Mr. B's Estates Watershed Storm Water Master Plan Update

Bismarck, North Dakota

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December 2009

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Storm Water Master Plan Update
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I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly registered professional engineer under the laws of the State of North Dakota.

Stephen M. Hoetzer, PE
Name

Dec 22, 2009
Date

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1.0 INTRODUCTION

1.1. Purpose

The Mr. B's Estates Watershed (Mr. B's Watershed) is located in northeast Bismarck and is a subwatershed of the Hay Creek watershed. The watershed is 296 acres in size and approximately 59% developed. The undeveloped land is poised to see future development. The Mr. B's Watershed was originally studied in the 2004 Centennial Watershed Storm Water Master Plan. The 2004 Centennial Watershed Master Plan included two adjacent watersheds, the Bismarck Expressway Watershed and the Carufel's Watershed. This master plan update only addresses the Mr. B's Watershed.

The 2004 Master Plan provided the recommended regional storm water facilities for the Mr. B's Watershed. Two of the major landowners within the Mr. B's Watershed have since submitted alternates to the original master planned facilities. These alternative regional facility plans have warranted an update to the storm water master plan. This master plan update will, in general:

- Update all watershed hydrology
- Reanalyze the 2004 Master Plan storm water management facilities
- Evaluate the landowner submitted storm water management alternatives
- Evaluate any additional storm water management alternatives
- Provide opinion of costs
- Provide a recommended regional storm water facility plan

This report provides a detailed summary of the update to the hydrologic and economic analysis for the alternatives to manage the surface water runoff within the Mr. B's Watershed. The hydrologic and economic analysis was completed for the City of Bismarck by Ulteig Engineers, Inc., of Bismarck, North Dakota.

1.2. Study Process

As noted above, the primary reason for this master update was to evaluate the submitted alternative storm water management plans. Approximately 67% of the watershed is owned by three landowners. Two of the landowners have submitted alternate storm water management plans and they are referred to as Mr. B's Alternatives and the McCormick Alternatives throughout this report. In order to have a thorough understanding of these alternative plans and issues associated with the original storm water management plan for the Mr. B's

Watershed, meetings were held with each of the three major landowners within the watershed. These meetings were held to provide Ulteig with a thorough understanding of the landowner's proposed storm water management objectives and their concerns about the original master planned facilities as well as adjacent landowner proposed alternatives. The two major items of contention to the landowners were the proposed locations of the master planned detention ponds and costs.

Property values were also an issue to each of the landowners. To address this issue, Ulteig contracted with Dakota Appraisal and Consulting, Ltd., to provide a preliminary land cost estimate to be included in the economic evaluation.

Ulteig scheduled regular meetings with the City of Bismarck engineering staff to discuss project progress and insure that all the pertinent water management plans were addressed. A draft of this watershed master plan update was provided to the three landowners and a follow-up meeting was held with each party. Their comments are contained in Appendix C.

2.0 AGENCY COORDINATION

As part of the Mr. B's Watershed Master Plan Update, agencies were contacted about the key issues that would affect the analysis and future design of water management facilities within the watershed. The following is a summary of the result of these meetings.

2.1. North Dakota Department of Transportation

The ND Department of Transportation's (NDDOT) major concern was that the flow at the 60-inch culvert under I-94 would not be increased and that the ditch block on the north side of the interstate not be over topped. The NDDOT would prefer that no facilities be placed within the right-of-way but they also stated that there may be a need to do this to reduce the potential for erosion. Any facilities placed within the right-of-way must meet the NDDOT's safety and design standards.

2.2. US Army Corps of Engineers

The US Army Corps of Engineers' (Corps) Bismarck office was familiar with the work that had been done on Miriam Avenue and that a Nationwide 404 permit had been issued for this work. Only the future road raise of Miriam Avenue may be covered by the original 404 permit. The Corps also stated that a 404 violation had occurred upstream of Miriam Avenue in McCormick Coulee and that this issue had been resolved. The Corps stated that if additional facilities or work was planned upstream or downstream of Miriam Avenue a detailed alternative

analysis would be required. The Corps expressed some concerns about allowing additional work within McCormick Coulee.

2.3. Montana-Dakota Utility Company

Montana-Dakota Utility Company (MDU) has a 270 KVW power line that could be affected by construction of Miriam Avenue or Channel Drive. MDU provided Ulteig with minimum clearance distance for the transmission lines where they cross roadways. The relocation or raise of transmission line would be a cost to the project sponsor and not MDU.

2.4. FEMA Floodplain Issues

The 100-year floodplain and regulatory floodway are identified on the Flood Insurance Rate Map (FIRM) for Hay Creek. Floodplain permitting would be an issue for the developer and is not dealt within this watershed evaluation.

2.5. Hay Creek Greenway

The Hay Creek Greenway identified a portion of the undeveloped land within the Mr. B's Watershed south of I-94. It appears that at this time the Hay Creek Greenway initiative is not moving forward and there are no plans to implement the initiative within the Mr. B's Watershed area.

3.0 WATERSHED HYDROLOGY

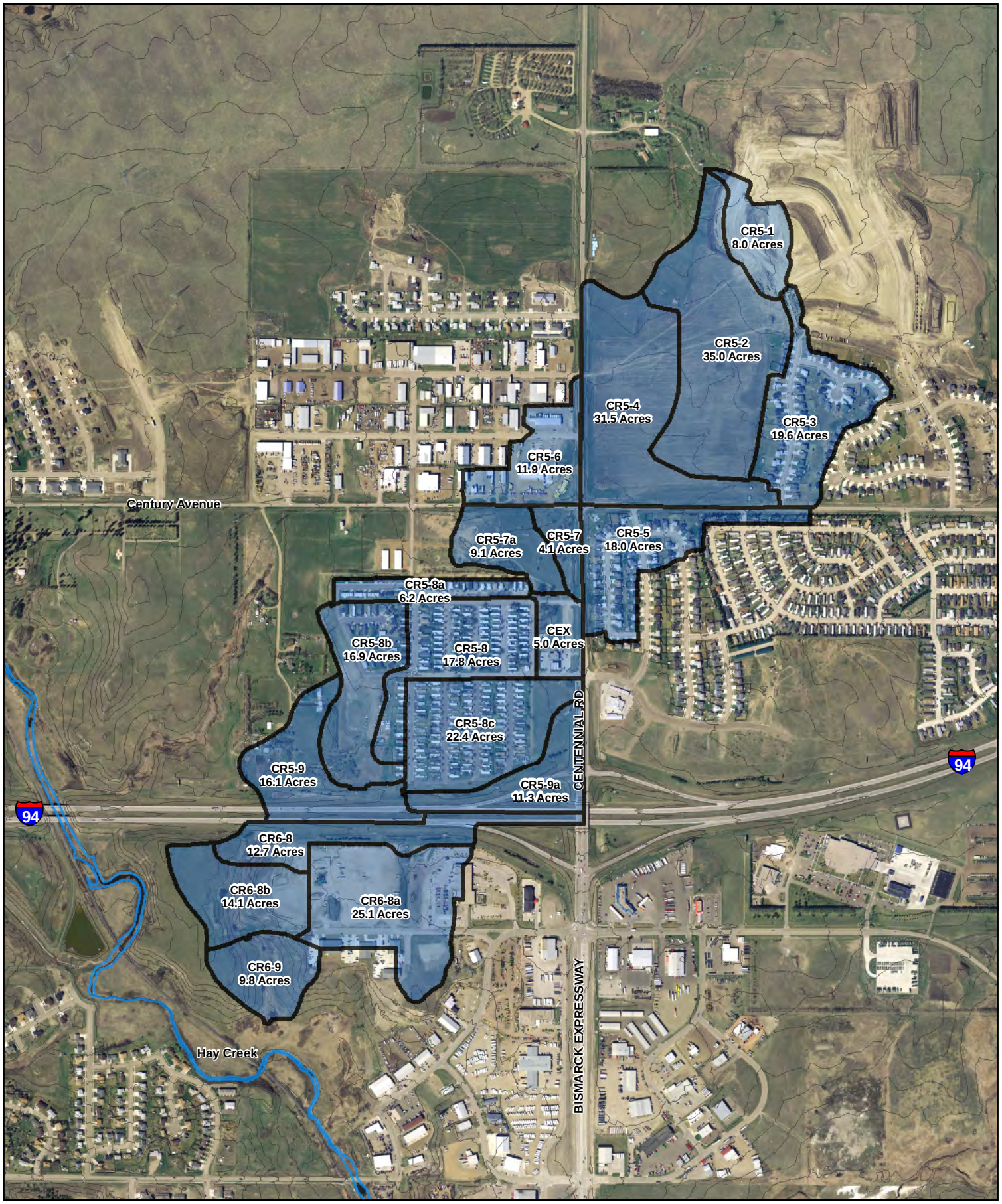
3.1. Watershed Location

The Mr. B's Watershed is located in northeast Bismarck. The Mr. B's Watershed is a part of the Centennial Watershed as identified in the 2004 Master Plan and drains directly into Hay Creek. The size and aerial extent of the watershed are illustrated on Figure 3.1.1. The watershed begins northeast of the intersection of Century Avenue and Centennial Road and runs southwest to Interstate Highway 94 (I-94). It discharges through I-94 and flows south in a well defined coulee to Hay Creek.

3.2. Existing Watershed

Mr. B's Watershed has a combination of developed and undeveloped area as shown in Figure 3.1.1. The developed portion of the watershed is residential, commercial, light industrial and a mobile home park and is 59% of the total watershed area. Thirty-one percent of the watershed is undeveloped and 10% is I-94 right-of-way. The majority of the undeveloped portion of the watershed is in the upper reaches of the watershed.

The watershed has been subdivided into 19 sub-watersheds with a total drainage area of 296 acres. Subwatersheds CR6-6 and CR6-7were included in the Mr. B's



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Data Sources: Aerial Photography - 2005
Watersheds - Ulteig Engineers
Cartography by SK & KN, 2009.05.27

Mr. B's Estates

0 500 1,000 2,000 Feet

1 inch = 1,000 feet

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LEGEND

Mr.B's Sub Watersheds

Hay Creek

Figure 3.1.1

Watershed in the 2004 Master Plan; however they do not outlet into Hay Creek at the same location as the Mr. B's Watershed and therefore have been removed from the Mr. B's Watershed in this master plan update.

3.3. Methodology

The baseline information developed and used for the hydrologic analysis was obtained using the Natural Resources Conservation Service (NRCS) standard methods and practices. The amount of rainfall for the analyzed events was taken from Table 3.1 of the "City of Bismarck's Stormwater Design Standards Manual."

The Hydrologic Analysis for the proposed project was performed using the HEC-1 Flood Hydrograph Package, September 1990, developed by the US Army Corps of Engineers. This computer model was used to analyze peak discharges, flow durations and runoff volumes for the selected hydrologic events.

The HEC-1 model formulates a mathematical simulation of the watershed basin based on the following data:

- Amount of rainfall runoff
- Total temporal distribution of this runoff
- Soil type
- Land use
- Specific hydraulic characteristics of the basin channels and watershed

The HEC-1 model is designed to calculate the surface runoff of the watershed basin by representing it as an interconnected system of hydrologic and hydraulic components. A single runoff component may represent a hydrograph from sub-basin runoff, combined sub-basins, a channel, or reservoir routing.

The baseline data provided in Section 4.0 was obtained from the Soil Conservation Service's (SCS) "Hydrology Manual for North Dakota," Soil Survey of Burleigh County, City of Bismarck topography and hydrologic models and alternatives, and water management plans provided by Houston Engineering, Inc. and Kadrmas, Lee & Jackson, Inc. Current land use was based on aerial photos and site inspections.

4.0 HYDROLOGY

4.1. Precipitation

The meteorological models for Mr. B's Watershed utilize a 6-hour SCS Type II storm distribution to simulate rainfall over the watershed. The SCS curve number method was used to model potential losses, while the SCS unit hydrograph was used to transform the rainfall into peak runoff volumes.

The 5, 10, 25, and 100 year, 6-hour design rainfalls were analyzed for each project alternative. The City of Bismarck has specified that the 6-hour duration events be used for the design of storm water control facilities. These events provide a range of runoff for design of the storm water control system. Table 4.1.1 displays the total rainfall depth for each design storm event included in this analysis.

Table 4.1.1 Design Storm Event Rainfall Totals

Return Period (6-Hour)	Rainfall Amount (Inches)
5-year	2.0
10-year	2.5
25-year	3.0
100-year	3.8

4.2. Loss Rate

The SCS curve number method was chosen to model potential precipitation loss for each storm. Soil data was obtained from the NRCS soil report for Burleigh County. Land-use distribution was obtained from the City of Bismarck's aerial photos and on-site observation.

The "Hydrology Manual for North Dakota" was used to assign a set of curve numbers to the land-use type and hydrologic condition of soils within the sub-basins. Runoff curve numbers (CN) were taken from Table 3-2 of the manual. The aerial imagery and the on-site evaluation of the watershed aided in assigning the most representative set of curve numbers to the different land use and vegetative cover types present in the basin.

