heavy rain. Unable to plant crops. Erosion cause by fast moving water.	With all the CRP removal, draining and diking, water moves faster than ever before. 2013 was the worst I have ever seen. 50% of our farm was not planted.	Hold water, clean river & Cart Creek.	I own the land where Cark Creek and the North Branch of the Park River meet. Cart Creek was always dry before July or August not that long ago. Now it never is.
Joyce Collis	14750 Hwy 17 Grafton	All of the culverts going east are collapsed or at the wrong angle all of the water backs up around and many property		redo the drainage	
Doug Davis	1344 Lawler Ave Grafton, ND	Crop loss, sandbagging of 2 properties, extensive erosion to ditches from overland Cart Creek flooding and water depositing in the field for a long period of time. Continuous running of sump pumps many acres of preventing planting 2013	too much water coming from Cart Creek into Park River and it comes too fast	some diversions of water from Cart Creek, dams or holding ponds to slow down water.	Water from Cart Creek not only damages adjacent property but the overland water, which could be enhanced by cutting of roads or ditches during flooding has devastated road ditches and filled my fields at my farm at Sec 5 Farmington 2 times within last 10 years. Costs to clean clay out of fields and fill holes in ditches have been quite high. Plus farm ability on the land for following years, especially in this wet cycle has been challenging.
John F. Desautel	405 Eastern Ave Grafton, ND 58237	We had to dike around the farm to try and keep water out. late spring planting, washed out roads, crops lost, and land damage.	The North Branch is filled with dead trees and has flooded our area for the last 20 or 30 years. It was gone over its banks and has been a big problem	I believe by slowing or holding water back & finding a over flow outlet to the east along with a clean out & doing some shayling(?) of the North Branch.	Prop Location (Sec 34 & part of 27 & 26). Areas impacted by flooding (Sec 21, 22, 28, 27, 33, 34).
John F. Desautel Farming Co. & D&H Land Co. LLC	7275 148th Ave NE Grafton, ND 58237 % Kevin Hoenke	Have lost crop many times from water coming down North Branch overflowing and going overland	To much water coming in North Branch river is not open to take all the water drainage has been changed upstream and water is coming too fast	I am hopeful that the two counties are talking. We have to have to use all options	I have been involved in Drain 70, 74 in Walsh County. The last 10 years the amount of water has changed we have lost hundreds of thousands in crop
Robert Desautel	15309 74th St NE Grafton, ND	Can't get in to see it P.P. 3 times last 5 years, when seeded heavy rain comes from NW. Drowns my crops	It jumps out of the North Branch straight north of Nash 1.5 miles. Runs across land to the southeast.	Holding water back to the Northwest	I think storing water close to the escarpment would be very feasible.
Beth & Rick Engelmann	Box 136 Hoople, ND 58243	Crop loss, land erosion, ditching		Getting Mountain water to Red River without going through Grafton. Clean Cart Creek, channel blocked with trees	Land Affected: SE 1/4 S9 159-54, NE 1/4 S16 159-54, SE 1/4 S22 159-54, SW 1/4 S23 159-54, SE 1/4 SW 1/4 S27 159-54, SW 1/4 S28 159-54, S35 159-54
Loren Estad	13545 84th St NE Crystal, ND	Crop damages and erosion to farm land	Mountain east to willow coulee on North side of 3 is becoming a major artery for excess runoff	Retention dams be placed west of Hwy 32	
Lindsey Fingarson	13021 78th St NE Edinburg, ND 58227	Crop loss - seeding later in the spring because of excess water from Cart Creek	Cart Creek can not handle the large amount of water at spring runoff and big summer rains.	Putting in retention dams at the water heads	19-160-55
Hans & Tara Halvorson	7467 Cty Rd 6 Nash, ND	Flooded yard most years. Water on the main floor in home for 1st time in 2013. Flooded woods most years. Flooded buildings (barn, outbuildings) most years	Getting worse every year. Incredible amount of "personal protection" that collectively affects others	Create "holding areas" further upstream to manage water levels	
Russell Hannessor	13120 Co Rd 3 Mountain, ND	Water exceeds creek and does major soil erosion next to drain	wetter weather causing more water and water coming off hill in Cavalier Co. faster than before	Slow down water in big coulee to the west in western Pembina and Cav. county	Your surface ponds will work but there is to much slope for five miles east of Mountain so detention dams are only thing that will help Mountain Area

EXHIBIT A

Name	Address	Impacts to Your Property as a Result of Flooding	Overland Flooding Observations	How to Reduce Flood Risk	Additional Comments
Chad Hornbaker	14445 76th St NE	Lived at residence 11 years. No damage from flooding. New drainage ditch on east side of property could have adverse effects in spring!	Water flows overland one mile north of my property and comes south 1.5 miles east of my property. Neighbors are affected by overland flooding.	Control individuals diking, ditching, and putting culverts in to protect their property but as a result force water on others.	Neighbors are fighting over forcing water on each others crops/fields/land and continue to dike/ditch with no obvious regulation or monitoring. Who is responsible for figuring out how ditch/dike will affect the watershed & flooding
Kevin Johnson	3348 McIntosh Dr Billings, MT 59101	Mostly just brush & some garbage	I really haven't seen any - but I don't live there either	Quit draining natural pot holes	
John H. Johnson	12637 81st St NE Edinburg, ND 58227	The North Branch of the Park River is eroding the banks at a faster pace than years ago. I live close to the river	I live on the Pembina Hills Escarpment and water drains at a high rate here so overland flooding is brief	More control of the water upstream	
Lonnette Kelley	8135 130th Ave NE Mountain, ND 58262	I have lived here since 1995 - during these past years never any flooding except for the time we had 9.5 inches at once-only small amounts of water in basement. Since 2005 yearly water in basement and increasing from 1 sump pump to 4 additional when the water starts running in. Has caused many dollars worth of damages and huge amounts of time fighting water	Last number of years water is coming from Walhalla area. Everything comes to our gravel corner & Hwy3-like a basin it fills the entire fields surrounding my home. Tries to run down the small creeks and ditches east but just no place to go. Something has changed in the last years to divert the water (all) to this basin area	Change whatever changed and let the water go back to its original path. Stop diverting the heavy flows of water here.	This change in the water flow is causing a hardship with my home-creating many problems with this 100 year old home, the drain fields, basement, appliances, as this is my business also creates many issues for my guests, with plumbing issues and cancelled appointments. Very costly and hard to continue fighting the waters. Was never this way in the past years.
Andrew Kirking, Emergency Manager	Not in Project Area		Rapid water movement through legal drains & ditches causing deep rutting & washouts	Slow water down. Whether through retention or increasing wetlands, hold water longer upstream	I'm not a farmer & have no land at stake, but if it is possible to have many smaller storage areas so that many give a little. Multi-section detention sites are better than what we have now, but could many small areas be implemented?
Michael Kiser (C/O) Dorothy Doktor Family Trust, Kiser Family Trust, Apalona Kiser	501 5th St W Ada, MN 56510	The entire family farm consists of 400 acres and includes a building site which we use and maintain. Basically the entire farm is impacted by flooding. The farmstead has not gotten flooded recently, but that is because we have diked it at our own expense. In 2013, the farmstead was almost flooded in spite of our diking effort's. In 2013, the farm flooded in the spring plus 3 times during the summer. The access to the farm was blocked by flooded roads. Soil and clay was eroded from neighboring farms and deposited on our farm, causing additional damage and expense. Very little of the farm was planted. Although previous years may not have been as bad as 2013, getting the crop planted and then having it survive summer floods has been increasingly very challenging and risky for the past 20 years or so.	2013 may have been the worst year yet.	Our farm is at the bottom of the Cart Creek watershed, so about 99% of the water in the entire watershed goes through it. Better enforcement of drainage restrictions on upper areas of watershed would have helped in the past and should be done in the future. At this point cleaning and diking the channels may help. Water retention may also help.	It is possible some farmland could be given up and used for water retention, but owners would need adequate compensation. It is noted compensation should be based on what the farm would rent and sell for if it was not negatively impacted by the drainage projects on farms upstream.
Bruce & Vicki Lenz	640 6th St Crystal, ND 58202	Personally none; however, flooding damaged parks, several homes in which one had to be destroyed, friends house had damage	Crystal has Cark Creek running through it. There was a lake here which is grown in swamp now the creek flows through it. If we got grants to restore the lake & fix the damn it would cut back on the town flooding	Explained above. Half the town was flooded	If the lake was restored, fish could be introduced, park could set up camp sights and it would be more $ in county with tourism
Bill Mitchell	1286 8th Ave NE Thompson, ND 58278				Section 22 has a small coulee on one end only flooding is some overland on this property
Leslie A. Moe POA for Helen Moe	1721 Charleswood Est Dr West Fargo, ND 58078	NA	Culverts not properly cared for or larger culverts need to be installed - ditches not cleaned out	Clean trees out of ditches, larger culverts to allow water to flow and bridge repair	
Ronald D. Moe	6689 Hwy 81 Grafton, ND 58237	Perpetual field crossing washouts, delayed spring planting, and some annual crop losses.	It is getting worse every year as farmers improve upon their field drains.	See my eleven page letter enclosed.	I think you should seriously look at doing a high-water diversion of Cart Creek and the north branch of the PR from the confluence of the two directly to the Red River along mid-section lines. Considering the property lines and farmstead locations shown on plat book maps it loos very doable to me.

EXHIBIT A

Name	Address	Impacts to Your Property as a Result of Flooding	Overland Flooding Observations	How to Reduce Flood Risk	Additional Comments
Mountain Cemetary Assn	Box 146 Mountain, ND 50262	No impact			
F. Paul O'Keefe	8233 137th Ave NE Crystal, ND 58222	During high water we are isolated by water over the roads and as a result the gravel is washed off. No damage to buildings	Erodes the topsoil. Delays planting. Piles up Debris. Bring in weeds	Holding areas to the N.W. on Cart Creek. Diversion around Crystal	High water is occurring more often. This has an impact on our property value, making sale of this property difficult. I am not qualified to comment on water storage
F Kenneth Olafson	208 E Oakland Ave Milton, ND 58260	Large comment letter, didn't return form.			
Roger Olafson	12945 84th St NE Edinburg, ND 58227	Moderate crop loss. Moderate to heavy property damage due to erosion and washouts caused by stream breakouts.	It seems some changes have been made upstream as water comes through in larger amounts in places there didn't use to cause problems	Combination of retention dams, holding areas to temporarily store water, channel improvements (cleaning & widening)	This is the third such meeting I have attended on Park River/Cart Creek flooding problems (Mountain-2006, Hoople-2009, Mountain-2014) and this is the first one where I felt there were some meaningful dialogue and well through out possible solutions to the flooding issues.
Robert Olgeirson	301 W Ave C Bismarck, ND 58501	We were forced to dig a $3000+ ditch across a good field to direct overland flooding. It came across several fields instead of the creek channel	Getting worse than it ever was	Keep some of the water in Cavalier county- which is the source	Main creek on our property flows south of Hwy 66 and then back. Creek shown on map is Not the main one but a much smaller drain and insignificant in comparison
Jerry & Nadine Olson	14187 State Hwy 66 - Box 74 Hoople, ND 58243	Our yard is very old and people chose the high ground	Overland flooding is created by us persons by using roads for dams and everyone wanting to run water away from them. Every north-south road should have a large culvert every mile to let water run east to the Red River	For many years nearly all farms had (potholes) or low ground that held water for days weeks or months before being planted. With new leveling and dirt mover these areas have been changed or moved.	Country Road 12 acts as huge dam and directs water as do many other township build (roads or dams) to keep water moving to someone else's land. I hope if you live in Osnabrock and want to go to Pembina there is a short way than through Grafton
Doug Ramsey	8169 136th Ave NE Crystal, ND 58222	It floods our land and puts water in our basement	It piles up along township roads and washes them out. It floods Crystal	Putting a diversion ditch around the west side of Crystal	For the North Branch of the Park River and Cart Creek dams should be built on the Pembina Escarpment.
Darryl Sander	810 Westwood Ave Larimore, ND 58251	On sec 31-157-53 the coulee that runs threw this quarter used to be spring runoff only, now with all the upstream drainage it has become a year round river. I understand a lot of drainage has been done without the proper permits. Why?			Some thing needs to be done about all the upstream drainage into a coulee when it should go to the river
Penny Sigfusson (Ventor)	8115 128th Ave NE	Water running in the basement like a waterfall	There is nowhere for the water to go except through my yard		All I need is a culvert put in on the North side of my yard, I think that would fix the problem
Chris Thompson	15320 71st PL Ne Grafton, ND 58237	Crop loss, property damage	I believe there is overland flooding caused by illegal dikes and other practices that don't allow the water to go into it's natural channels	Improving the existing drains and waterways	
Ron & Delores Willis	PO Box 370 Ilwaco, WA 98624	Unknown, Live in Washington State	None	No Knowledge	(Picture on comment form)