The hydrologic conditions of all soils present within the basin were assumed to be "Good." The final loss rate was determined by calculating a weight-average curve number value to be used in the model.

Antecedent soil moisture has a significant effect on both the volume and rate of runoff. Antecedent moisture conditions II (AMC-II) was used when determining the curve number for each soil and land-use within the individual sub-basins. AMC-II is an average condition which assumes that 1.4 to 2.1 inches of rainfall has occurred within the previous 5 days.

Table 4.2.1 shows the final weighted-average curve number for existing and future conditions based on land use, soil group and drainage area for each sub-basin within the project watershed.

Table 4.2.1 Drainage Area and Weighted Average CN

Watershed Sub-basin	Drainage Area (acres)	Existing TO Future Land Use	Soils Group	Existing CN	Future CN
CR5-1	8	Residential	B	72	72
CR5-2	35	Crop/Grass to Commercial/Residential	B	66	85
CR5-3	19.6	Residential	B	72	75
CR5-4	31.5	Crop/Grass to Commercial	B	66	92
CR5-5	18	Residential	B	72	72
CR5-6	11.9	Light Industrial	B	88	88
CR5-7	4.8	Grassland to Commercial	B	61	92
CR5-7a	8.4	Grassland to Commercial	B	61	84
CEX	5	Commercial/Grass to all Commercial	B	75	92
CR5-8	17.8	Mobile Home Park	B	80	80
CR5-8a	6.2	Mobile Home Park	B	79	80
CR5-8b	16.9	Mobile Home Park/Grasslands	B	67	67
CR5-8c	22.4	Mobile Home/Grass to Mobile Home/Commercial	B	76	81
CR5-9	16.1	Grassland/I-94	B	69	69
CR5-9a	13.3	Grassland/I-94	B	66	66
CR6-8	12.7	Grassland/I-94	B	72	73
CR6-8a	25.1	Light Industrial	B	84	84
CR6-8b	14.1	Grassland to Light Industrial	B	72	86
CR6-9	9.8	Grassland/Marsh	D	80	80

4.3. Transform

After accounting for any losses due to infiltration, the remaining volume of precipitation received over a basin is considered excess precipitation. This excess precipitation must be "transformed" into direct point runoff. For the Mr. B's Watershed, the SCS "Unit Hydrograph" method was utilized to transform excess precipitation from each storm event. In the HEC-1 model, this method required the used to specify a lag time (T_L) for each individual sub-basin. The lag time is defined as the time difference between the center of mass of rainfall excess and the peak of the unit hydrograph and can be approximated from the time of concentration (T_C). To calculate lag time for each sub-basin in the watershed, the "Hydrology Manual for North Dakota", (similar to the TR-55) procedure for calculating travel time (T_T) and time of concentration (T_C) were followed.

Based on the field inspection, it was determined that a combination of sheet flow, shallow concentrated flow, and street flow most accurately represents the

method in which runoff was moving through the basin. Open channel flow was not found to be a significant component to the conveyance of runoff due to the absence of well defined channel throughout the watershed.

Once the travel times for sheet flow, street flow, and shallow concentrated flows were determined in each sub-basin, these values were summed to yield a time of concentration (T_C). The SCS lag time (T_L) was approximated by applying the equation displayed below:

$$T_L \text{ (hr)} = 0.6\ T_C$$

The time of concentration directly influences the slope and peak of the runoff hydrograph. Table 4.3.1 displays a summary of the SCS time of concentration and lag times used in the HEC-1 model for each sub-basin.

Table 4.3.1 Time of Concentration and Lag Time

Watershed Sub-Basin	Time of Concentration (Min)	SCS Lag Time (hr)
CR5-1	10	0.10
CR5-2	35	0.35
CR5-3	26	0.26
CR5-4	27	0.27
CR5-5	17	0.17
CR5-6	6	0.06
CR5-7	5	0.05
CR5-7a	15	0.15
CEX	5	0.05
CR5-8	22	0.22
CR5-8a	10	0.10
CR5-8b	32	0.32
CR5-8c	29	0.29
CR5-9	13	0.13
CR5-9a	12	0.12
CR6-8	10	0.10
CR6-8a	12	0.12
CR6-8b	10	0.10
CR6-9	6	0.06

4.4. Flow Routing

Storm water runoff was routed through the different watershed (reaches) with the Muskingum routing method. This type of routing was utilized based on its applicability to channels having mild slope. The route times for selected reaches are shown in Table 4.4.1.

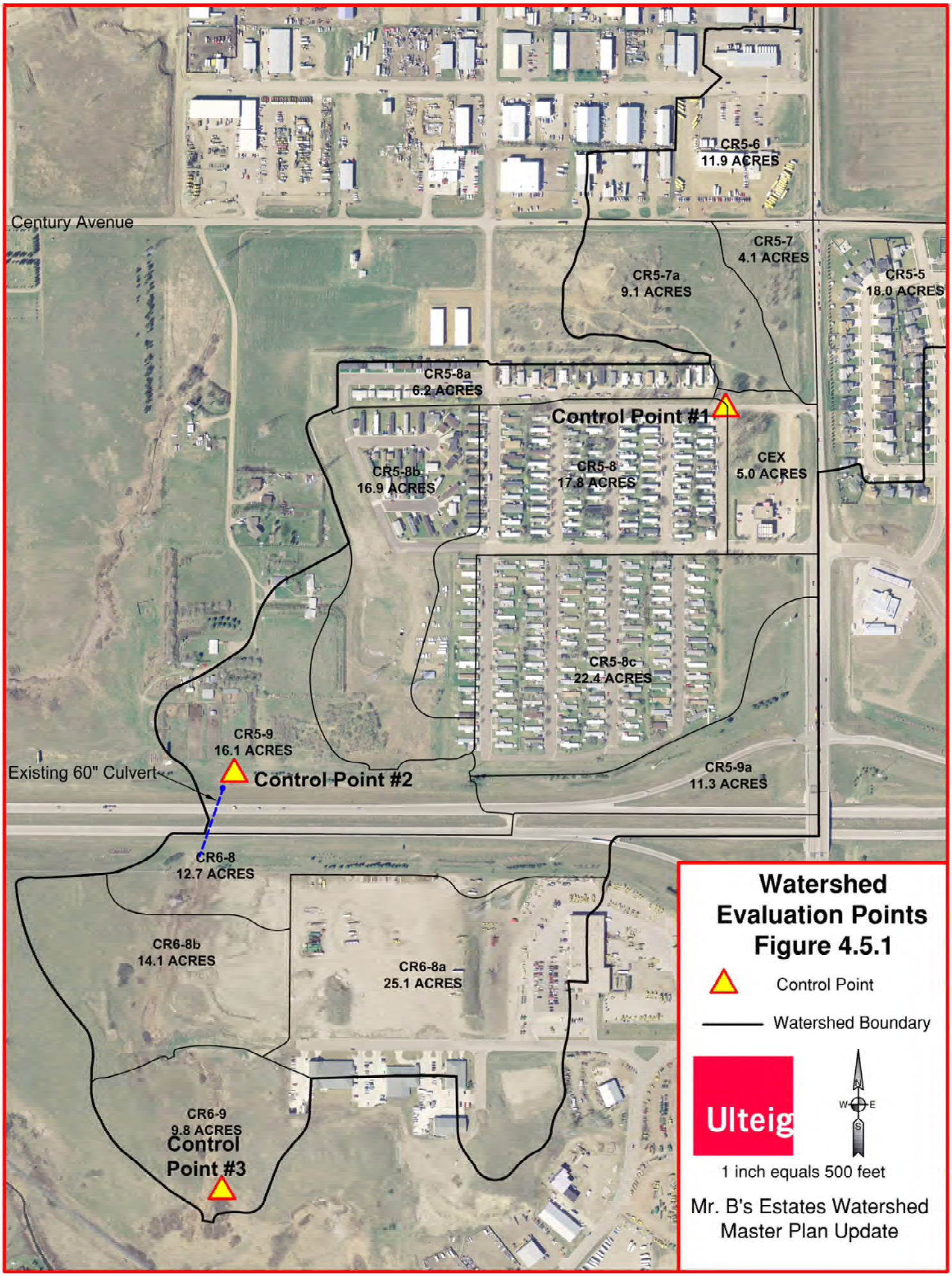
Table 4.4.1 Flow Routing Times

Watershed Reach	Travel Time (hr)
CR5-1 through CR5-2	0.227
CR5-3 through CR5-2	0.247
Patomac Drive	0.063
CR5-2 through CR5-4	0.063
WAPA Channel	0.037
Lower Mr. B's Coulee	0.074
Outlet Channel	0.147

4.5. Watershed Evaluation Points

Mr. B's Estates was constructed in the mid to late 1960's across from an existing coulee. All the land upstream (142 acres) of Mr. B's Estates was predominantly pasture and hay land. Therefore, it was possible to control the limited runoff with roadway culverts and a small open channel. The areas upstream are being developed and the rate and amount of runoff will increase as development continues. The rate of development may increase when the intersection of Century Avenue and Centennial Road is upgraded in 2011.

The existing drainage system is inadequate to handle major storms when the entire upstream watershed is developed. In order to reduce the flooding hazard, the City of Bismarck has made a decision to design the water management facilities to handle the 100 year – 6 hour rainfall event with no increase in the peak discharge at the I-94 crossing and at the outlet into Hay Creek based on existing conditions. A third important evaluation points is headwaters of the existing open channel through the Mr. B's Estates mobile home park. These key watershed evaluation points for the 100-year 6-hour event are shown on Figure 4.5.1. These identified points were used as the initial basis to determine if a water management plan would meet these hydrologic parameters.



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4.6. HEC-1 Results

The HEC-1 model for Mr. B's Watershed was run for ten scenarios, including all the alternatives submitted by engineering firms on behalf of the landowner and alternatives formulated by Ulteig.

A detailed description of each scenario modeled is presented in Section 5.0 of this report. Table 4.6.1 displays the modeled peak flows for selected locations within the Mr. B's Watershed including the three evaluation points. A detailed spreadsheet that displays the peak flows, runoff volumes, and water stages for the 100 yr – 6 hour rainfall event (1 percent annual chance flood event) is presented in Appendix A.

Table 4.6.1
HEC-1 Model Results Summary
For Each Scenario

	Rainfall Event	Runoff Volume		Existing Conditions	Revised Master Plan	DISCHARGE						
						Mr. B's Alt A-1	Mr. B's Alt A-2	Mr. B's Alt B-1 & B-2	McCormick Alt	**Carufel Diversion	Alt U-1	Alt U-2
	(Year)	Existing (AC-FT)	Future (AC-FT)	(CFS)	(CFS)	(CFS)	(CFS)	(CFS)	(CFS)	(CFS)	(CFS)	(CFS)
Intersection of Century & Centennial (Outflow)	P_5	2.2	8.6	17	110	76	76	104	110	-	104	104
	P_{10}	3.2	10.6	22	136	91	91	129	136	-	129	129
	P_{25}	5.1	14.1	32	180	94	94	172	180	-	172	172
	P_{100}	8.7	20.1	80	254	102	102	242	253	242	242	242
East Chatham Channel (Inflow)	P_5	3.9	10.9	17	23	23	23	0	23	-	0	0
Control Point 1	P_{10}	5.4	13.6	21	33	28	28	0	33	-	0	0
	P_{25}	8.2	18.3	31	63	47	62	0	63	-	0	0
	P_{100}	13.4	26.0	61	102	124	139	31	102	151	31	31
WAPA Channel (Inflow)	P_5	4.6	11.3	23	87	92	31	8	87	-	8	157
	P_{10}	6.3	14.0	28	101	121	38	10	101	-	10	195
	P_{25}	9.6	18.1	37	131	176	76	14	131	-	14	260
	P_{100}	15.6	27.0	68	179	258	152	50	179	170	50	370
I-94 (Inflow)	P_5	7.6	14.6	63	142	117	112	145	142	-	118	117
Control Point 2	P_{10}	10.4	18.5	86	175	152	147	181	175	-	145	144
	P_{25}	15.6	25.4	129	238	189	201	207	238	-	171	170
	P_{100}	25.4	37.4	204	352	241	239	243	352	222	200	198
Miriam Avenue (Outflow)	P_5	8.4	15.1	73	139	118	113	144	111	-	113	112
	P_{10}	11.5	19.1	93	165	154	148	175	131	-	135	134
	P_{25}	17.5	26.3	125	210	189	186	195	159	-	148	148
	P_{100}	28.3	38.9	213	263	218	216	220	240	168	168	167
Discharge into Hay Creek	P_5	10.9	19.1	92	172	142	137	154	109	-	118	116
Control Point 3	P_{10}	14.6	24.1	122	207	173	168	186	125	-	139	138
	P_{25}	21.7	33.0	165	259	233	225	239	149	-	170	166
	P_{100}	34.5	48.2	232	333	310	305	314	215	212	222	220

** Only the 100 yr 6 hour event was modeled; 200 cfs was diverted to Carufel's Coulee

Watershed Control Points as shown on Figure 4.5.1

5.0 WATER MANAGEMENT SCENARIOS

The following section contains a detailed write up of the storm water management scenarios. Three of the scenarios presented in the following section were outlined in the 2004 Watershed Master Plan. Five were submitted on behalf of landowners within the watershed and two were developed by Ulteig. It is important to note that a majority of the undeveloped land within the watershed is owned by three entities. The scenarios evaluated take into account the views of these entities and attempt to meet their concerns.

5.1. Existing Conditions

The original "Existing Conditions" HEC-1 model was revised and updated to reflect existing conditions. The existing infrastructure handles the modeled rainfall events and this can be explained by the current land use and available amount of detention storage. Although the amount of storage is small, it is located at a critical point. The detention storage is mostly made up of ditch storage and a small detention area in sub-watershed CR5-3. The existing conditions peak flows at these designated evaluation points (Figure 4.5.1) are:

Location	Existing Conditions Q_{100} (cfs)
Evaluation Point 1 (East end of Chatham Channel)	61
Evaluation Point 2 (Inflow into I-94 Culvert)	204
Evaluation Point 3 (Outlet into Hay Creek)	232

5.2. Revised Master Plan

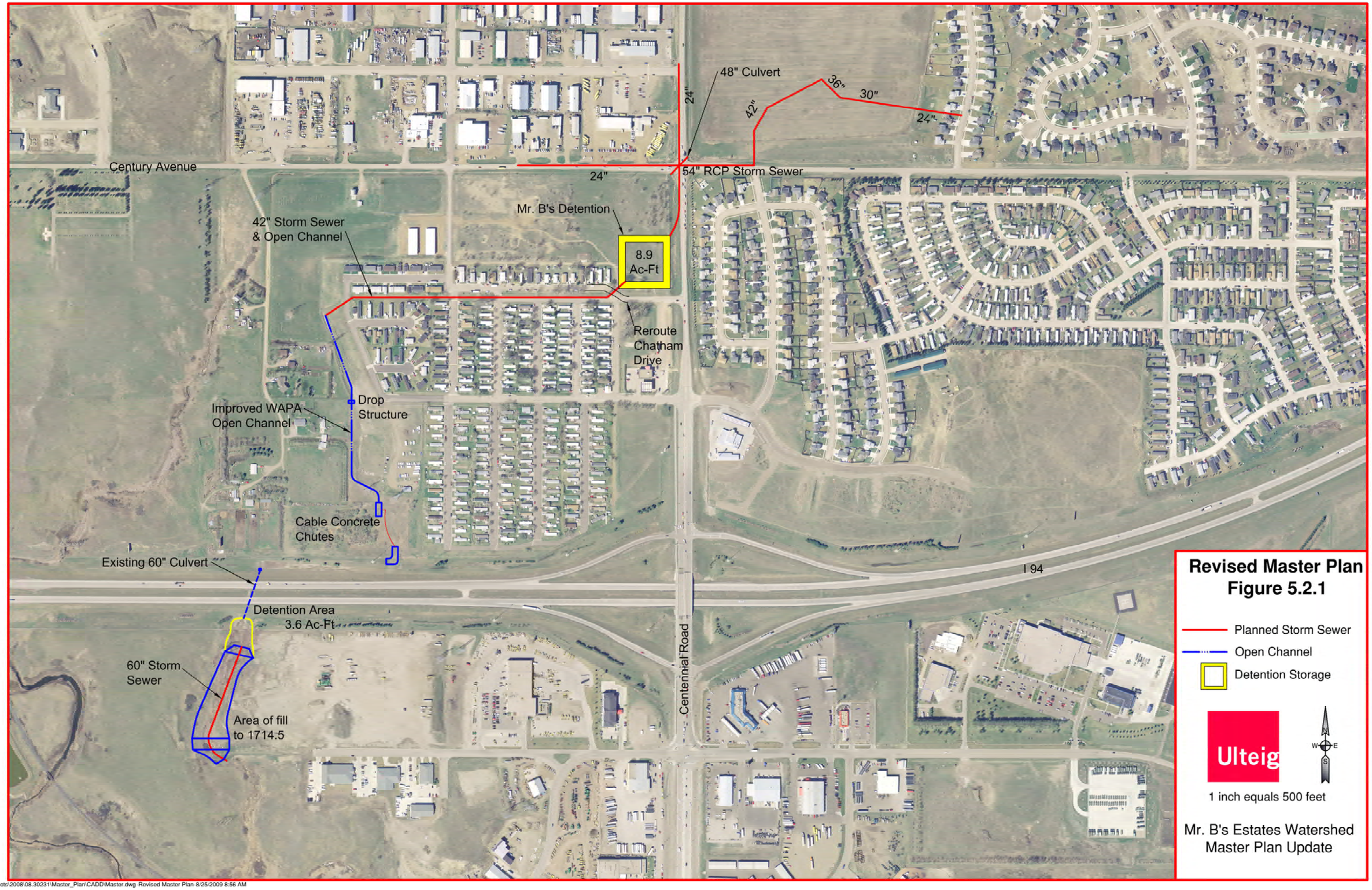
The 2004 Watershed Master Plan was developed by Houston Engineering, Inc. The original HEC-1 model contained some inconsistencies when comparing it to the actual and proposed hydrologic conditions within the watershed. These inconsistencies were carried forward into other alternatives presented to the City of Bismarck by Houston Engineering, Inc., and Kadrmas, Lee & Jackson, Inc. For this master plan update, revisions were made to the plan based on the review of topographic, hydraulic, and land use data along with HEC-1 model input data. The basic elements of the Revised 2004 Watershed Master Plan are:

- Reclamation of Sattler Detention Pond
- Projected development of trunk line storm sewers within the Turnbow Development

- Installation of trunk line storm sewers on east and west Century Avenue
- Installation of trunk line storm sewer north on Centennial Road
- Collector storm sewer (54″) south on Centennial Road
- Overflow culvert at the intersection of Century Avenue and Centennial Road
- Open channel on the west side of Centennial Road between the intersection of Century and Centennial and Mr. B's Detention Pond
- Mr. B's Detention Pond (8.9 ac-ft)
- Chatham Drive storm sewer (42″)
- Chatham Drive open channel improvements
- Relocation of Chatham Drive to the north
- *Improvements to the Western Area Power Administration (WAPA) open channel including:
    - Regrading and enlargement
    - Grade stabilization structure
    - Two cable-concrete chute drops
- *Small McCormick detention pond (3.7 ac-ft)
- *Filling 700 lineal feet of McCormick's Coulee to elevation 1714.5
- *Installation of a 60″ storm sewer down McCormick's Coulee south of I-94 through the proposed fill area

The * items above were either not included in the 2004 Master Plan facilities or cost estimate. These water management elements are shown on Figure 5.2.1. The resulting discharges for this plan in comparison to the existing conditions are:

Location	**Revised Master Plan Q_{100} (cfs)**	**Existing Conditions Q_{100} (cfs)**
Evaluation Point 1 (East end of Chatham Channel)	102	61
Evaluation Point 2 (Inflow into I-94 Culvert)	352	204
Evaluation Point 3 (Outlet into Hay Creek)	333	232



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The estimated project cost of the revised Master Plan is $3,504,500. A detailed cost estimate for revised Master Plan can be found in Appendix B.

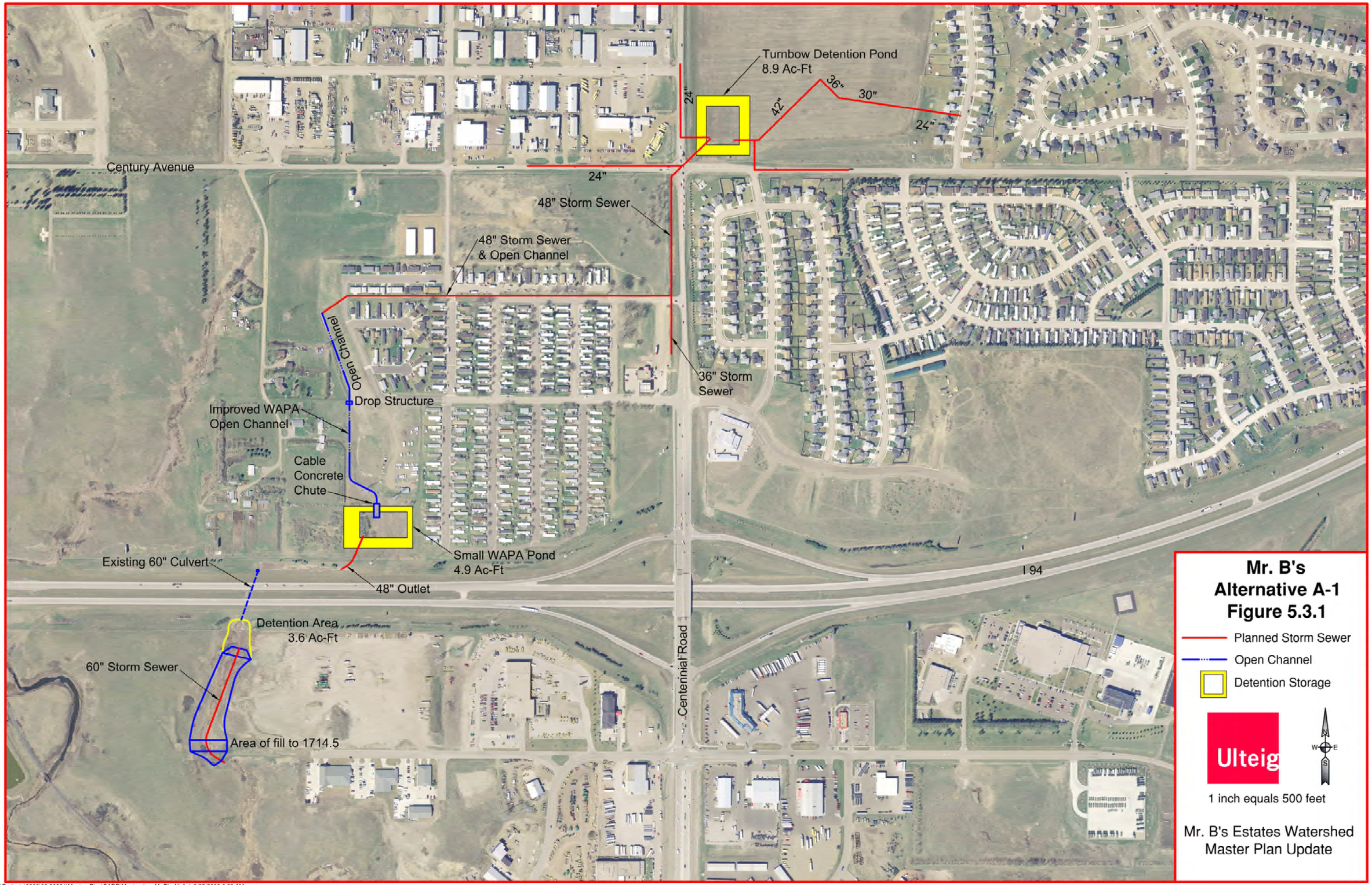
5.3. Mr. B's Alternative A-1

Mr. B's Alternatives A-2, A-2, B-1 and B-2 were submitted to the City of Bismarck in April of 2008 by Kadrmas, Lee & Jackson, Inc. on behalf of the Breene's.

Mr. B's Alternative A-1 utilizes most of the elements of the Master Plan, but moves the Mr. B's Detention Pond as proposed in the Master Plan to the northeast corner of the intersection of Century Avenue and Centennial Road, and increases the size of the storm sewer between the Century and Centennial intersection and the WAPA channel. Another small detention pond was proposed at the south end of the WAPA channel just above the I-94 right-of-way. It has been named the WAPA Detention Pond and has 4.9 acre-feet of storage. The WAPA Detention Pond was added to reduce the peak inflow to the I-94 culvert. It was assumed for this master plan update that the 2004 Master Plan facilities as updated in this master plan from I-94 to Hay Creek remain unchanged. The elements of Alternative A-1 are:

- Reclamation of Sattler Detention Pond
- Projected development of the trunk line storm sewers within the Turnbow Development
- Turnbow Detention Pond (8.9 ac-ft)
- Installation of trunk line storm sewers on east and west Century Avenue
- Installation of trunk line storm sewer on Centennial Road and Chatham Drive (48")
- Improvement to Chatham Drive open channel
- Repair to Chatham Drive pavement (Chatham Drive remains in its current location)
- Improvements to the WAPA open channel including:
    - Regrading and enlargement
    - Grade stabilization structure
    - Two cable-concrete chute drops
- Small WAPA Detention Pond upstream of I-94 (4.9 ac-ft)
- Small McCormick Detention Pond (3.7 ac-ft)
- Filling 700 lineal feet of McCormick's Coulee to elevation 1714.5
- Installation of a 60" storm sewer down McCormick's Coulee south of I-94 through the proposed fill area

These water management elements are shown on Figure 5.3.1.