EXHIBIT A

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

Cart Creek Site 1

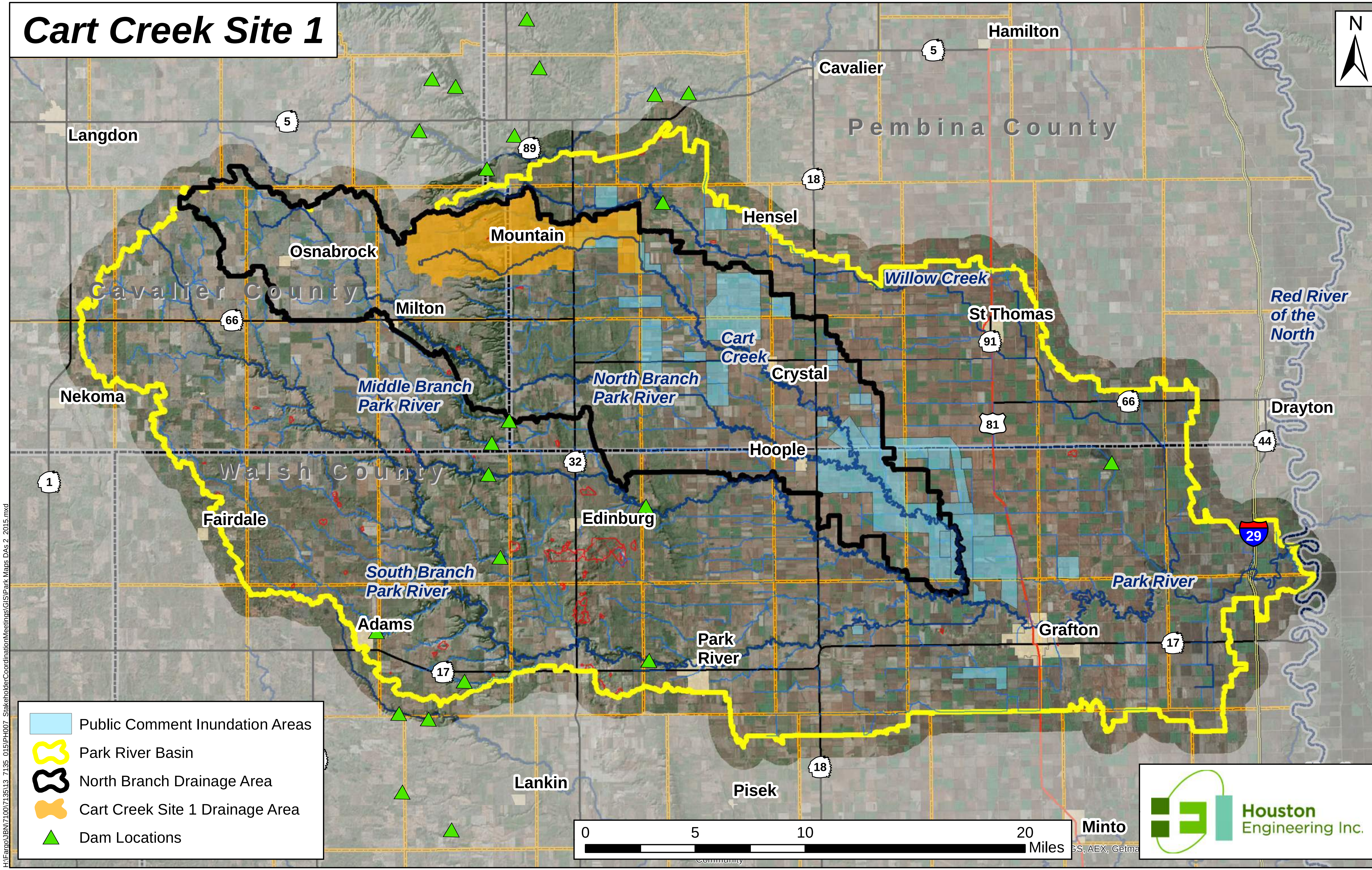


EXHIBIT C

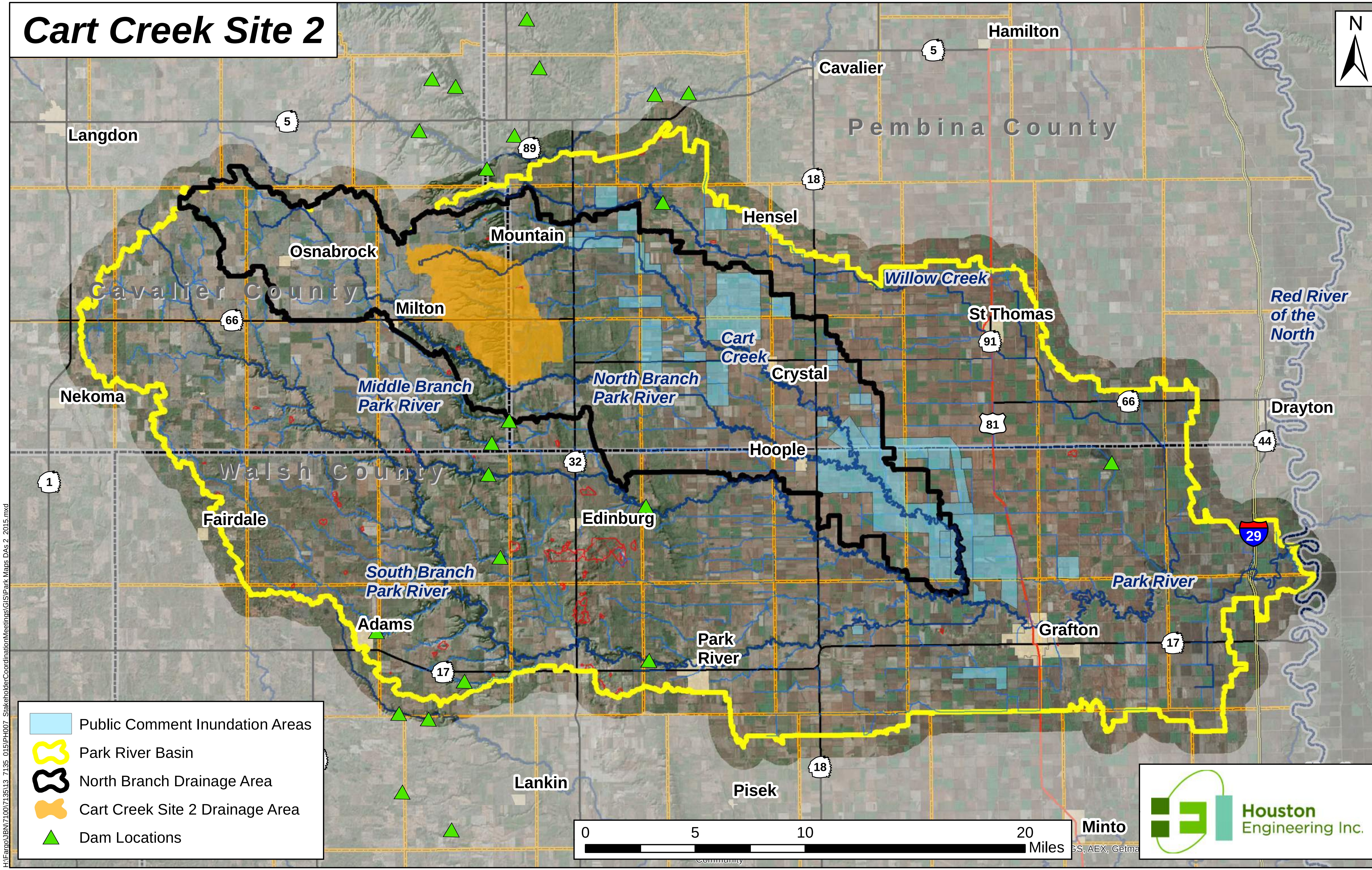

Cart Creek Site 2
N
Hamilton
Cavalier
Pembina County
Langdon
Hensel
Mountain
Osnabrock
Cavalier County
Milton
Willow Creek
St Thomas
Red River of the North
Cart Creek
Crystal
North Branch Park River
Middle Branch Park River
Nekoma
Drayton
Hoople
Walsh County
Fairdale
Edinburg
South Branch Park River
Park River
Adams
Grafton
Park River
Lankin
Pisek
Minto
29
Public Comment Inundation Areas
Park River Basin
North Branch Drainage Area
Cart Creek Site 2 Drainage Area
Dam Locations
0
5
10
20
Miles
Houston Engineering Inc.