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The resulting discharges for this plan are:

Location	Mr. B's Alternative A-1 Q_{100} (cfs)	Existing Conditions Q_{100} (cfs)
Evaluation Point 1 (East end of Chatham Channel)	124	61
Evaluation Point 2 (Inflow into I-94 Culvert)	241	204
Evaluation Point 3 (Outlet into Hay Creek)	310	232

The estimated project cost of Mr. B's Alternative A-1 is $3,350,000. A detailed cost estimate for Mr. B's Alternative A-1 can be found in Appendix B.

5.4. Mr. B's Alternative A-2

The Mr. B's Alternative A-2 is essentially the same as Alternative A-1 except that the 48" storm sewer continues south along Centennial Road north of the I-94 right-of-way and discharges into a concrete-lined open channel along the I-94 right-of-way. It was necessary to concrete line the channel adjacent to I-94 because of the high flow velocity and that low flows would all be diverted into this channel by the storm sewer. It was assumed for this master plan update that the 2004 Master Plan facilities as updated in this master plan from I-94 to Hay Creek remain unchanged. The elements of Alternative A-2 are:

- Reclamation of Sattler Detention Pond
- Projected development of the trunk line storm sewers within the Turnbow Development
- Turnbow Detention Pond (8.9 ac-ft)
- Installation of trunk line storm sewers on east and west Century Avenue
- Installation of Centennial Road storm sewer from the intersection of Century and Centennial to the I-94 right-of-way (48")
- Concrete line open channel from Centennial Road to the small WAPA Detention Pond
- Improvements to Chatham Drive open channel
- Improvements to the WAPA open channel including:
    - Regrading and enlargement
    - Grade stabilization structure
    - Two cable-concrete chute drops
- Small WAPA Detention Pond upstream of I-94 (4.9 ac-ft)
- Small McCormick Detention Pond (3.7 ac-ft)
- Filling 700 lineal feet of McCormick's Coulee to elevation 1714.5.

- Installation of a 60″ storm sewer down McCormick's Coulee south of I-94 through the proposed fill area

These water management elements are shown on Figure 5.4.1. The resulting discharges for this plan are:

Location	Mr. B's Alternative A-2 Q_{100} (cfs)	Existing Conditions Q_{100} (cfs)
Evaluation Point 1 (East end of Chatham Channel)	139	61
Evaluation Point 2 (Inflow into I-94 Culvert)	239	204
Evaluation Point 3 (Outlet into Hay Creek)	314	232

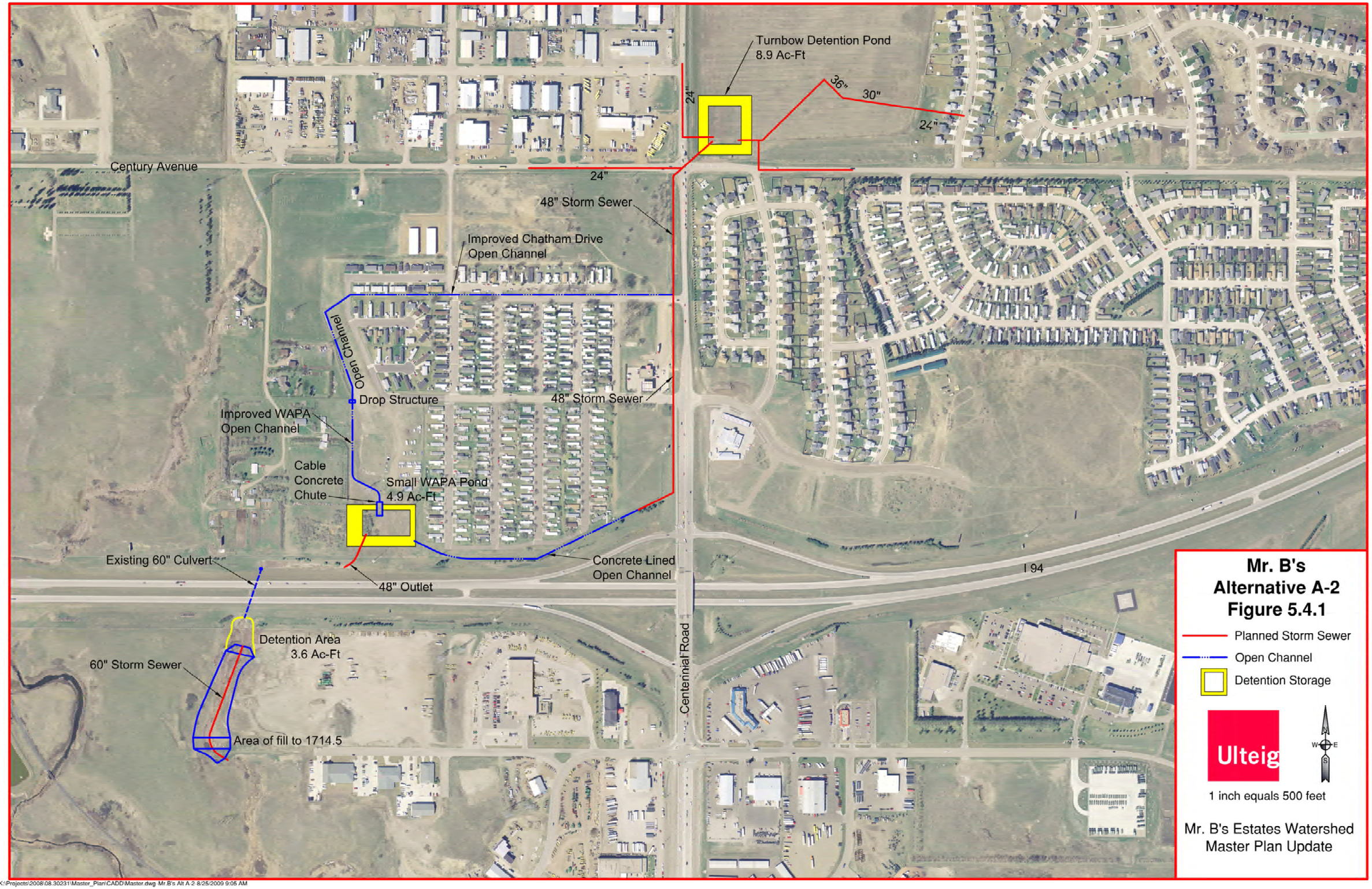
The estimated project cost of Mr. B's Alternate A-2 is $3,643,900. A detailed cost estimate for Mr. B's Alternative A-2 can be found in Appendix B.

5.5. Mr. B's Alternatives B-1 and B-2

Mr. B's Alternative B eliminates the upper watershed detention pond and the capacity of the WAPA Detention Pond has been increased to 18 ac-ft and provides all the storage for the watershed north of I-94. All upstream flows will be diverted around Mr. B's Estates by a 72″ storm sewer and a concrete-lined open channel. No improvement will be made to the Chatham Drive open channel or the WAPA open channel.

Mr. B's Alternatives B-1 and B-2 are identical with the exception of the length of the 72″ storm sewer and the length of the concrete-lined open channel. Alternative B-1 has a shorter 72″ storm sewer and longer concrete-lined open channel. The open channel downstream of the 72″ storm sewers must be concrete lined to eliminate erosion from high flow velocities and long term low flows erosion. It was assumed for this master plan update that the 2004 Master Plan facilities as updated in this master plan from I-94 to Hay Creek remain unchanged. The elements of Alternatives B-1 and B-2 include:

- Reclamation of Sattler Detention Pond
- Projected development of the trunk line storm sewers within the Turnbow Development
- Installation of trunk line storm sewers on east and west Century Avenue
- Installation of the 72″ Centennial Road storm sewer from the intersection of Century Avenue and Centennial Road to I-94



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- 72″ storm sewer and a concrete-lined open channel adjacent to I-94 from Centennial Road to the large WAPA pond
- **No** improvements to the Chatham or WAPA open channels
- Construction of the large WAPA Detention Pond (18 ac-ft)
- Small McCormick Detention Pond (3.7 ac-ft)
- Filling 700 lineal feet of McCormick's Coulee to elevation 1714.5
- Installation of a 60″ storm sewer down McCormick's Coulee south of I-94 through the proposed fill area

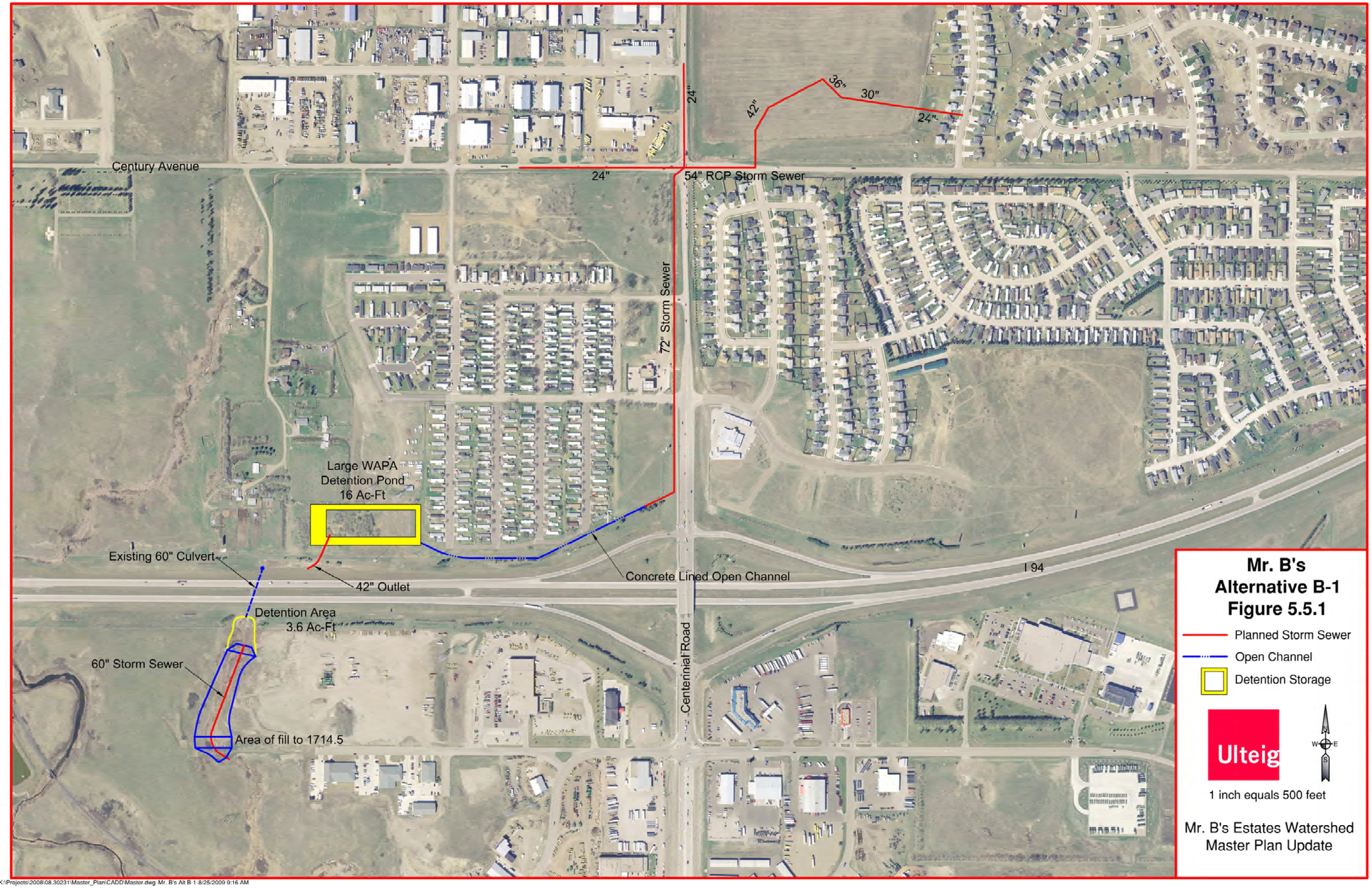
These water management elements for the Mr. B's Alternatives B-1 and B-2 are shown on Figures 5.5.1 and 5.5.2. The resulting discharges for Alternative B-1 and Alternative B-2 are as follows:

Location	Mr. B's Alternative B-1 & B-2 Q_{100} (cfs)	Existing Conditions Q_{100} (cfs)
Evaluation Point 1 (East end of Chatham Channel)	31	61
Evaluation Point 2 (Inflow into I-94 Culvert)	243	204
Evaluation Point 3 (Outlet into Hay Creek)	314	232

The estimated project cost of Mr. B's Alternative B-1 is $3,408,500, and the estimated project cost of Mr. B's Alternative B-2 is $3,686,800. The detailed cost estimates for Mr. B's Alternatives B-1 and B-2 can be found in Appendix B.

5.6. McCormick Alternative

In June of 2008 Houston Engineering, Inc. submitted an Alternative to the 2004 Watershed Master Plan on behalf of Mr. Steve McCormick. The elements of the Revised 2004 Master Plan remain the same north of I-94. Only those elements of the plan south of I-94 were changed. McCormick's Coulee would be straightened, less fill material would be placed in the coulee than in the original 2004 Master Plan, and Miriam Avenue would become a roadway embankment with a 48″ culvert. The Miriam Avenue roadway embankment would provide 9.7 ac-ft of storage. In addition, the available storage above the future proposed Channel Drive roadway embankment would be included as a water management feature. Channel Drive would have a 48″ culvert and provide 8.1 ac-ft of storage. The proposal to the City of Bismarck also included the cost of raising MDU's 270 KVW power line because of the construction of Channel Drive and Miriam Avenue. Raising and relocating the power lines was viewed as necessary to the storm water project because these roadways functioned as



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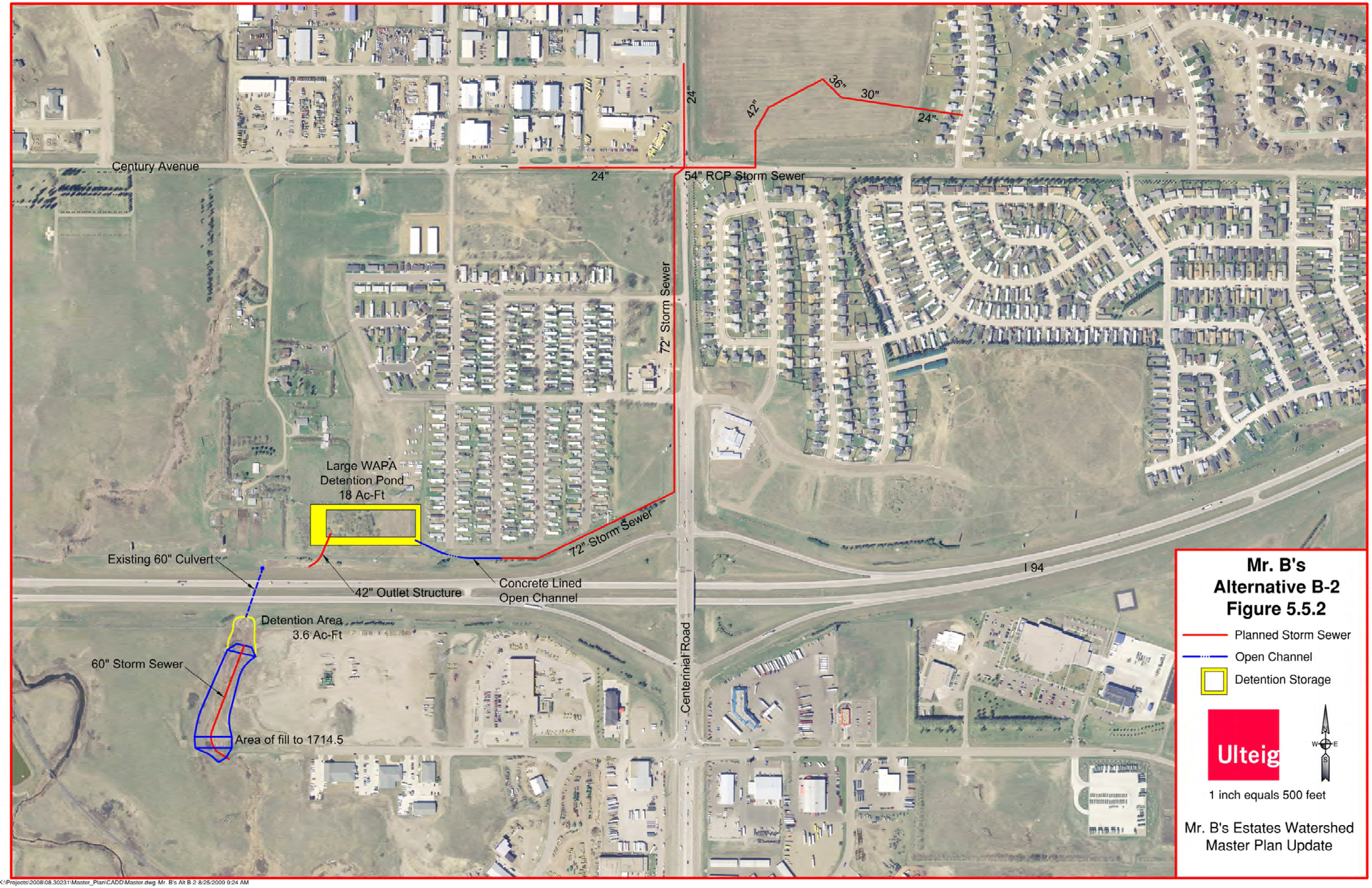

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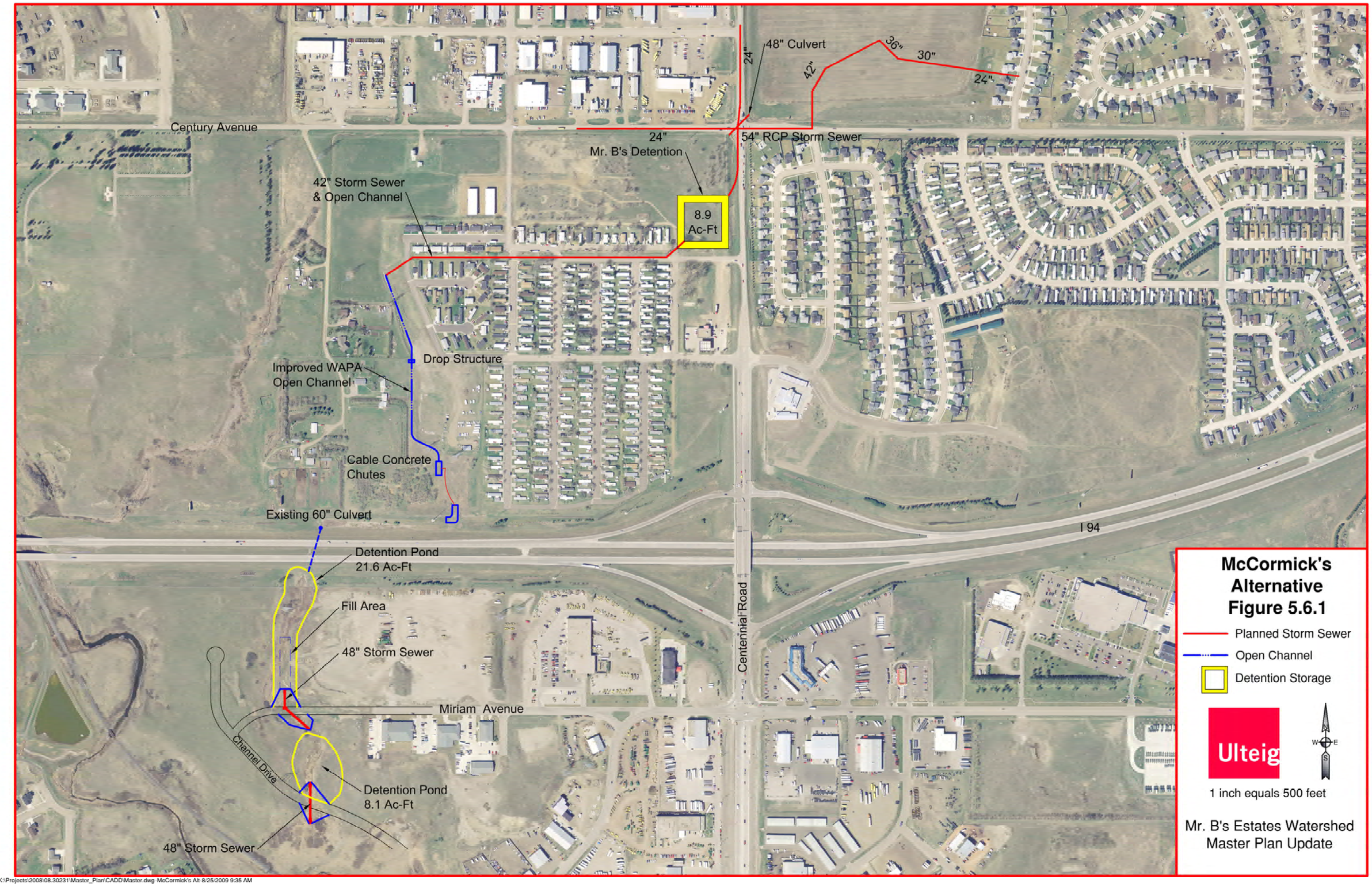
water management facilities. The filling of McCormick Coulee upstream of Miriam Avenue and the construction of Channel Drive could potentially create wetland impacts that would have to be mitigated. The elements of the McCormick Alternative are:

- Reclamation of Sattler Detention Pond
- Projected development of the trunk line storm sewers within the Turnbow Development
- Installation of trunk line storm sewers on east and west Century Avenue
- Installation of trunk line storm sewer north on Centennial Road
- Collector storm sewer (54″) south on Centennial Road
- Overflow culvert at the intersection of Century Avenue and Centennial Road
- Open channel along the west side of Centennial Road between the intersection of Century and Centennial and Mr. B's Detention Pond
- Mr. B's Detention Pond (8.9 ac-ft)
- Chatham Drive storm sewer (42″)
- Chatham Drive open channel improvements
- Relocation of Chatham Drive to the north
- Improvements to the WAPA open channel including:
    - Regrading and enlargement
    - Grade stabilization structure
    - Two cable-concrete chute drops
- Regrade and fill McCormick's Coulee to elevation 1704.0
- Raise Miriam Avenue to elevation 1714.5 (11.6 ac-ft)
- Construct an embankment at the future Channel Drive with a 48″ culvert (8.1 ac-ft)
- Raise the MDU high voltage line
- Mitigation for lost coulee habitat in McCormick Coulee

These water management elements are shown on Figure 5.6.1. The resulting discharges for the McCormick Alternative are as follows:

Location	McCormick Alternative Q_{100} (cfs)	Existing Conditions Q_{100} (cfs)
Evaluation Point 1 (East end of Chatham Channel)	102	61
Evaluation Point 2 (Inflow into I-94 Culvert)	352	204
Evaluation Point 3 (Outlet into Hay Creek)	215	232



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The estimated project cost of the McCormick Alternative is $3,653,000. The detailed cost estimate for the McCormick Alternative can be found in Appendix B.

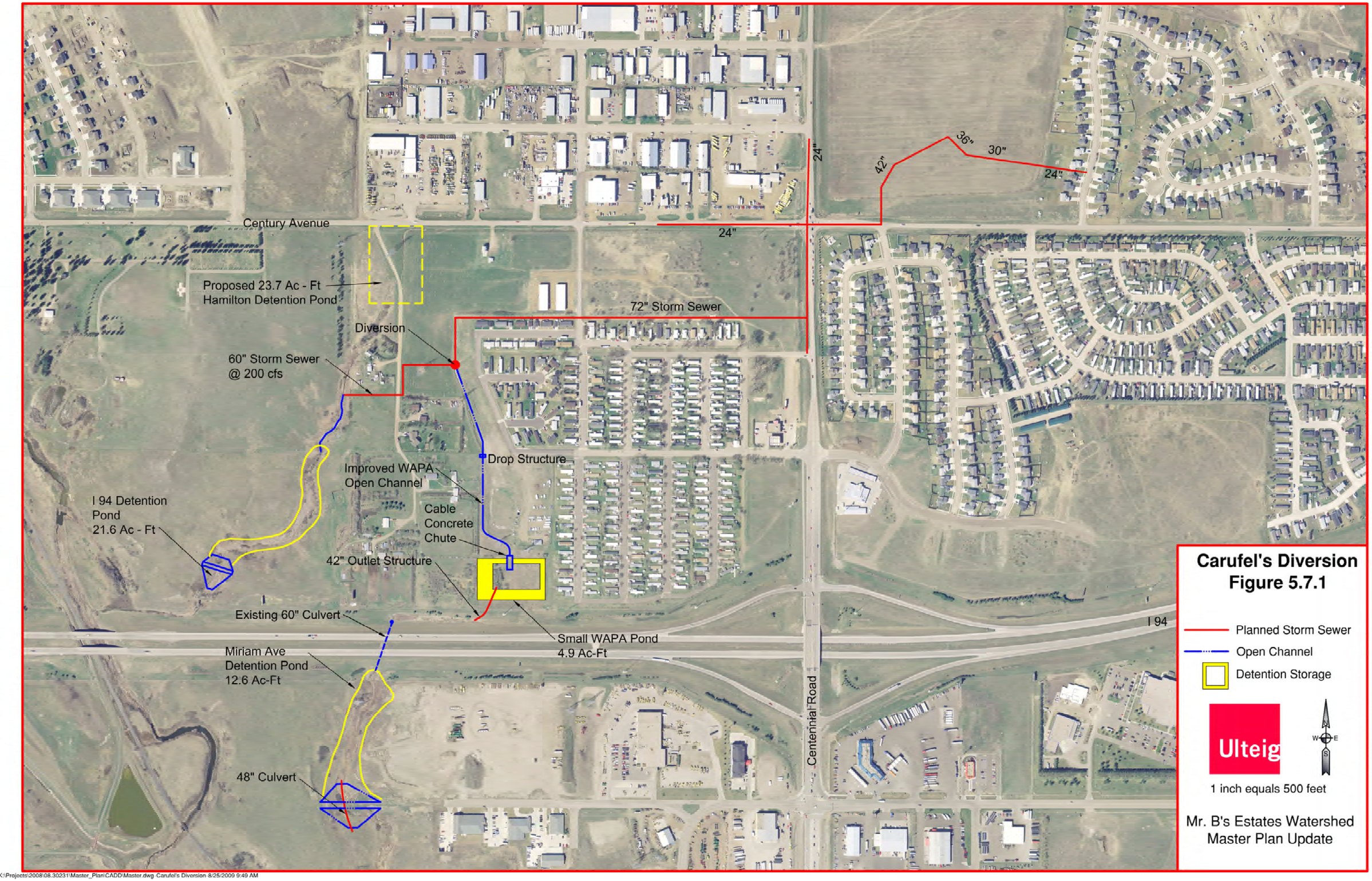
5.7. Carufel's Diversion

A diversion of flows from Mr. B's Watershed to Carufel's Coulee was presented in the 2004 Master Plan but was never fully developed. There is some logic for the diversion because the majority of the underdeveloped area is in the upper portion of the watershed and it appears to be a simple matter to divert the water from the upper watershed to Carufel's Coulee.