EXHIBIT C

North Branch Site 1

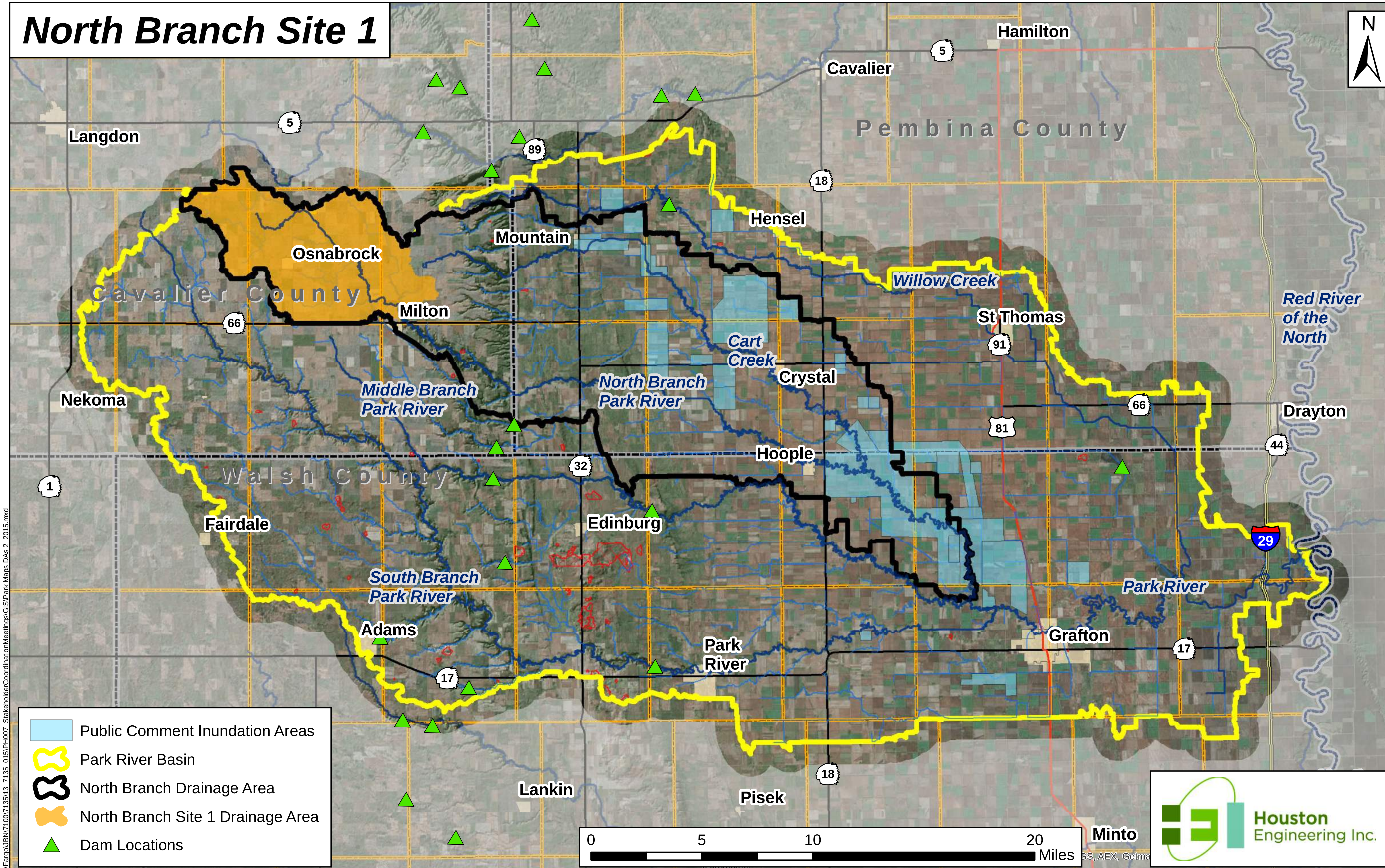


EXHIBIT C

North Branch Site 2

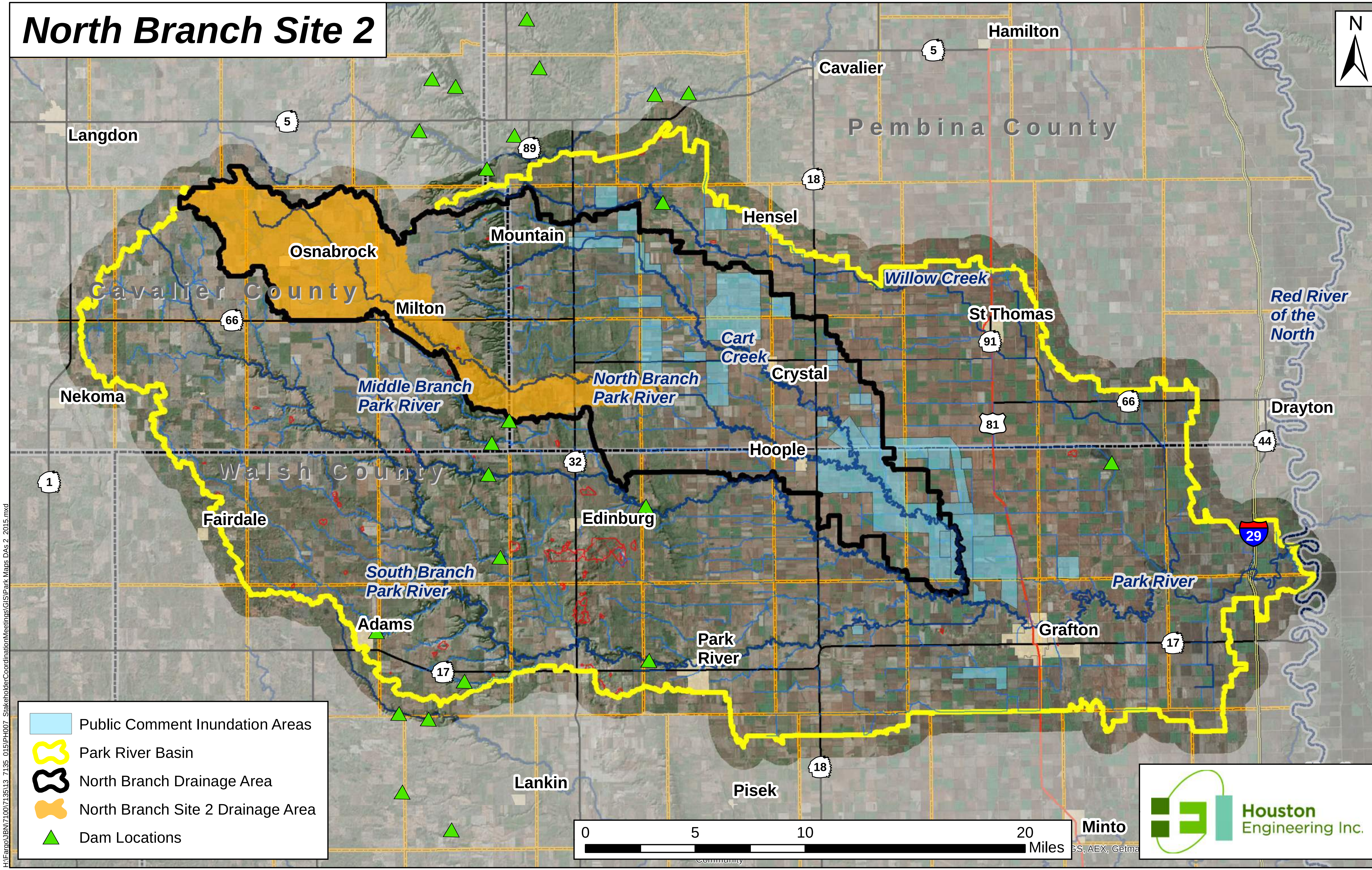


EXHIBIT C

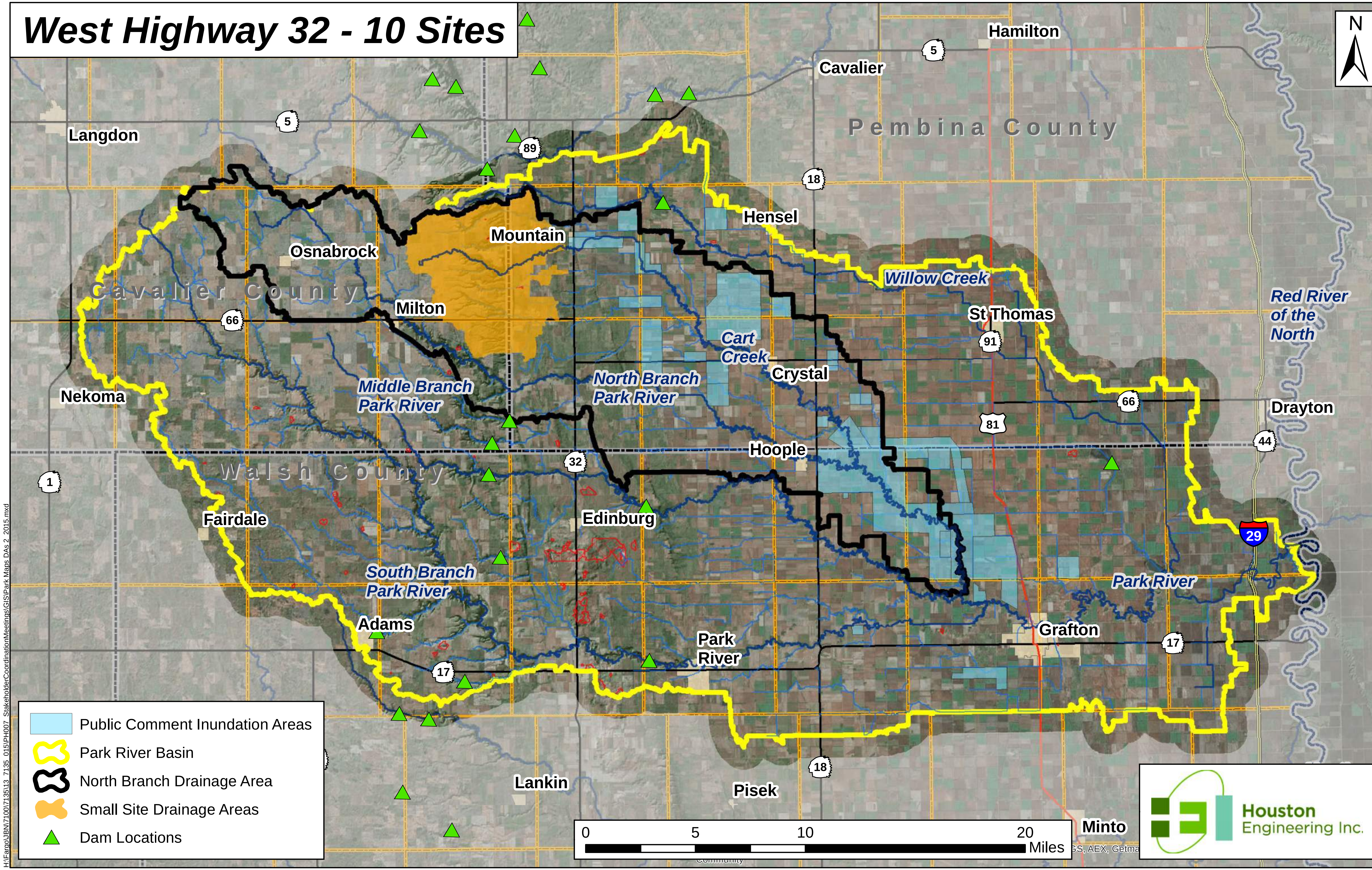

West Highway 32 - 10 Sites
N
Hamilton
Cavalier
Langdon
Pembina County
Cavalier County
Walsh County
Hensel
Mountain
Osnabrock
Milton
Willow Creek
St Thomas
Red River of the North
Cart Creek
Crystal
Middle Branch Park River
North Branch Park River
Nekoma
Drayton
Hoople
Fairdale
Edinburg
South Branch Park River
Park River
Adams
Grafton
Park River
Lankin
Pisek
Minto
Public Comment Inundation Areas
Park River Basin
North Branch Drainage Area
Small Site Drainage Areas
Dam Locations
0 5 10 20
Miles
Houston Engineering Inc.

EXHIBIT C

Site Statistics Summary

February 4, 2015

DRAFT - *Preliminary Site Identification*

Site ID	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Drainage Area (Square Miles)	Storage @ Spillway (Acre-Feet)	Storage (Inches)	Spillway Elevation* (NAVD88)	Maximum Spillway Depth* (NAVD88)	Average Pool Depth at Spillway* (NAVD88)	Spillway Surface Area* (Acres)	Top of Dam Elevation* (NAVD88)	Average Top of Dam Height* (NAVD88)	Top of Dam Surface Area* (Acres)	Impact Cropland at Max. Spillway Depth (Acres)	Impacted Hay and Pasture at Max. Spillway Depth (Acres)	Impact Forested Land at Max. Spillway Depth (Acres)	Impact Wetlands at Max. Spillway Depth (Acres)	Currently CRP at Max. Spillway Depth (Acres)	Currently WRP at Max. Spillway Depth (Acres)	Stakeholder Comments
Cart Site 1 - Pool A	X		X				X		26.1 (1) 19.6 (3)	2682	1.93 (1) 2.57 (3)	980	15	6	475	985	8.9	577	365	61	0	34	133	205	
Cart Site 1 - Pool B**	X		X				X		2.3	545	2.13	970	13	5	115	973	6.1	149	97	0	14	2	10	0	
Cart Site 2 - Upper		X	X				X		12.2	2093	3.21	1195.5	17	5	499	1200.5	12.5	717	70	366	2	37	10	263	
Cart Site 2 - Lower		X	X				X		13.3	2709	3.53	1171	12	6	457	1176	9.9	623	188	244	1	8	0	1	
North Branch Site 1- Milton Dam**					X	X	X		45.0	2304	0.96	1555	51	15	150	1565	26.7	246	20	47	0	1	8	0	
North Branch Site 2**				X		X	X		65.6	3848	1.10	939	16	7	583	944	10.1	596	578	0	3	0	0	0	
West 32 1-A**								X	3.2	113	0.65	1352.37	35	12	9.2	1357.37	22.2	11.7	0.0	0.0	8.0	0.0	0.0	0.0	
West 32 1-B**								X	5.3	315	1.11	1207.79	23	7	48.2	1212.79	11.9	64.9	33.6	0.1	6.6	7.9	0.0	0.0	
West 32 1-C**								X	7.2	239	0.62	1120.16	28	11	21.9	1125.16	12.2	29.2	0.0	0.5	0.0	19.6	0.0	0.0	
West 32 2-A**								X	5.7	254	0.84	1274.94	32	12	21.3	1279.94	21.0	27.1	0.0	0.0	7.1	0.0	0.0	0.0	
West 32 2-B**								X	8.1	391	0.90	1153.91	35	12	33.8	1158.91	14.4	43.4	0.0	1.1	13.1	0.1	0.0	0.0	
West 32 2-C**								X	13.0	439	0.63	1079.5	34	13	32.8	1084.5	17.5	39.9	0.0	0.0	0.1	26.7	0.0	0.0	
West 32 3-A**								X	1.8	27	0.29	1091.93	22	6	4.8	1096.93	5.5	15.9	0.1	1.1	2.2	1.0	0.0	0.0	
West 32 4-A**								X	1.7	42	0.46	1266.03	14	4	9.8	1271.03	12.1	15.8	0.0	0.0	5.4	0.0	0.0	0.0	
West 32 4-B**								X	3.4	183	1.00	1286.86	26	11	17.4	1291.86	12.0	22.1	0.0	0.0	7.6	5.7	0.0	0.0	
West 32 4-C**								X	14.0	298	0.40	1159.84	31	9	33.0	1164.84	13.6	62.2	0.0	24.7	0.0	3.8	0.0	0.0	

**Top of dam and spillway requirements should be considered approximate. Detailed spillway analysis will determine freeboard requirements.*

*** Site operated as "Flow-Through" - No Gated storage*

EXHIBIT D

Site Performance Summary

10-Year Synthetic Event

February 4, 2015

DRAFT - *Preliminary Site Identification*

Site ID	Drainage Area (Square Miles)	Utilized Storage (Acre-Feet)	Utilized Storage (Inches)	Maximum Pool Elevation (NAVD88)	Maximum Pool Depth (Feet)	Maximum Pool Area (Acres)	Impact Cropland at Max. Pool Depth (Acres)	Impacted Hay and Pasture at Max. Pool Depth (Acres)	Impact Forested Land at Max. Pool Depth (Acres)	Impact Wetlands at Max. Pool Depth (Acres)	Currently CRP at Max. Pool Depth (Acres)	Currently WRP at Max. Pool Depth (Acres)	Stakeholder Comments
Scenario 1													
Cart Site 1 - Pool A	26.1	2682	1.93	976.8	12.0	333	233	61	0	31	43	155	
Cart Site 1 - Pool B**	2.3	545	2.13	966.6	9.1	71	64	0	6	2	0	0	
Scenario 2													
Cart Site 2 - Upper	12.2	2093	3.21	1190.9	12.1	237	22	194	0	13	3	149	
Cart Site 2 - Lower	13.3	2709	3.53	1166.7	8.0	360	140	202	0	8	0	0	
Scenario 3													
Cart Site 1 - Pool A	19.6	2682	2.57	975.4	10.6	279	181	61	0	29	13	143	
Cart Site 1 - Pool B**	2.3	545	2.77	966.5	9.0	70	63	0	5	2	0	0	
Cart Site 2 - Upper	12.2	2093	3.21	1190.9	12.1	237	22	194	0	13	3	149	
Cart Site 2 - Lower	13.3	2709	3.53	1166.7	8.0	360	140	202	0	8	0	0	
Scenario 4													
North Branch Site 2**	65.6	3848	1.10	932.6	9.9	326	323	0	3	0	0	0	
Scenario 5													
North Branch Site 1- Milton Dam**	45.0	2304	0.96	1531.9	28.0	40	4	18	0	1	0	0	
Scenario 6													
North Branch Site 2**	65.6	3848	1.10	934.6	11.9	431	427	0	3	0	0	0	
North Branch Site 1- Milton Dam**	45.0	2304	0.96	1531.9	28.0	40	4	18	0	1	0	0	
Scenario 7													
Cart Site 1 - Pool A	26.1	2682	1.93	975.4	10.6	279	181	61	0	29	13	143	
Cart Site 1 - Pool B**	2.3	545	3.53	966.5	9.0	70	63	0	5	2	0	0	
Cart Site 2 - Upper	12.2	2093	3.21	1190.9	12.1	237	22	194	0	13	3	149	
Cart Site 2 - Lower***	13.3	2709	3.53	1166.7	8.0	360	140	202	0	8	0	0	
North Branch Site 2**	65.6	3848	1.10	934.6	11.9	431	427	0	3	0	0	0	
North Branch Site 1- Milton Dam**	45.0	2304	0.96	1531.9	28.0	40	4	18	0	1	0	0	
Scenario 8													
West 32 1-A**	3.2	113	0.65	1338.0	20.9	3	0.0	0.0	3.1	0.0	0.0	0.0	
West 32 1-B**	5.3	315	1.11	1202.8	18.5	30	22.4	0.1	3.1	4.7	0.0	0.0	
West 32 1-C**	7.2	239	0.62	1114.2	22.0	15	0.0	0.1	0.0	13.9	0.0	0.0	
West 32 2-A**	5.7	254	0.84	1262.4	19.0	10	0.0	0.0	1.1	0.0	0.0	0.0	
West 32 2-B**	8.1	391	0.90	1145.4	26.9	20	0.0	0.1	4.3	0.0	0.0	0.0	
West 32 2-C**	13.0	439	0.63	1070.3	25.2	22	0.0	0.0	0.0	16.1	0.0	0.0	
West 32 3-A**	1.8	27	0.29	1082.2	11.8	1	0.0	0.4	0.5	0.1	0.0	0.0	
West 32 4-A**	1.7	42	0.46	1260.8	8.3	4	0.0	0.0	2.5	0.0	0.0	0.0	
West 32 4-B**	3.4	183	1.00	1277.2	16.0	9	0.0	0.0	3.0	3.8	0.0	0.0	
West 32 4-C**	14.0	298	0.40	1148.5	19.5	11	0.0	6.7	0.0	3.4	0.0	0.0	

*** Site operated as "Flow-Through" - No Gated storage*

EXHIBIT D

Site Performance Summary

25-Year Synthetic Event
February 4, 2015
DRAFT - *Preliminary Site Identification*

Site ID	Drainage Area (Square Miles)	Utilized Storage (Acre-Feet)	Utilized Storage (Inches)	Maximum Pool Elevation (NAVD88)	Maximum Pool Depth (Feet)	Maximum Pool Area (Acres)	Impact Cropland at Max. Pool Depth (Acres)	Impacted Hay and Pasture at Max. Pool Depth (Acres)	Impact Forested Land at Max. Pool Depth (Acres)	Impact Wetlands at Max. Pool Depth (Acres)	Currently CRP at Max. Pool Depth (Acres)	Currently WRP at Max. Pool Depth (Acres)	Stakeholder Comments
Scenario 1													
Cart Site 1 - Pool A	26.1	2682	1.93	978.6	13.8	414	314	61	0	31	95	182	
Cart Site 1 - Pool B**	2.3	545	2.13	967.4	9.9	80	70	0	8	2	0	0	
Scenario 2													
Cart Site 2 - Upper	12.2	2093	3.21	1192.4	13.6	325	38	249	0	25	6	185	
Cart Site 2 - Lower	13.3	2709	3.53	1168.0	9.3	393	158	216	0	8	0	0	
Scenario 3													
Cart Site 1 - Pool A	19.6	2682	2.57	976.8	12.0	334	235	61	0	31	44	155	
Cart Site 1 - Pool B**	2.3	545	2.77	967.3	9.8	79	70	0	7	2	0	0	
Cart Site 2 - Upper	12.2	2093	3.21	1192.4	13.6	325	38	249	0	25	6	185	
Cart Site 2 - Lower	13.3	2709	3.53	1168.0	9.3	393	158	216	0	8	0	0	
Scenario 4													
North Branch Site 2**	65.6	3848	1.10	935.5	12.7	466	462	0	3	0	0	0	
Scenario 5													
North Branch Site 1- Milton Dam**	45.0	2304	0.96	1542.6	38.7	74	8	29	0	1	4	0	
Scenario 6													
North Branch Site 2**	65.6	3848	1.10	936.7	13.9	518	514	0	3	0	0	0	
North Branch Site 1- Milton Dam**	45.0	2304	0.96	1542.6	38.7	74	8	29	0	1	4	0	
Scenario 7													
Cart Site 1 - Pool A	26.1	2682	1.93	976.8	12.0	334	235	61	0	31	44	155	
Cart Site 1 - Pool B**	2.3	545	3.53	967.3	9.8	79	70	0	7	2	0	0	
Cart Site 2 - Upper	12.2	2093	3.21	1192.4	13.6	325	38	249	0	25	6	185	
Cart Site 2 - Lower***	13.3	2709	3.53	1168.0	9.3	393	158	216	0	8	0	0	
North Branch Site 2**	65.6	3848	1.10	936.7	13.9	518	514	0	3	0	0	0	
North Branch Site 1- Milton Dam**	45.0	2304	0.96	1542.6	38.7	74	8	29	0	1	4	0	
Scenario 8													
West 32 1-A**	3.2	113	0.65	1346.9	29.9	7	0.0	0.0	5.8	0.0	0.0	0.0	
West 32 1-B**	5.3	315	1.11	1206.0	21.7	42	29.7	0.1	5.7	6.5	0.0	0.0	
West 32 1-C**	7.2	239	0.62	1117.9	25.7	19	0.0	0.3	0.0	17.6	0.0	0.0	
West 32 2-A**	5.7	254	0.84	1270.1	26.7	16	0.0	0.0	3.8	0.0	0.0	0.0	
West 32 2-B**	8.1	391	0.90	1150.8	32.3	28	0.0	0.5	9.4	0.0	0.0	0.0	
West 32 2-C**	13.0	439	0.63	1076.0	30.8	28	0.0	0.0	0.0	21.9	0.0	0.0	
West 32 3-A**	1.8	27	0.29	1088.4	18.0	3	0.0	0.9	1.4	0.6	0.0	0.0	
West 32 4-A**	1.7	42	0.46	1264.0	11.6	8	0.0	0.0	4.2	0.0	0.0	0.0	
West 32 4-B**	3.4	183	1.00	1283.2	22.0	14	0.0	0.0	5.4	4.9	0.0	0.0	
West 32 4-C**	14.0	298	0.40	1155.6	26.6	24	0.0	17.1	0.0	3.8	0.0	0.0	