The City would have to decide if it wants to endorse a plan which diverts water from one watershed to another. The diversion would also require approval from the Burleigh County Water Resource District. There must be a compelling reason to move forward with a plan that diverts water to Carufel's Coulee.

A plan has been developed to divert 200 cfs from the upper portion of Mr. B's Watershed via a 60" storm sewer. The location of the storm sewer system is detailed on Figure 5.7.1. In order to accommodate this additional flow, a detention pond is proposed just above I-94 on the lower end of Carufel's Coulee. The detention facility would have a capacity of 22.7 ac-ft. The detention is designed to handle the flows from the Carufel's Watershed and the diverted 200 cfs. This plan assumes the Hamilton Avenue Detention Pond just south of Century Avenue is in place. It should be pointed out that all the low flows would be diverted to Carufel's Coulee. Therefore, it will be critical to stabilize the coulee below the diversion point. To develop the HEC-1 model for the diversion alternative, the outflow hydrograph from the proposed Hamilton Pond in the Carufel's Watershed was obtained from the City of Bismarck. Miriam Avenue would be constructed as a street crossing with no additional downstream detention. The elements of the Carufel's Diversion are:

- Reclamation of Sattler Detention Pond
- Projected development of the trunk line storm sewers within the Turnbow Development
- Installation of trunk line storm sewers on east and west Century Avenue
- Installation of trunk line storm sewer north on Centennial Road
- Install 500 lf of 72" storm sewer south along Centennial Road to the north of Mr. B's 72" storm sewer
- Install Mr. B's north storm sewer (72")
- Diversion manhole
- 60" storm sewer diversion to Carufel's Coulee
- Improvement to 800 lf of Carufel's Coulee
- I-94 Detention pond on Carufel's Coulee (22.7 ac-ft)



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- Improvements to the WAPA open channel including:
  - Regrading and enlargement
  - Grade stabilization structure
  - Two cable-concrete chute drops
- Small WAPA Detention Pond
- Miriam Avenue street crossing with 48″ culvert

These water management elements are shown on Figure 5.7.1 The resulting discharges for the Carufel's Diversion are as follows:

Location	Carufel's Diversion Q_{100} (cfs)	Existing Conditions Q_{100} (cfs)
Evaluation Point 1 (East end of Chatham Channel)	151	61
Evaluation Point 2 (Inflow into I-94 Culvert)	222	204
Evaluation Point 3 (Outlet into Hay Creek)	212	232

The estimated project cost of the Carufel's Diversion is $3,627,800. The detailed cost estimate for the Carufel's Diversion can be found in Appendix B.

5.8. Alternative U-1

The Alternative U-1 combines elements from Mr. B's Alternative B-1 and Miram Avenue as a detention pond with no upstream fill in McCormick's Coulee and no construction of Channel Drive.

The U-1 Alternative consists of a 72″ storm sewer along Centennial Road from the intersection of Century Avenue and Centennial Road to the north edge of I-94. The 72″ storm sewer discharges into a concrete-lined open channel adjacent to the I-94 right-of-way. The open channel discharges into the proposed large WAPA Detention Pond.

Miriam Avenue would be constructed to an elevation of 1714.5 feet and used as a detention pond with 21 ac-ft of available storage. The flow would be controlled by a 48″ RCP through the roadway embankment. The McCormick Coulee upstream and downstream of Miriam Avenue would not be disturbed, therefore, eliminating the need for mitigation. The elements of the U-1 Alternative are as follows:

- Reclamation of Sattler Detention Pond
- Projected development of the trunk line storm sewers within the Turnbow Development

- Installation of trunk line storm sewers on east and west Century Avenue
- Installation of the 72" Centennial Road storm sewer from the intersection of Century and Centennial to I-94
- Concrete lined open channel adjacent to I-94 from Centennial Road to the large WAPA pond
- **No** improvements to the Chatham or WAPA open channels
- Construction of the large WAPA detention pond (18 ac-ft)
- Miriam Avenue as a roadway embankment with a 48" roadway culvert and natural storage (no fill in McCormick's Coulee)

These water management elements are shown on Figure 5.8.1. The resulting discharges for the Alternative U-1 are as follows:

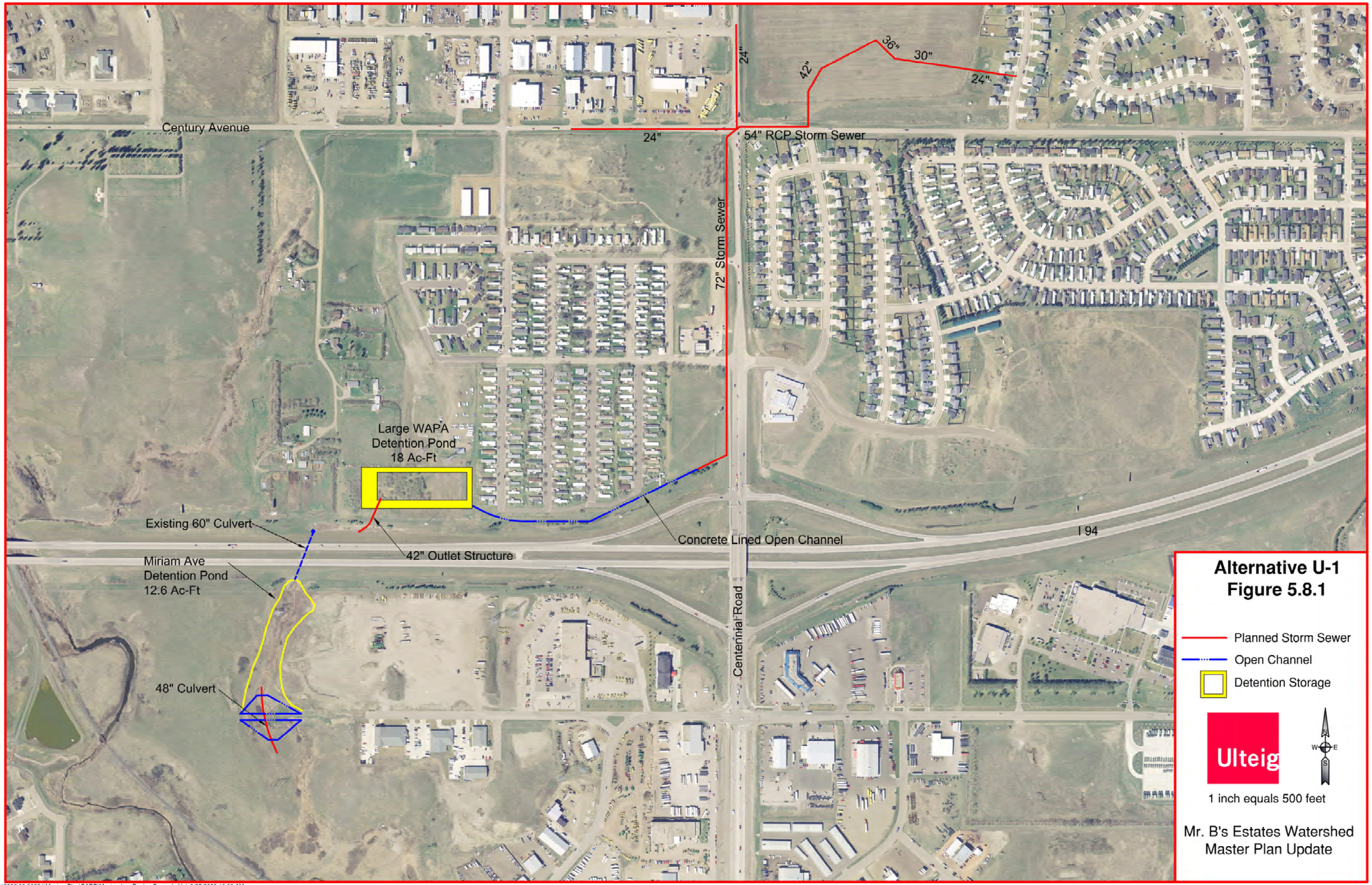
Location	Alternative U-1 Q_{100} (cfs)	Existing Conditions Q_{100} (cfs)
Evaluation Point 1 (East end of Chatham Channel)	31	61
Evaluation Point 2 (Inflow into I-94 Culvert)	200	204
Evaluation Point 3 (Outlet into Hay Creek)	223	232

The estimated project cost for the Alternative U-1 is $3,162,700. The detailed cost estimate for the Alternative U-1 can be found in Appendix B.

5.9. Alternative U-2

The Alternative U-2 is designed to minimize the impact to traffic flow and the lives of people living in Mr. B's Estates. A 72" storm sewer would be installed from the intersection of Century Avenue and Centennial Road to the north edge of Mr. B' Estates, thence north of the last row of mobile homes to the WAPA open channel. Major improvements would need to be made to the WAPA open channel which would discharge into the large WAPA Detention Pond adjacent to I-94.

Miriam Avenue would be constructed to an elevation of 1714.5 feet and used as a detention pond with 21 ac-ft of available storage. The flow would be regulated by a 48" RCP culvert. McCormick's Coulee upstream and downstream of Miriam Avenue would remain in its natural state, therefore, eliminating the need for mitigation. The elements of the Alternative U-2 are as follows:



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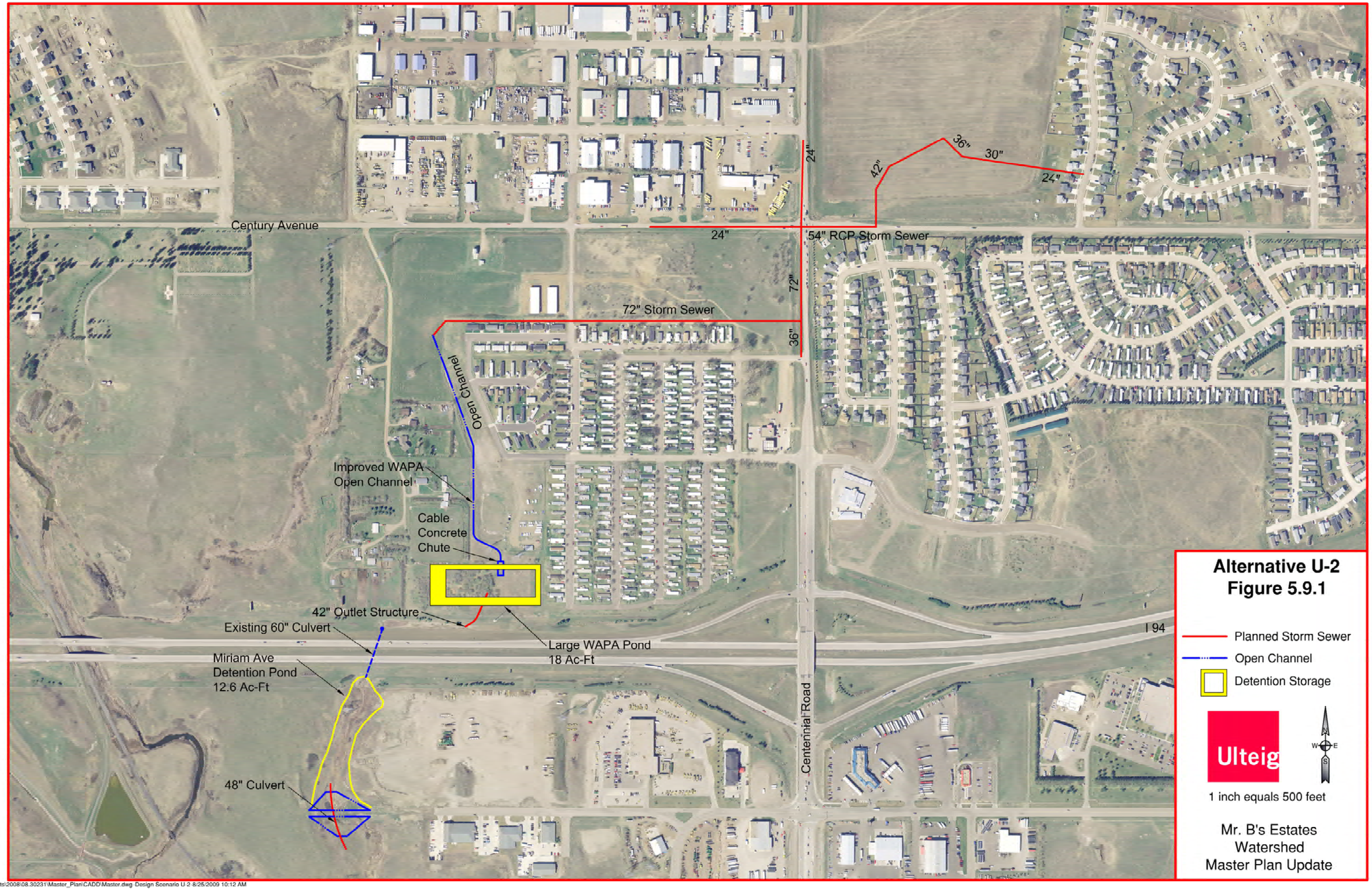
- Reclamation of Sattler Detention Pond
- Projected development of the trunk line storm sewers within the Turnbow Development
- Installation of trunk line storm sewers on east and west Century Avenue
- Installation of the 72″ Centennial Road storm sewer from the intersection of Century Avenue and Centennial Road to I-94
- **No** improvements to the Chatham Drive open channel
- Increase the capacity of the WAPA channel to 350 cfs
- Construction of the large WAPA Detention pond (18 ac-ft)
- Miriam Avenue as a roadway crossing with a 48″ RCP roadway culvert and natural storage (21 ac-ft)

These water management elements are shown on Figure 5.9.1. The resulting discharges for the Alternative U-2 are as follows:

Location	Alternative U-2 Q_{100} (cfs)	Existing Conditions Q_{100} (cfs)
Evaluation Point 1 (East end of Chatham Channel)	31	61
Evaluation Point 2 (Inflow into I-94 Culvert)	198	204
Evaluation Point 3 (Outlet into Hay Creek)	220	232

The estimated project cost for the U-2 Alternative is $2,926,400. The detailed cost estimate for this Alternative can be found in Appendix B.



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5.10. Summary of Costs

The same unit costs have been used for each scenario. The estimated land costs were provided to Ulteig by Dakota Appraisal and Consulting, Inc. in February 2009. The land values are *not* an appraisal. Table 5.10.1 "Opinion of Costs Summary" provides a summary of costs for the nine scenarios evaluated.

Table 5.10.1 Opinion of Costs Summary

Water Management Plan	Original Opinion of Cost	Opinion of Total Project Cost	Opinion of Construction Costs	Opinion of Land Costs
Master Plan	$2,162,030 [1]	$3,504,500	$2,739,900	$764,600
Mr. B's Alternative A-1	$2,637,180 [2]	$3,350,000	$2,481,000	$869,000
Mr. B's Alternative A-2	$2,306,403 [2]	$3,643,900	$2,774,900	$869,000
Mr. B's Alternative B-1	$2,024,015 [2]	$3,408,500	$3,190,500	$218,000
Mr. B's Alternative B-2	$2,699,536 [2]	$3,686,800	$3,468,800	$218,000
McCormick's Alternative	--------	$3,653,000	$2,751,400	$901,600
Diversion to Carufel's Coulee	--------	$3,627,800	$3,434,500	$193,300
Alternative U-1	--------	$3,162,700	$2,944,700	$218,000
Alternative U-2	--------	$2,926,400	$2,708,400	$218,000

Notes:

1. Opinion of costs is from the 2004 Master Plan and did not include land costs or any costs for the master planned facilities south of I-94.
2. Opinion of costs provided as part of the alternative submittals by Houston Engineering, Inc. and Kadrmas, Lee & Jackson, Inc.

6.0 CONCLUSION AND RECOMMENDATIONS

Each Alternative was evaluated to determine if it meets each of the following criteria:

- ✓ Provides 100-year flood protection for the residents of Mr. B's Estates.
- ✓ Flows do not exceed the design capacity of the 60" culvert at Interstate Highway 94.
- ✓ The discharge at the Hay Creek outlet is not increased.
- ✓ The Alternative is constructible and cost effective.

The Revised Master Plan and Mr. B's Alternatives A-1, A-2, B-1 and B-2 exceed the design discharge at the I-94 culvert and have an increase in the discharge from the watershed at Hay Creek. The McCormick Alternative exceeds the design capacity of the I-94 culvert and has environmental impacts to the McCormick Coulee south of I-94.

The Carufel Diversion meets hydrologic criteria but is costly and has the added concern of diverting water from one watershed to another. The diversion issue would make assessing the cost of this project extremely difficult.

Because all of the initial alternatives did not meet the established design criteria, elements of the proposed alternatives were combined to develop new alternatives which meet the design criteria. There was serious land owner opposition to the development of detention ponds on prime development land within the upper reaches of the waters. Therefore, some form of the WAPA Detention Pond became essential so as not to exceed the design capacity of the existing I-94 culvert. It was also important to reduce the impact to McCormick Coulee downstream of I-94. Alternative U-1 used the main elements of Alternative B-1 and used Miriam Avenue as a 21 acre-foot detention pond. Alternative U-1 meets the basic design criteria but has right-of-way and constructability problems along the south side of Mr. B's Estates. In order to overcome the construction and right-of-way problem, Alternative U-2 was developed. Its major advantage is that it greatly reduces the disruption to traffic flow by rerouting the 72" storm sewer north of Mr. B's Estates. Alternative U-2 also uses Miriam Avenue as a detention pond. The Miriam Avenue Road can be constructed under an existing US Army Corps of Engineers 404 permit and has minimal environmental impacts.

Considering all the alternatives and their impacts on people, the hydrology and the environment, our recommendation would be the Alternative U-2 over a given timeline or as development occurs. Alternative U-2 meets all the design objectives and has the lowest estimate cost. In addition the 100 year flow at Divide Avenue was reduced by approximately 90 cfs based on inserting Alternative U-2 in the November 2004 Hay Creek model.

Appendix A
HEC-1, 100 yr, Evaluation Data

Mr. B's Estates Watershed Storm Water Master Plan Update
Evaluation Points

Location	Century Avenue/Centennial Road					Chatham Drive/Mr. B's Pond					East End of Chatham Channel			Outlet of Chatham Pond into Headwater of WAPA Open			WAPA @ I-94					I-94					Miriam Ave					Outlet into Hay Creek			Location
Plan	DA (Acres)	Peak Inflow (cfs)	Peak Discharge (cfs)	Inv Elev / Stage / Overflow Elev	Volume (Ac-ft)	DA (Acres)	Peak Inflow (cfs)	Peak Discharge (cfs)	Inv Elev / Stage / Overflow Elev	Volume (Ac-ft)	DA (Acres)	Peak Discharge (cfs)	Volume (Ac-ft)	DA (Acres)	Peak Discharge (cfs)	Volume (Ac-ft)	DA (Acres)	Peak Inflow (cfs)	Peak Discharge (cfs)	Inv Elev / Stage / Overflow Elev	Volume (Ac-ft)	DA (Acres)	Peak Inflow (cfs)	Peak Outflow (cfs)	Stage Inv(1714.5) Overflow(1725)	Volume (Ac-ft)	DA (Acres)	Peak Inflow (cfs)	Peak Discharge (cfs)	Inv Elev / Stage / Overflow Elev	Volume (Ac-ft)	DA (Acres)	Peak Discharge (cfs)	Volume (Ac-ft)	Plan
Existing Conditions MrB-6ex.oh1	0.147			1776.1		0.199			1769.8		0.213			0.231			0.32					0.366					0.408			1696		0.463			**Existing Conditions MrB-6ex.oh1**
		84	80	1780.3***			84	61	1774.2***			62			68				160				204	189	1721.5			230	213	1704.4***			232		
				1779.8	8.73				1774	13.35			13.89			15.57					22.76					25.36				1703.8	28.3			34.46	
Revised Master Plan MrB-6mp.oh1	0.165			1769		0.2			1663.5		0.221			0.231			0.32					0.366					0.386			1704		0.463			**Revised Master Plan MrB-6mp.oh1**
		254	254	1777.2			307	161	1772.5			102			179				300				352	295	1725.3***			298	263	1714.4***			333		
				All Pipe Flow	20.09				1773.5	23.24			10.96			26.96					34.83					37.44				1714.5	38.95			48.23	
Mr. B's Alternative A1 KLJ-6A1.oh1	0.147			1771.5		0.2					0.221			0.231			0.32			1740		0.366					0.386			1704		0.463			**Mr. B's Alternative A1 KLJ-6A1.oh1**
		242	102	1776.3				190				124			258			367	198	1744.5			241	218	1722.7			225	218	1712.2			310		
				1777.5	17.68					23.24			4.07			26.96				1748	34.83					37.44				1714.5	38.95			48.23	
Mr. B's Alternative A2 KLJ-6A2.oh1	0.147			1771.5		0.2					0.221			0.231			0.32			1740		0.366					0.386			1704		0.463			**Mr. B's Alternative A2 KLJ-6A2.oh1**
		242	102	1776.3				190				139			152			367	197	1744.5			239	216	1722.6			222	216	1712.1			305		
				1777.5	17.68					23.24			5.28			6.26				1748	34.83					37.44				1714.5	38.95			48.23	
Mr. B's Alternative B1 & B2 KLJ-6B12.oh1	0.147					0.221					0.221			0.231			0.32			1740		0.366					0.386			1704		0.463			**Mr. B's Alternative B1 & B2 KLJ-6B12.oh1**
			242					350				31			50			485	203	1745.6			243	221	1722.8			228	220	1712.3			314		
					17.68					26.99			0.23			1.2				1747	34.83					37.44				1714.5	38.94			48.25	
McCormick's Alternative McC-6mr.oh1	0.165			1769		0.2					0.221			0.231			0.32					0.366					0.408			1703		0.458			**McCormick's Alternative McC-6mr.oh1**
		253	253	1777.2			307	161	1772.5			102			179				300				352	295	1725.3***				328	240	1714.3		247	215		
				All Pipe Flow	20.09				1773.5	23.24			10.96			26.96					34.83					37.44				1714.5	40.39			46.06	
Carufel's Diversion CAR-DivU.oh1	0.147					na					0.221			0.231			0.32			1740		0.366					0.408			1696		0.463			**Carufel's Diversion CAR-DivU.oh1**
			242					na				151			170			285	180	1742.7			222	201	1722			217	168	1705.8			212		
					17.68					na			4.18			5.2				1749	13.02					15.62				1714	19.87			26.02	
Alternative U-1 U1.oh1	0.147					0.221					0.221			0.231			0.32			1740		0.366					0.408			1696		0.463			**Alternative U-1 U1.oh1**
			242					350				31			50			485	159	1748.3			200	188	1721.5			242	168	1705.7			223		
					17.68					26.99			0.23			1.2				1749	34.83					37.44				1714	41.68			47.83	
Alternative U-2 U2.oh1	0.147					0.221					0.221			0.231			0.32			1740		0.366					0.408			1696		0.463			**Alternative U-2 U2.oh1**
			242					350				31			370			485	159	1748			198	187	1721.4			237	167	1705.6			220		
					17.68					26.99			0.23			27				1749	34.83					37.44				1714	41.68			47.83	

*** Denotes Roadway or Embankment is overtopped.

Appendix B
Detailed Opinion of Probable Costs

Mr. B's Estates Watershed
Storm Water Master Plan Update

Elements of the Revised Master Plan:

- Reclamation of Sattler Detention Pond
- Projected development of trunk line storm sewers within the Turnbow Development
- Installation of trunk line storm sewers on east and west Century Avenue
- Installation of trunk line storm sewer north on Centennial Road
- Collector storm sewer (54") south on Centennial Road
- Overflow culvert at the intersection of Century Avenue and Centennial Road
- Open channel on the west side of Centennial Road between the intersection of Century and Centennial and Mr. B's Detention Pond
- Mr. B's Detention Pond (8.9 ac-ft)
- Chatham Drive storm sewer (42")
- Chatham Drive open channel improvements
- Relocation of Chatham Drive to the north
- *Improvements to the Western Area Power Administration (WAPA) open channel including:
    - Regrading and enlargement
    - Grade stabilization structure
    - Two cable-concrete chute drops
- *Small McCormick detention pond (3.7 ac-ft)
- *Filling 700 lineal feet of McCormick's Coulee to elevation 1714.5
- *Installation of a 60" storm sewer down McCormick's Coulee south of I-94 through the proposed fill area