*** Site operated as "Flow-Through" - No Gated storage*

EXHIBIT D

Site Performance Summary

50-Year Synthetic Event

February 4, 2015

DRAFT - *Preliminary Site Identification*

Site ID	Drainage Area (Square Miles)	Utilized Storage (Acre-Feet)	Utilized Storage (Inches)	Maximum Pool Elevation (NAVD88)	Maximum Pool Depth (Feet)	Maximum Pool Area (Acres)	Impact Cropland at Max. Pool Depth (Acres)	Impacted Hay and Pasture at Max. Pool Depth (Acres)	Impact Forested Land at Max. Pool Depth (Acres)	Impact Wetlands at Max. Pool Depth (Acres)	Currently CRP at Max. Pool Depth (Acres)	Currently WRP at Max. Pool Depth (Acres)	Stakeholder Comments
Scenario 1													
Cart Site 1 - Pool A	26.1	2682	1.93	979.8	15.0	466	357	61	0	33	128	201	
Cart Site 1 - Pool B**	2.3	545	2.13	967.9	10.5	84	73	0	9	2	0	0	
Scenario 2													
Cart Site 2 - Upper	12.2	2093	3.21	1193.3	14.5	381	54	279	0	31	9	219	
Cart Site 2 - Lower	13.3	2709	3.53	1168.8	10.1	410	166	225	0	8	0	0	
Scenario 3													
Cart Site 1 - Pool A	19.6	2682	2.57	977.8	13.0	375	275	61	0	31	70	168	
Cart Site 1 - Pool B**	2.3	545	2.77	967.9	10.4	84	73	0	9	2	0	0	
Cart Site 2 - Upper	12.2	2093	3.21	1193.3	14.5	381	54	279	0	31	9	219	
Cart Site 2 - Lower	13.3	2709	3.53	1168.8	10.1	410	166	225	0	8	0	0	
Scenario 4													
North Branch Site 2**	65.6	3848	1.10	937.3	14.6	538	535	0	3	0	0	0	
Scenario 5													
North Branch Site 1- Milton Dam**	45.0	2304	0.96	1548.8	44.9	110	14	37	0	1	6	0	
Scenario 6													
North Branch Site 2**	65.6	3848	1.10	937.9	15.2	558	554	0	3	0	0	0	
North Branch Site 1- Milton Dam**	45.0	2304	0.96	1548.8	44.9	110	14	37	0	1	6	0	
Scenario 7													
Cart Site 1 - Pool A	26.1	2682	1.93	977.8	13.0	375	275	61	0	31	70	168	
Cart Site 1 - Pool B**	2.3	545	3.53	967.9	10.4	84	73	0	9	2	0	0	
Cart Site 2 - Upper	12.2	2093	3.21	1193.3	14.5	381	54	279	0	31	9	219	
Cart Site 2 - Lower***	13.3	2709	3.53	1168.8	10.1	410	166	225	0	8	0	0	
North Branch Site 2**	65.6	3848	1.10	937.9	15.2	558	554	0	3	0	0	0	
North Branch Site 1- Milton Dam**	45.0	2304	0.96	1548.8	44.9	110	14	37	0	1	6	0	
Scenario 8													
West 32 1-A**	3.2	113	0.65	1352.4	35.3	9	0.0	0.0	8.0	0.0	0.0	0.0	
West 32 1-B**	5.3	315	1.11	1207.8	23.4	48	33.6	0.1	6.6	7.9	0.0	0.0	
West 32 1-C**	7.2	239	0.62	1120.2	27.9	22	0.0	0.5	0.0	19.6	0.0	0.0	
West 32 2-A**	5.7	254	0.84	1274.9	31.6	21	0.0	0.0	7.1	0.0	0.0	0.0	
West 32 2-B**	8.1	391	0.90	1153.9	35.4	34	0.0	1.1	13.1	0.1	0.0	0.0	
West 32 2-C**	13.0	439	0.63	1079.5	34.4	33	0.0	0.0	0.1	26.7	0.0	0.0	
West 32 3-A**	1.8	27	0.29	1091.9	21.5	5	0.1	1.1	2.2	1.0	0.0	0.0	
West 32 4-A**	1.7	42	0.46	1266.0	13.6	10	0.0	0.0	5.4	0.0	0.0	0.0	
West 32 4-B**	3.4	183	1.00	1286.9	25.7	17	0.0	0.0	7.6	5.7	0.0	0.0	
West 32 4-C**	14.0	298	0.40	1159.8	30.8	33	0.0	24.7	0.0	3.8	0.0	0.0	

*** Site operated as "Flow-Through" - No Gated storage*

EXHIBIT D

Site Performance Summary

100-Year Synthetic Event

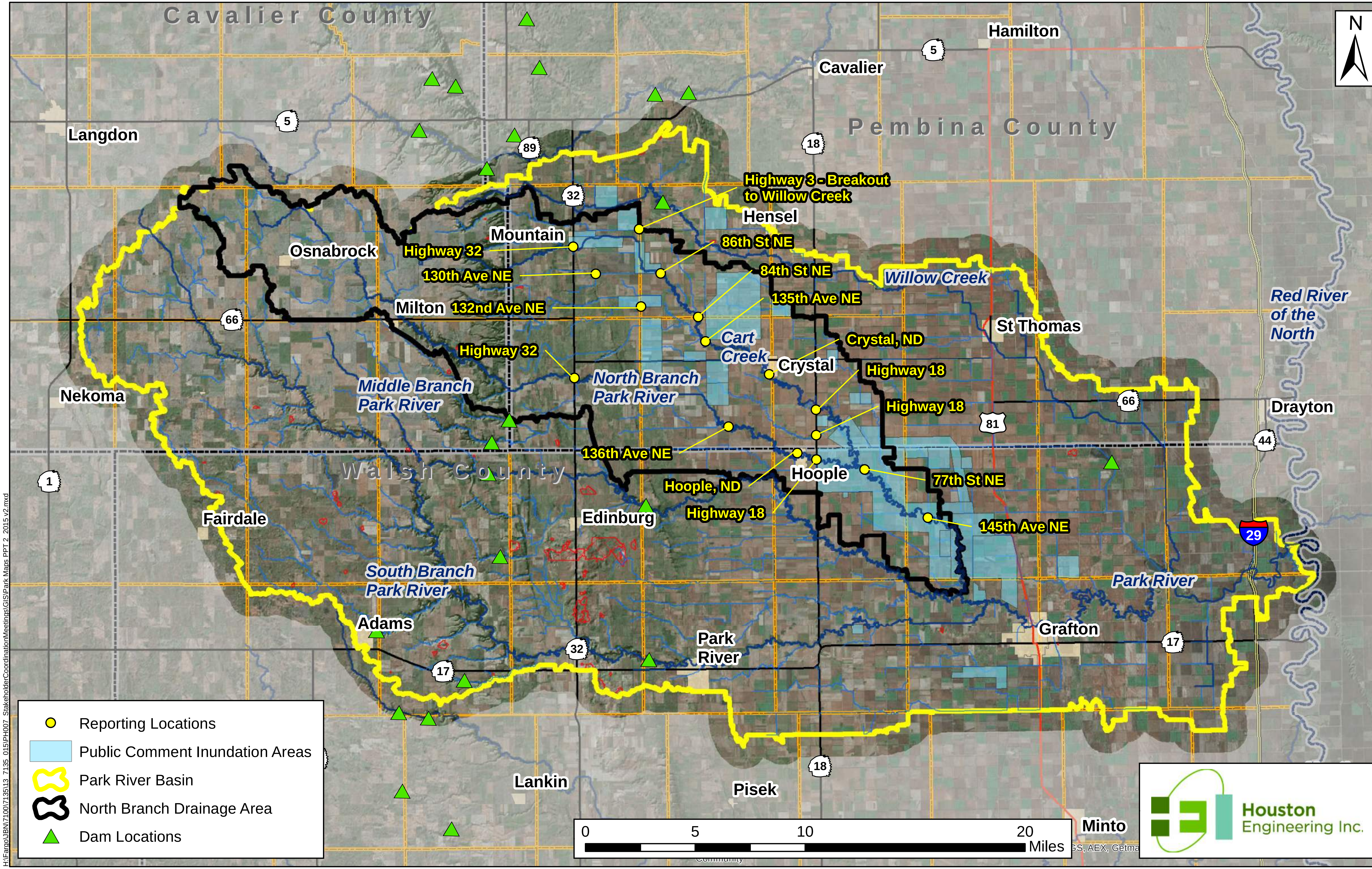
February 4, 2015

DRAFT - *Preliminary Site Identification*

Site ID	Drainage Area (Square Miles)	Utilized Storage (Acre-Feet)	Utilized Storage (Inches)	Maximum Pool Elevation (NAVD88)	Maximum Pool Depth (Feet)	Maximum Pool Area (Acres)	Impact Cropland at Max. Pool Depth (Acres)	Impacted Hay and Pasture at Max. Pool Depth (Acres)	Impact Forested Land at Max. Pool Depth (Acres)	Impact Wetlands at Max. Pool Depth (Acres)	Currently CRP at Max. Pool Depth (Acres)	Currently WRP at Max. Pool Depth (Acres)	Stakeholder Comments
Scenario 1													
Cart Site 1 - Pool A	26.1	2682	1.93	980.6	15.8	501	388	61	0	36	149	215	
Cart Site 1 - Pool B**	2.3	545	2.13	969.2	11.7	106	91	0	12	2	9	0	
Scenario 2													
Cart Site 2 - Upper	12.2	2093	3.21	1194.1	15.4	431	64	311	0	36	10	243	
Cart Site 2 - Lower	13.3	2709	3.53	1169.7	11.0	428	175	232	0	8	0	0	
Scenario 3													
Cart Site 1 - Pool A	19.6	2682	2.57	978.7	13.9	417	317	61	0	31	98	183	
Cart Site 1 - Pool B**	2.3	545	2.77	968.4	11.0	91	79	0	10	2	3	0	
Cart Site 2 - Upper	12.2	2093	3.21	1194.1	15.4	431	64	311	0	36	10	243	
Cart Site 2 - Lower	13.3	2709	3.53	1169.7	11.0	428	175	232	0	8	0	0	
Scenario 4													
North Branch Site 2**	65.6	3848	1.10	938.9	16.2	582	577	0	3	0	0	0	
Scenario 5													
North Branch Site 1- Milton Dam**	45.0	2304	0.96	1554.1	50.2	143	19	45	0	1	8	0	
Scenario 6													
North Branch Site 2**	65.6	3848	1.10	939.0	16.3	583	577	0	3	0	0	0	
North Branch Site 1- Milton Dam**	45.0	2304	0.96	1554.1	50.2	143	19	45	0	1	8	0	
Scenario 7													
Cart Site 1 - Pool A	26.1	2682	1.93	978.7	13.9	417	317	61	0	31	98	183	
Cart Site 1 - Pool B**	2.3	545	3.53	968.4	11.0	91	79	0	10	2	3	0	
Cart Site 2 - Upper	12.2	2093	3.21	1194.1	15.4	431	64	311	0	36	10	243	
Cart Site 2 - Lower***	13.3	2709	3.53	1169.7	11.0	428	175	232	0	8	0	0	
North Branch Site 2**	65.6	3848	1.10	939.0	16.3	583	577	0	3	0	0	0	
North Branch Site 1- Milton Dam**	45.0	2304	0.96	1554.1	50.2	143	19	45	0	1	8	0	
Scenario 8													
West 32 1-A**	3.2	113	0.65	1352.7	35.7	9	0.0	0.0	8.2	0.0	0.0	0.0	
West 32 1-B**	5.3	315	1.11	1208.2	23.8	49	34.4	0.1	6.7	8.2	0.0	0.0	
West 32 1-C**	7.2	239	0.62	1120.6	28.4	23	0.0	0.6	0.0	20.3	0.0	0.0	
West 32 2-A**	5.7	254	0.84	1275.4	32.0	22	0.0	0.0	7.4	0.0	0.0	0.0	
West 32 2-B**	8.1	391	0.90	1154.5	35.9	35	0.0	1.3	13.6	0.1	0.0	0.0	
West 32 2-C**	13.0	439	0.63	1080.2	35.1	34	0.0	0.0	0.1	27.6	0.0	0.0	
West 32 3-A**	1.8	27	0.29	1092.2	21.8	5	0.2	1.1	2.3	1.0	0.1	0.0	
West 32 4-A**	1.7	42	0.46	1266.3	13.9	10	0.0	0.0	5.6	0.0	0.0	0.0	
West 32 4-B**	3.4	183	1.00	1287.3	26.1	18	0.0	0.0	7.9	5.7	0.0	0.0	
West 32 4-C**	14.0	298	0.40	1160.8	31.8	36	0.0	27.1	0.0	3.8	0.0	0.0	

*** Site operated as "Flow-Through" - No Gated storage*

EXHIBIT D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Pembina County
Walsh County
Hamilton
Cavalier
Langdon
Hensel
Mountain
Osnabrock
Milton
Nekoma
Fairdale
Adams
Lankin
Pisek
Minto
Edinburg
Park River
Hoople
Crystal
St Thomas
Drayton
Grafton
Highway 3 - Breakout to Willow Creek
Highway 32
130th Ave NE
132nd Ave NE
Highway 32
86th St NE
84th St NE
135th Ave NE
Crystal, ND
Highway 18
Highway 18
136th Ave NE
Hoople, ND
Highway 18
77th St NE
145th Ave NE
Willow Creek
Cart Creek
North Branch Park River
Middle Branch Park River
South Branch Park River
Park River
Red River of the North
N
0
5
10
20
Miles
Reporting Locations
Public Comment Inundation Areas
Park River Basin
North Branch Drainage Area
Dam Locations
Houston Engineering Inc.

EXHIBIT E

Preliminary

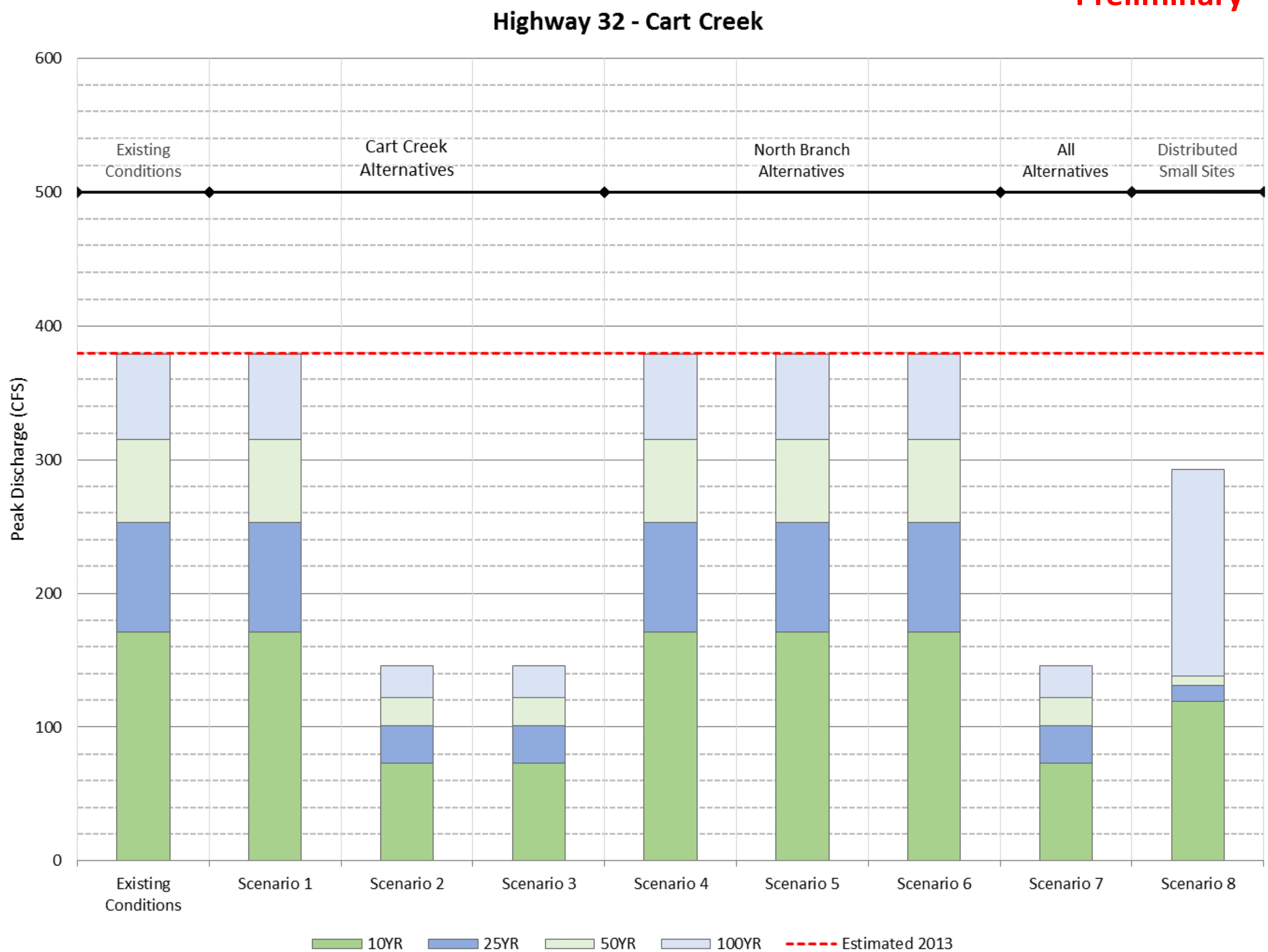
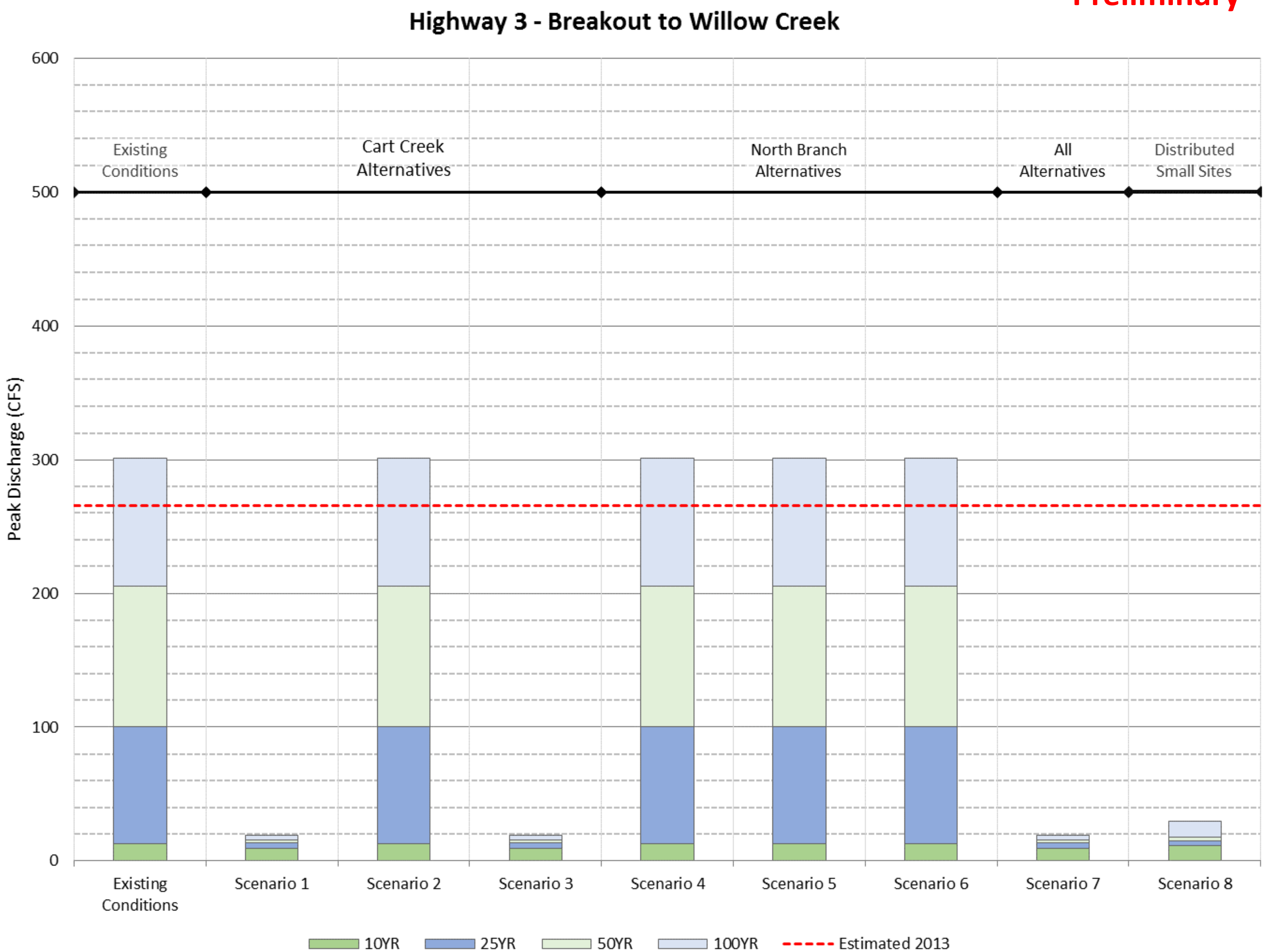


EXHIBIT E

Preliminary

EXHIBIT E

Preliminary



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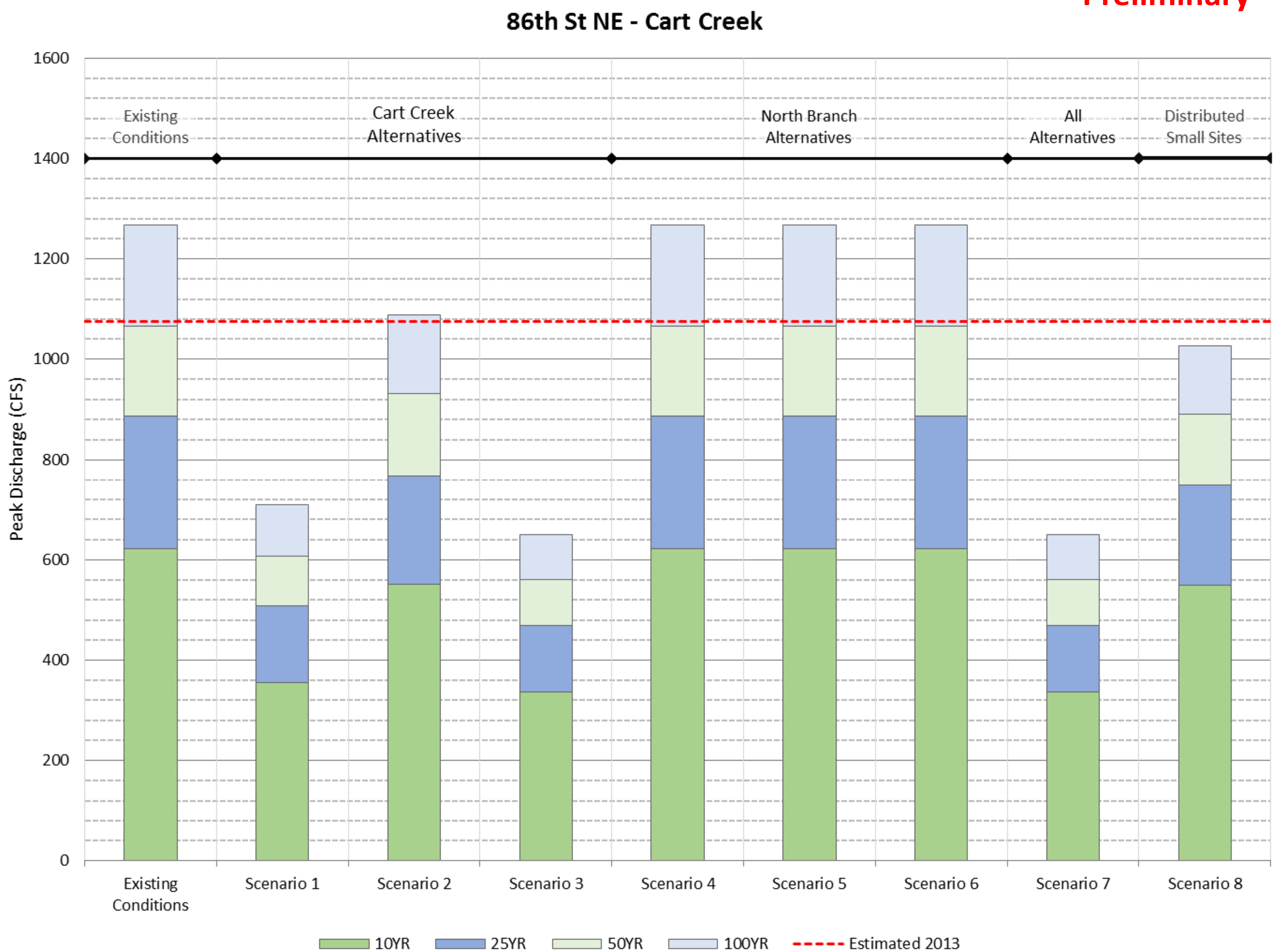

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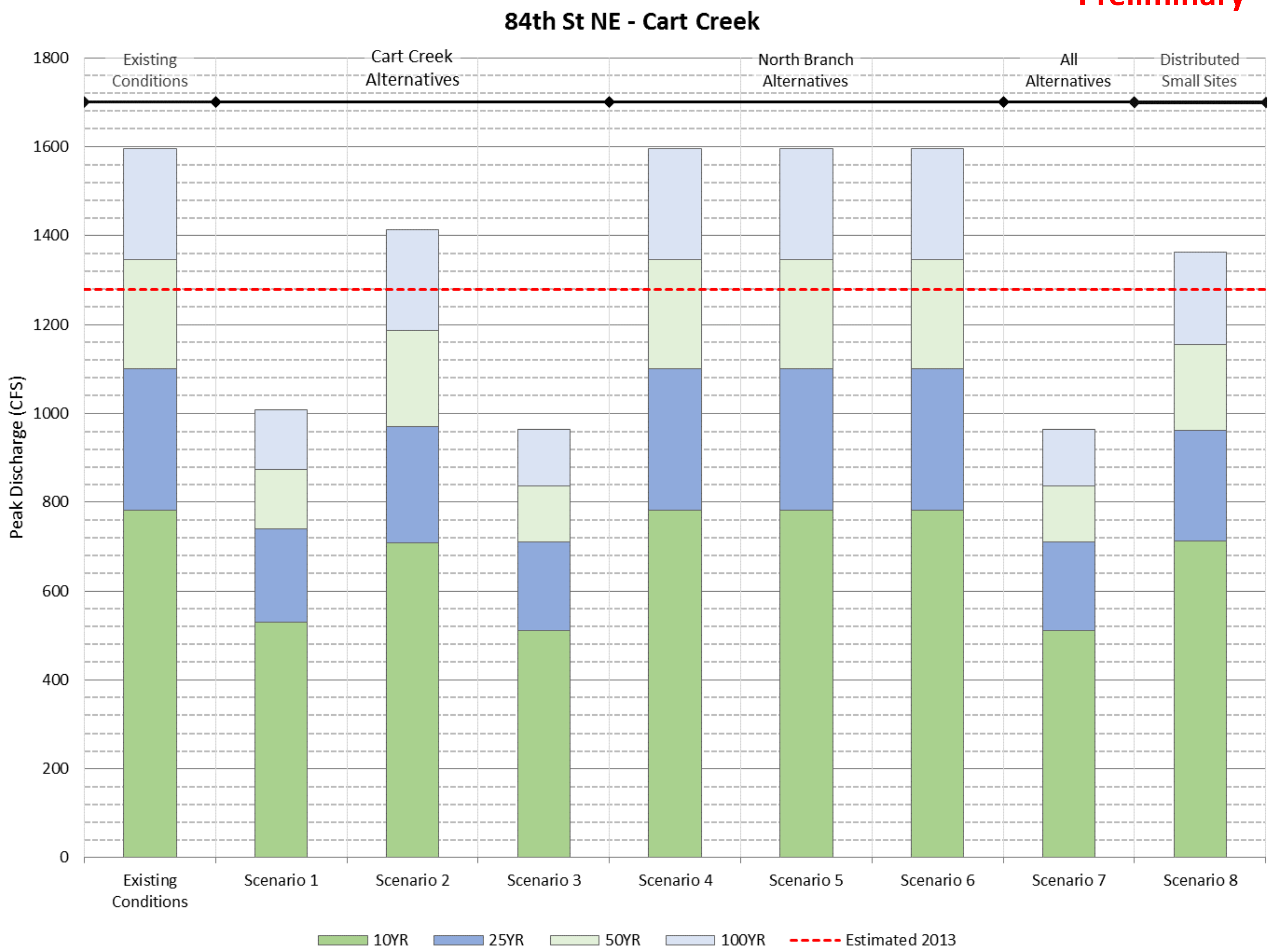
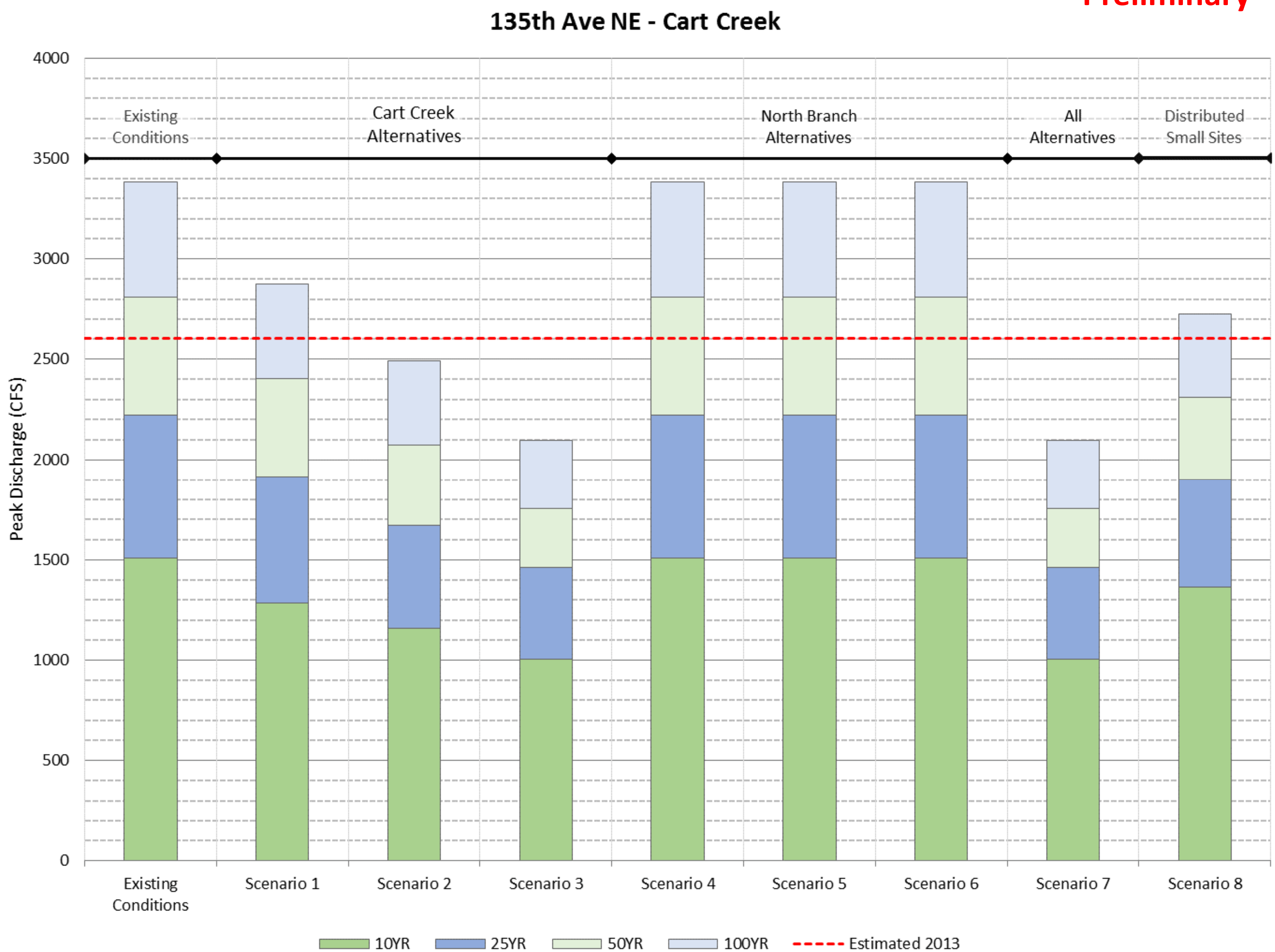


EXHIBIT E

Preliminary

EXHIBIT E

Preliminary



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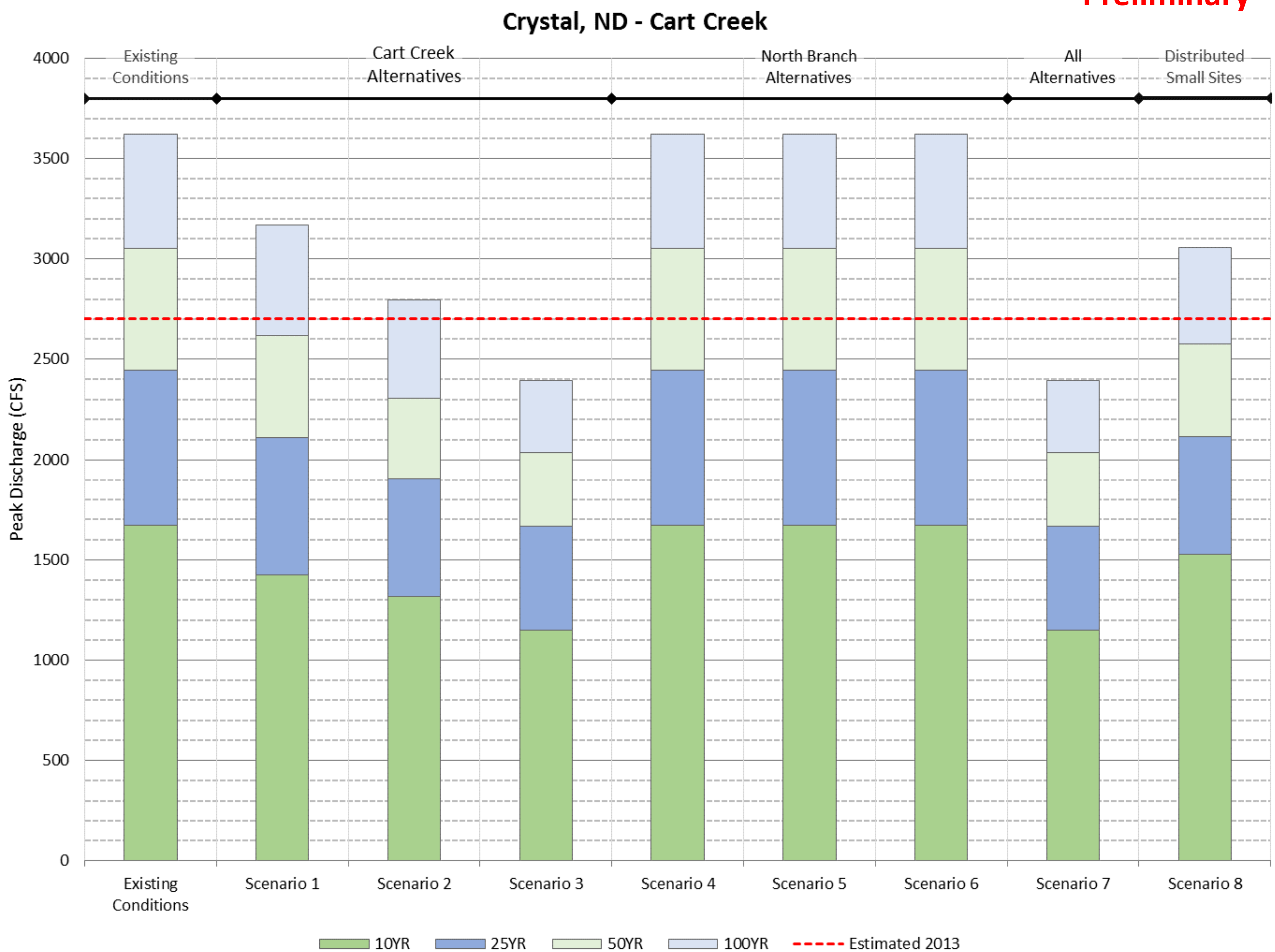

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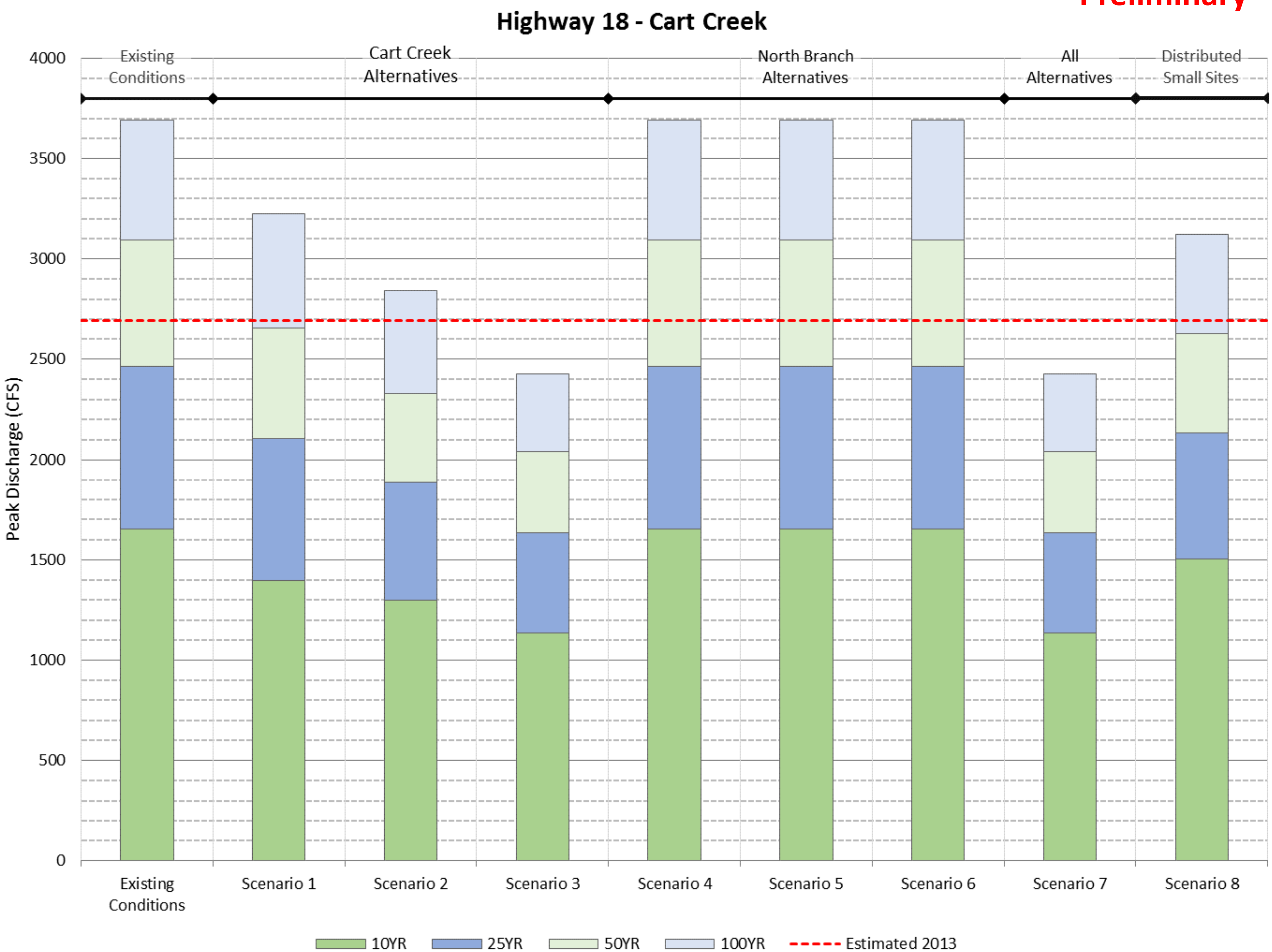
Preliminary



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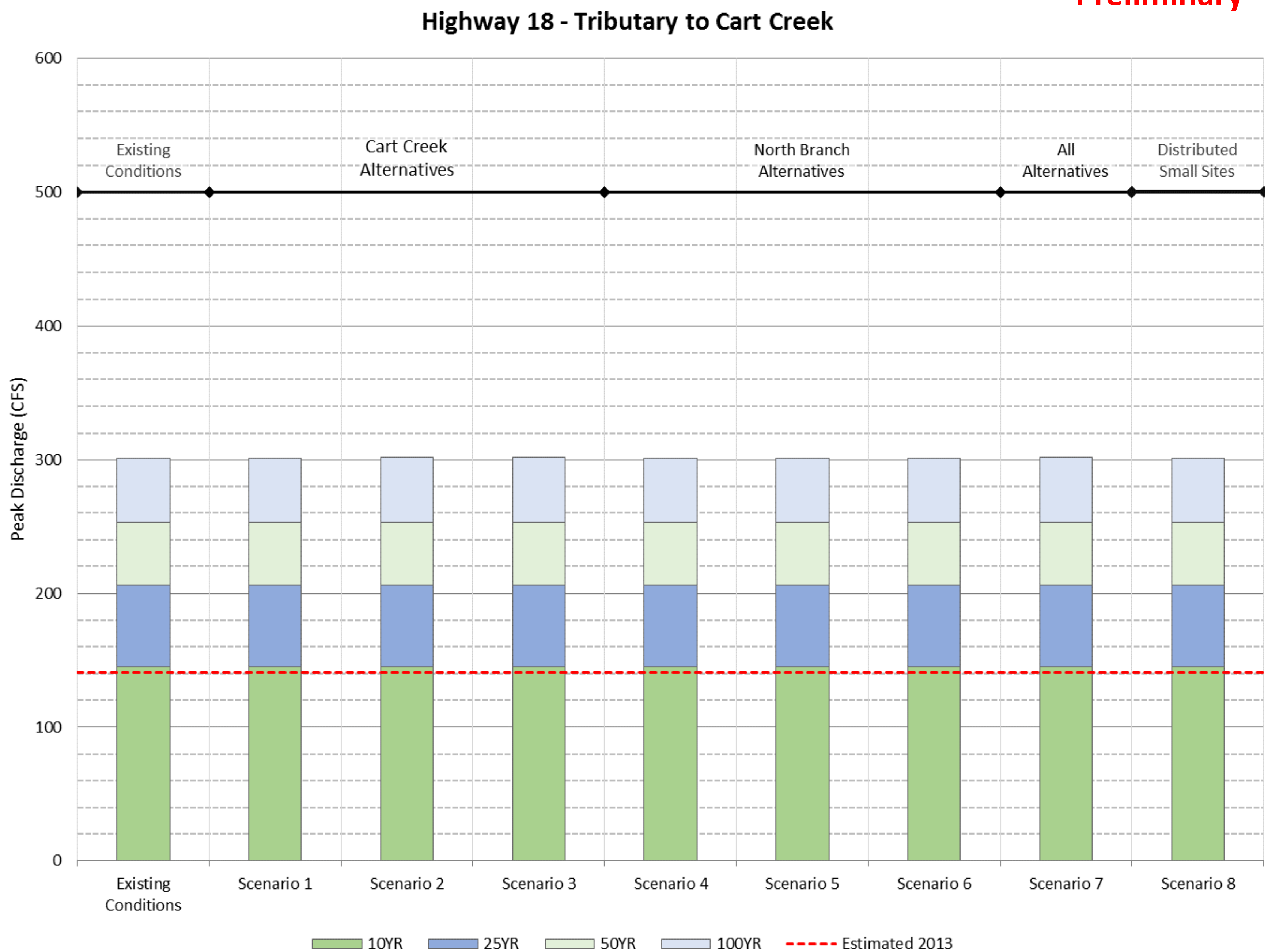

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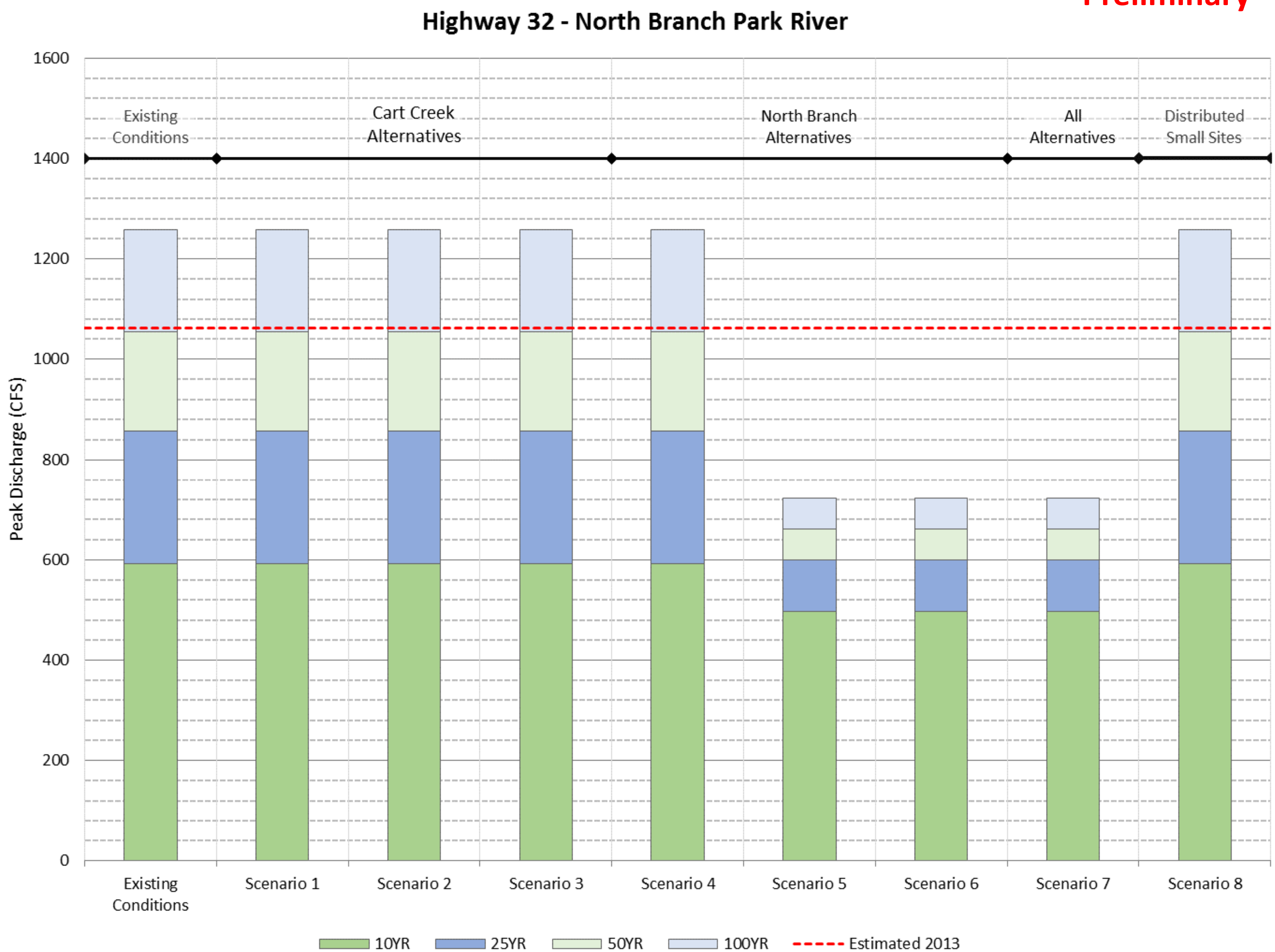

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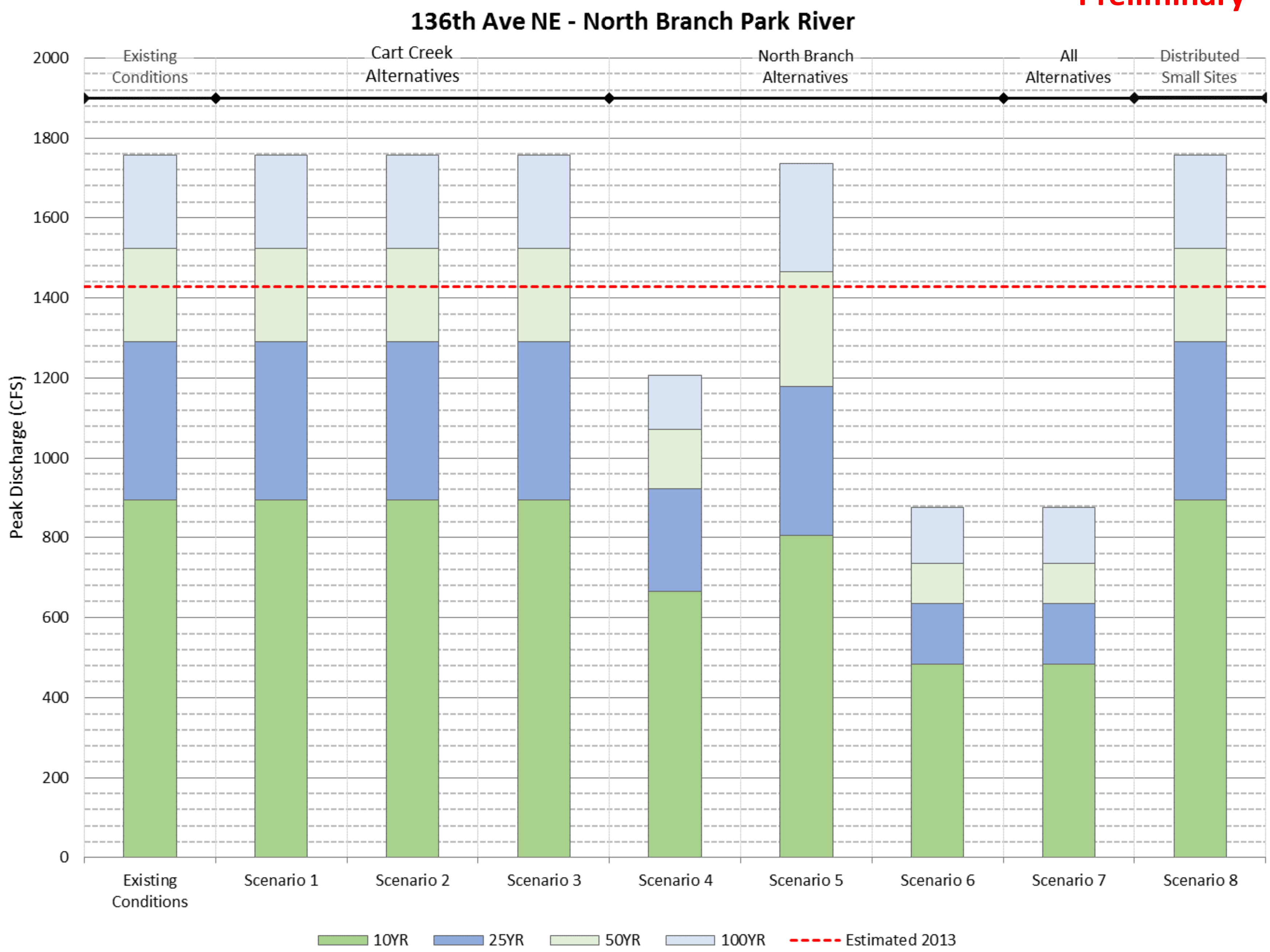

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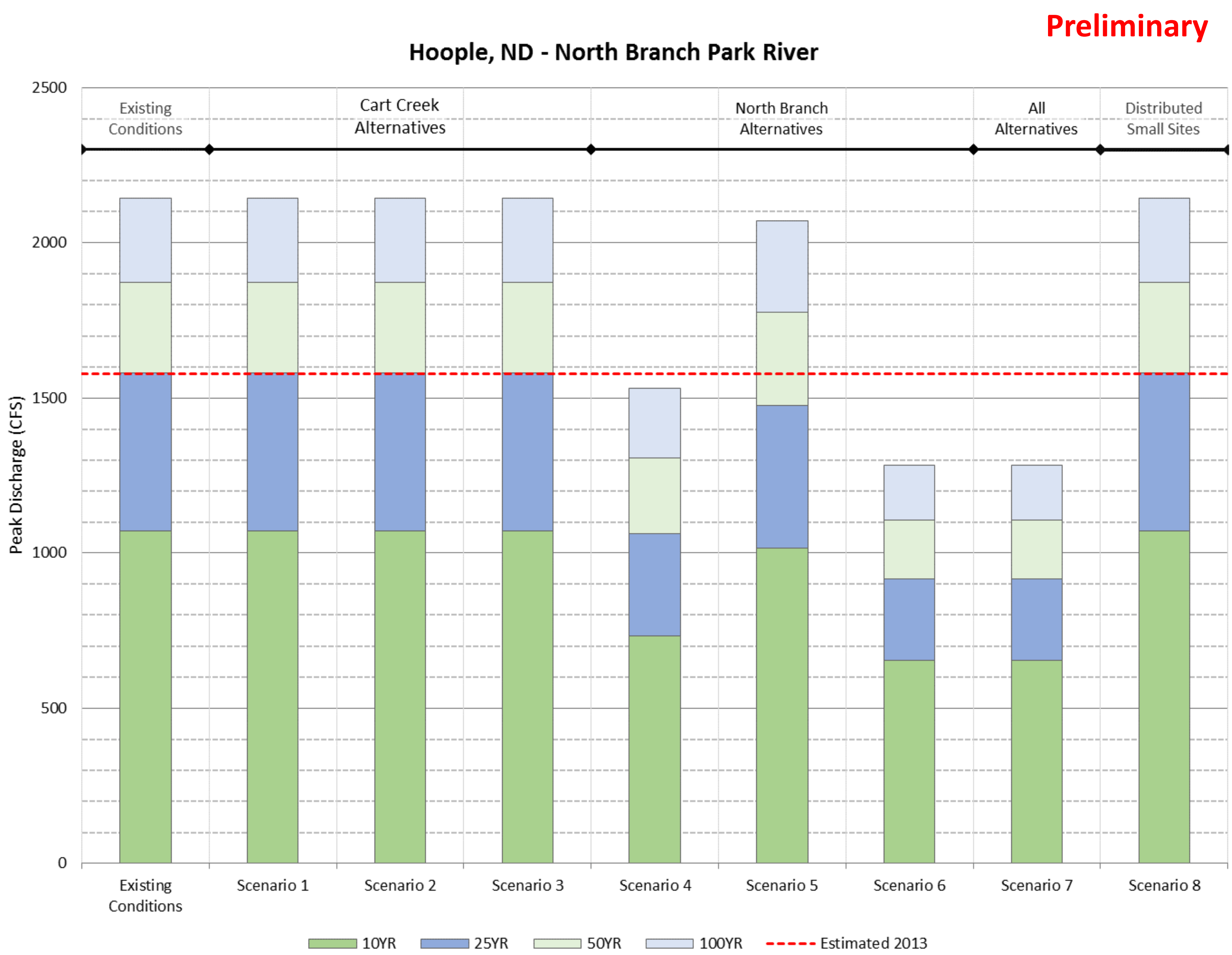
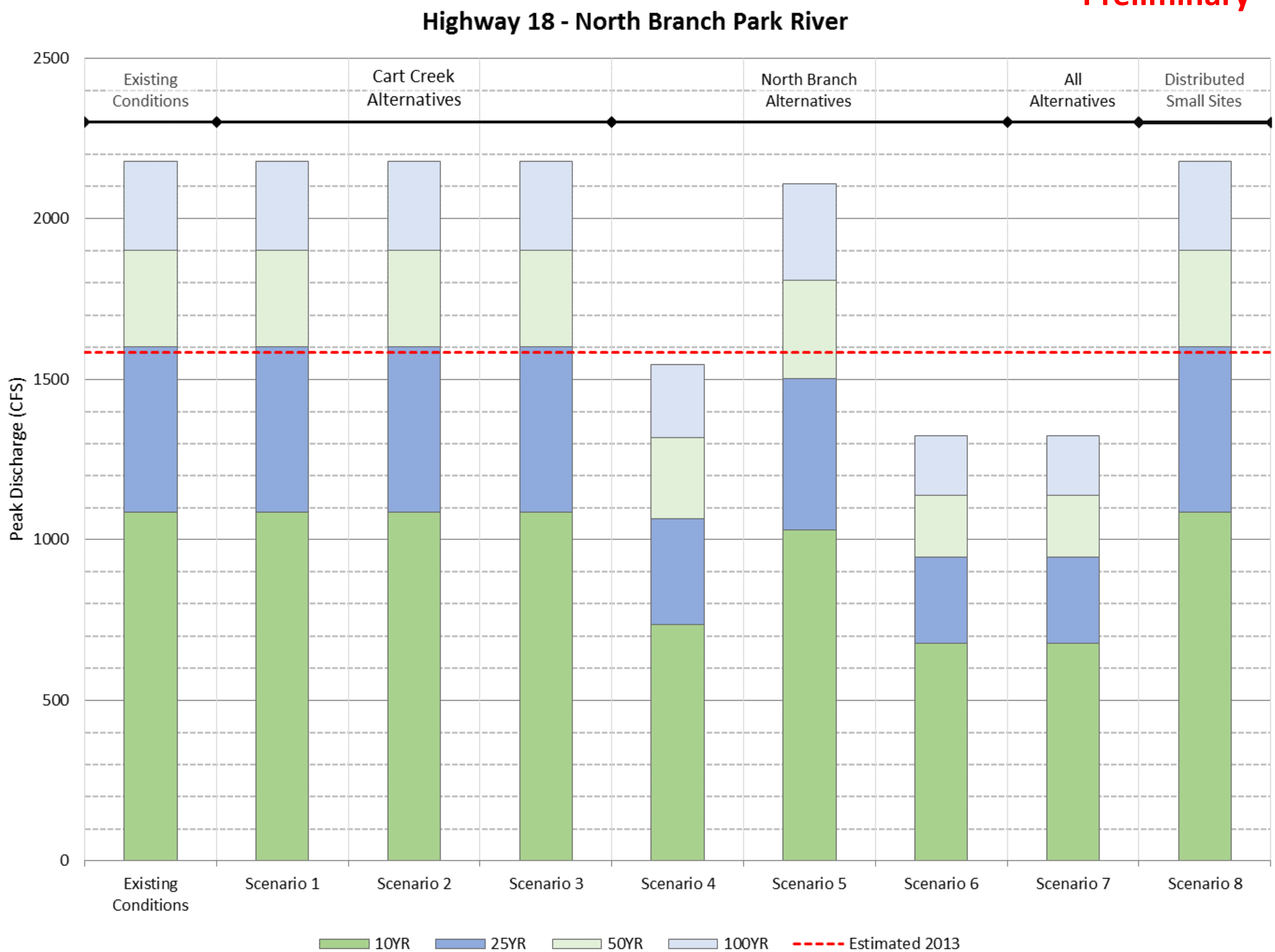

Preliminary
Hoople, ND - North Branch Park River
Peak Discharge (CFS)
2500
2000
1500
1000
500
0
Existing Conditions
Cart Creek Alternatives
North Branch Alternatives
All Alternatives
Distributed Small Sites
Existing Conditions
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Scenario 7
Scenario 8
10YR
25YR
50YR
100YR
Estimated 2013

EXHIBIT E

Preliminary



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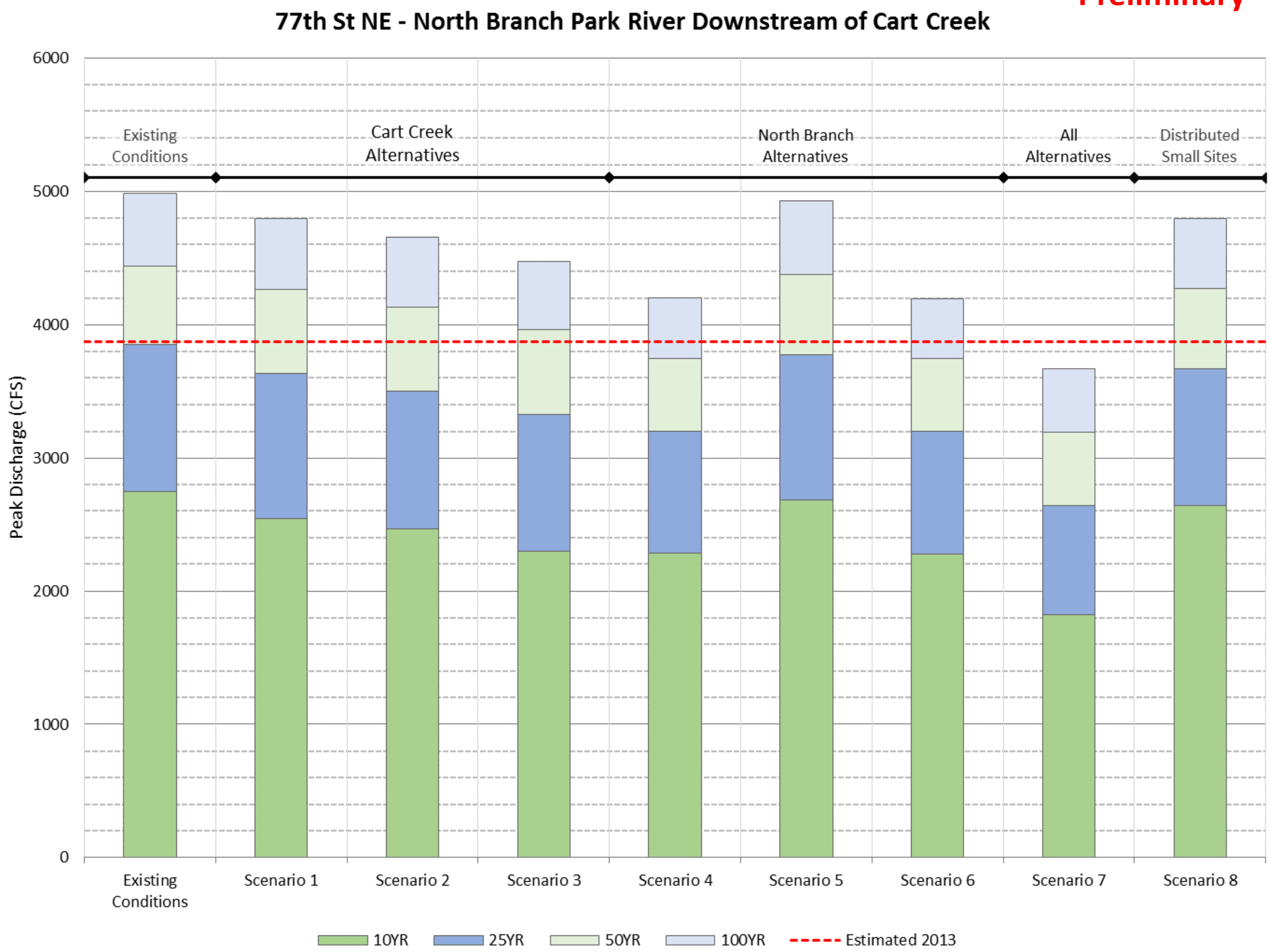

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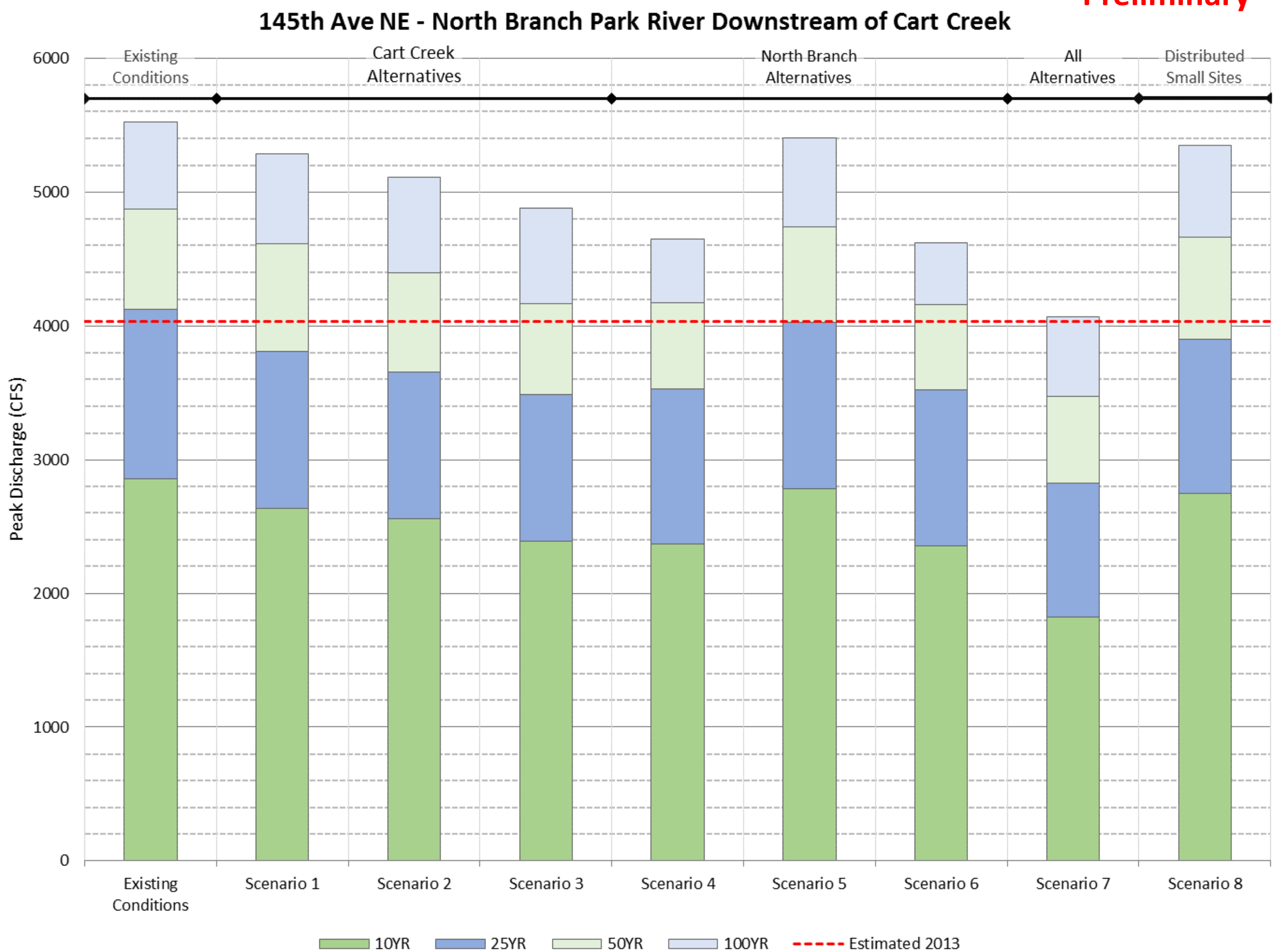

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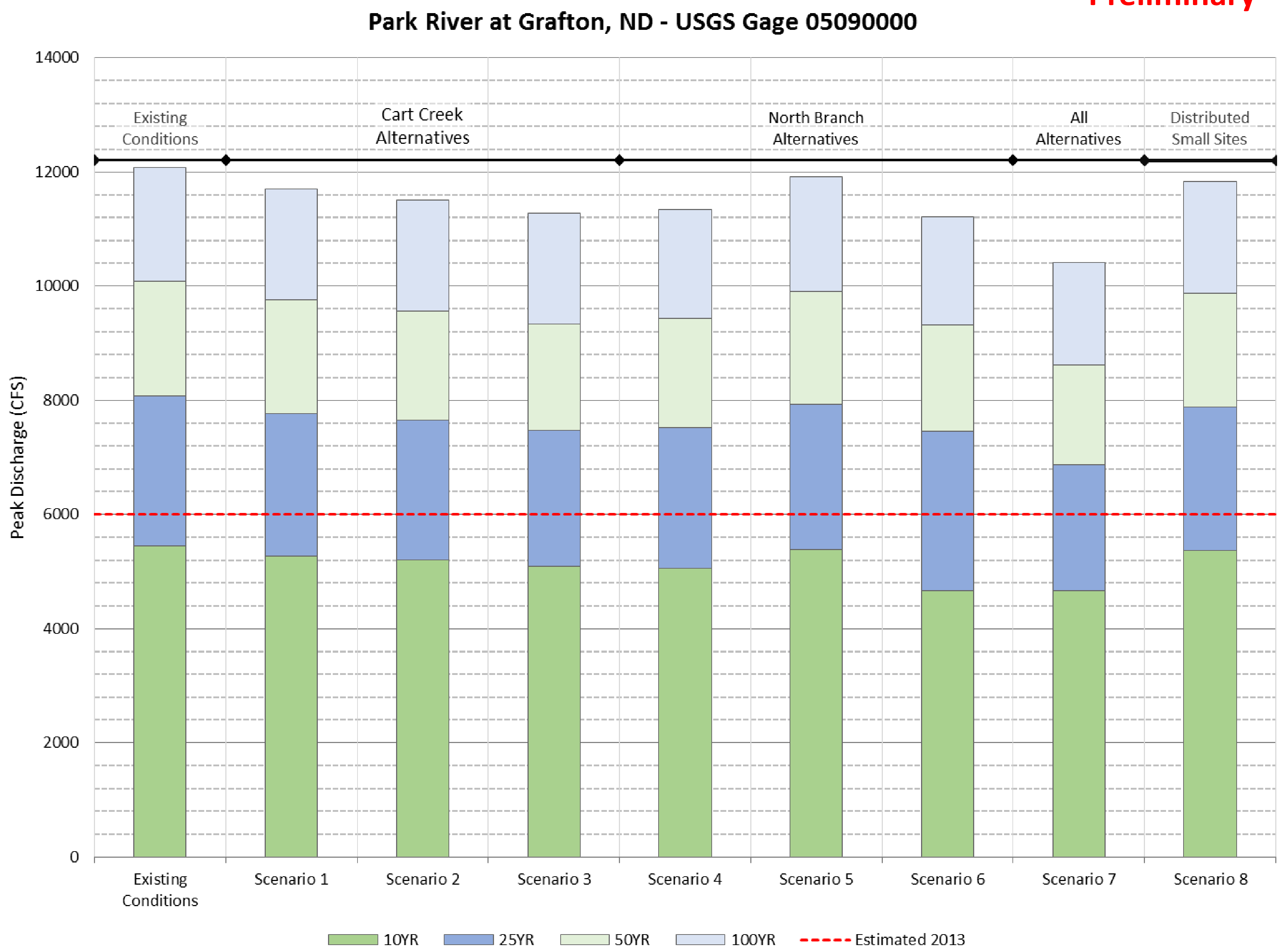

EXHIBIT E