The * items above were either not included in the 2004 Master Plan facilities or cost estimate.
Elements not included in the Opinion of Cost:

1. Filling of Coulee South of I-94 to elevation 1714.5
2. Raising the MDU Power Line to provide for adequate clearance
3. Mitigation for placing fill within the coulee

Opinion of Probable Costs
Mr. B's Estates Watershed
Revised Master Plan

North of Century Facilities

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
18" RCP Storm Sewer	LF	400	$50.00	$20,000.00
24" RCP Storm Sewer	LF	1,010	$60.00	$60,600.00
30" RCP Storm Sewer	LF	590	$80.00	$47,200.00
36" RCP Storm Sewer	LF	350	$100.00	$35,000.00
42" RCP Storm Sewer	LF	430	$140.00	$60,200.00
48" RCP Storm Sewer	LF	580	$165.00	$95,700.00
48" Flared End Sec	EA	2	$1,500.00	$3,000.00
Concrete Inlets	EA	19	$4,000.00	$76,000.00
Concrete Manholes	EA	8	$6,000.00	$48,000.00
Granular Pipe Bedding	Tons	1,514	$25.00	$37,850.00
Reclaim Sattler Pond	LS	1	$5,000.00	$5,000.00
			SUBTOTAL	**$488,550.00**

Century Avenue to West End of Chatham Drive (To WAPA Channel)

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
18" RCP Storm Sewer	LF	250	$50.00	$12,500.00
24" RCP Storm Sewer	LF	200	$60.00	$12,000.00
42" RCP Storm Sewer	LF	1,930	$140.00	$270,200.00
54" RCP Storm Sewer	LF	880	$220.00	$193,600.00
30" RCP Spillway Pipe	LF	180	$95.00	$17,100.00
10' x 4' RCP Box Culvert	LF	302	$600.00	$181,200.00
Concrete Inlets	EA	10	$4,000.00	$40,000.00
Concrete Manholes	EA	9	$6,000.00	$54,000.00
Concrete Headwall (2-30")	LS	1	$3,000.00	$3,000.00
Baffled Outlets (2-30")	EA	2	$1,500.00	$3,000.00
Riprap and Geotextile	Tons	40	$45.00	$1,800.00
42" Baffled Outlet	EA	1	$2,000.00	$2,000.00
Mr. B's Pond Excavation	CY	15,100	$4.00	$60,400.00
Mr. B's Embankment Fill	CY	2,600	$4.00	$10,400.00
Topsoil Removal/Replacement	CY	4,000	$4.15	$16,600.00
Granular Pipe Bedding	Tons	1,720	$25.00	$43,000.00
Seeding Class I	SY	24,500	$0.75	$18,375.00
Reconstruct Chatham @ 36' wide	LF	320	$210.00	$67,200.00
Chatham Channel Excavation	CY	3,800	$4.00	$15,200.00
Asphalt Removal	SY	1,320	$4.00	$5,280.00
			SUBTOTAL	**$1,026,855.00**

WAPA Channel Improvement

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
Topsoil Removal and Replace	CY	1,340	$4.15	$5,561.00
Excavation	CY	2,100	$4.00	$8,400.00
SSSP Drop Structure	SF	672	$35.00	$23,520.00
Cable Concrete	SY	1,350	$100.00	$135,000.00
Seeding	SY	9,000	$0.75	$6,750.00
Rock Riprap and Fabric	Tons	50	$45.00	$2,250.00
			SUBTOTAL	**$181,481.00**

Mr. B's Coulee South of Interstate

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
Remove 48" Roadway Culvert	LF	100	$70.00	$7,000.00
60" RCP Class II	LF	670	$245.00	$164,150.00
Bedding	Tons	670	$25.00	$16,750.00
Energy Disipator	LS	1	$28,900.00	$28,900.00
Inlet Headwall	LS	1	$3,000.00	$3,000.00
Manholes	EA	2	$6,000.00	$12,000.00
Stripping for Pipe	CY	1,000	$6.00	$6,000.00
Compacted Fill	CY	5,600	$4.00	$22,400.00
			SUBTOTAL	**$260,200.00**

TOTAL CONSTRUCTION	**$1,957,086.00**
CONTINGENCIES, ENGINEERING AND ADMINISTRATION @ 40%	**$782,834.40**
TOTAL ESTIMATED CONSTRUCTION COSTS	**$2,739,920.40**
Land Cost for Mr. B's Detention Pond - 122,100 SF @ $6/SF	**$732,600.00**
Small Miriam Ave Detention Pond - 70,000 SF @ LS	**$32,000.00**
Total Land Costs	**$764,600.00**
TOTAL PROJECT COSTS	**$3,504,520.40**

NOTE: No costs are included in this estimate for the following items because they are being done solely to benefit the landowner and not for water management purposes:

1. Fill of the coulee south of I-94
2. Raising the MDU power line over the fill area and Miriam Avenue
3. Mitigation for placing fill within coulee

Mr. B's Estates Watershed
Storm Water Master Plan Update

Elements of the Mr. B's Alternative A-1:

- Reclamation of Sattler Detention Pond
- Projected development of the trunk line storm sewers within the Turnbow Development
- Turnbow Detention Pond (8.9 ac-ft)
- Installation of trunk line storm sewers on east and west Century Avenue
- Installation of trunk line storm sewer on Centennial Road and Chatham Drive (48")
- Improvement to Chatham Drive open channel
- Repair to Chatham Drive pavement (Chatham Drive remains in its current location)
- Improvements to the WAPA open channel including:
    - Regrading and enlargement
    - Grade stabilization structure
    - Two cable-concrete chute drops
- Small WAPA Detention Pond upstream of I-94 (4.9 ac-ft)
- Small McCormick Detention Pond (3.7 ac-ft)
- Filling 700 lineal feet of McCormick's Coulee to elevation 1714.5
- Installation of a 60" storm sewer down McCormick's Coulee south of I-94 through the proposed fill area

Elements Not Included in the Opinion of Cost:

1. Filling of Coulee South of I-94 to elevation 1714.5
2. Raising the MDU Power Line to provide for adequate clearance
3. Mitigation for placing fill within the coulee

Opinion of Probable Costs
Mr. B's Estates Watershed
Mr. B's Alternative A-1

North of Century Facilities

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
18" RCP Storm Sewer	LF	400	$50.00	$20,000.00
24" RCP Storm Sewer	LF	1,010	$60.00	$60,600.00
30" RCP Storm Sewer	LF	590	$80.00	$47,200.00
36" RCP Storm Sewer	LF	350	$100.00	$35,000.00
42" RCP Storm Sewer	LF	430	$140.00	$60,200.00
48" RCP Storm Sewer	LF	520	$165.00	$85,800.00
Concrete Inlets	EA	19	$4,000.00	$76,000.00
Concrete Manholes	EA	8	$6,000.00	$48,000.00
Granular Pipe Bedding	Tons	1,514	$25.00	$37,850.00
Reclaim Sattler Pond	LS	1	$5,000.00	$5,000.00
Topsoil Removal/Replacement	CY	2,600	$4.15	$10,790.00
Detention Pond Excavation	CY	21,000	$4.00	$84,000.00
Seeding	SY	13,300	$0.75	$9,975.00
Pond Control Structure	LS	1	$7,400.00	$7,400.00
			SUBTOTAL	**$587,815.00**

Century Avenue to West End of Chatham Drive (To WAPA Channel)

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
18" RCP Storm Sewer	LF	250	$50.00	$12,500.00
24" RCP Storm Sewer	LF	200	$60.00	$12,000.00
48" RCP Storm Sewer	LF	2,840	$165.00	$468,600.00
54" RCP Storm Sewer	LF	60	$220.00	$13,200.00
54" Baffled Outlet	EA	1	$3,000.00	$3,000.00
10' x 4' RCP Box Culvert	LF	120	$600.00	$72,000.00
Concrete Inlets	EA	10	$4,000.00	$40,000.00
Channel Excavation	CY	3,800	$4.00	$15,200.00
Topsoil Removal/Replacement	CY	1,850	$4.15	$7,677.50
Granular Bedding	Tons	2,165	$25.00	$54,125.00
Seeding Class I	SY	8,300	$0.75	$6,225.00
Patch Chatham Drive	LF	800	$70.00	$56,000.00
			SUBTOTAL	**$760,527.50**

WAPA Channel Improvement

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
Topsoil Removal and Replace	CY	1,340	$4.15	$5,561.00
Excavation	CY	2,100	$4.00	$8,400.00
SSSP Drop Structure	SF	672	$35.00	$23,520.00
Seeding	SY	9,000	$0.75	$6,750.00
Rock Riprap and Fabric	Tons	50	$45.00	$2,250.00
Cable Concrete (Pond Inlet)	SY	426	$100.00	$42,600.00
			SUBTOTAL	**$89,081.00**

Small WAPA Detention Pond

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
Excavation	CY	4,650	$4.00	$18,600.00
Compacted Embankment Fill	CY	3,000	$4.00	$12,000.00
Topsoil Removal and Replace	CY	1,600	$4.15	$6,640.00
Seeding	SY	13,300	$0.75	$9,975.00
Pond Outlet Structure	LS	1	$27,280.00	$27,280.00
			SUBTOTAL	**$74,495.00**

Mr. B's Coulee South of Interstate

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
Remove 48" Roadway Culvert	LF	100	$70.00	$7,000.00
60" RCP Class II	LF	670	$245.00	$164,150.00
Bedding	Tons	670	$25.00	$16,750.00
Energy Dissipator	LS	1	$28,900.00	$28,900.00
Inlet Headwall	LS	1	$3,000.00	$3,000.00
Manholes	EA	2	$6,000.00	$12,000.00
Stripping for Pipe	CY	1,000	$6.00	$6,000.00
Compacted Fill	CY	5600	$4.00	$22,400.00
			SUBTOTAL	**$260,200.00**

Total Construction	**$1,772,118.50**
Contingencies, Engineering and Administration @ 40%	**$708,847.40**
Total Estimated Construction Costs	**$2,480,965.90**

LAND COST FOR:	
Turnbow Detention Pond - 118,500 SF @ $6.00/SF	**$711,000.00**
Small WAPA Detention Pond - 126,000 SF @ $1/SF	**$126,000.00**
Small Miriam Ave Detention Pond - 70,000 SF @ LS	**$32,000.00**
Total Land Costs	**$869,000.00**

TOTAL PROJECT COST $3,349,965.90

NOTE: No costs are included in this estimate for the following items because they are being done solely to benefit the landowner and not for water management purposes:

1. Fill of the coulee south of I-94
2. Mitigation for placing fill in the coulee
3. Raising the MDU power line over the fill area and Miriam Avenue

Mr. B's Estates Watershed
Storm Water Master Plan Update

Elements of the Mr. B's Alternative A-2:

- Reclamation of Sattler Detention Pond
- Projected development of the trunk line storm sewers within the Turnbow Development
- Turnbow Detention Pond (8.9 ac-ft)
- Installation of trunk line storm sewers on east and west Century Avenue
- Installation of Centennial Road storm sewer from the intersection of Century and Centennial to the I-94 right-of-way (48")
- Concrete line open channel from Centennial Road to the small WAPA Detention Pond
- Improvements to Chatham Drive open channel
- Improvements to the WAPA open channel including:
    - Regrading and enlargement
    - Grade stabilization structure
    - Two cable-concrete chute drops
- Small WAPA Detention Pond upstream of I-94 (4.9 ac-ft)
- Small McCormick Detention Pond (3.7 ac-ft)
- Filling 700 lineal feet of McCormick's Coulee to elevation 1714.5.
- Installation of a 60" storm sewer down McCormick's Coulee south of I-94 through the proposed fill area

Elements Not Included in the Opinion of Cost:

1. Filling of Coulee South of I-94 to elevation 1714.5
2. Raising the MDU Power Line to provide for adequate clearance
3. Mitigation for placing fill within the coulee

Opinion of Probable Costs
Mr. B's Estates Watershed
Mr. B's Alternative A-2

North of Century Facilities

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
18" RCP Storm Sewer	LF	400	$50.00	$20,000.00
24" RCP Storm Sewer	LF	1,010	$60.00	$60,600.00
30" RCP Storm Sewer	LF	590	$80.00	$47,200.00
36" RCP Storm Sewer	LF	350	$100.00	$35,000.00
42" RCP Storm Sewer	LF	430	$140.00	$60,200.00
48" RCP Storm Sewer	LF	520	$165.00	$85,800.00
Concrete Inlets	EA	19	$4,000.00	$76,000.00
Concrete Manholes	EA	8	$6,000.00	$48,000.00
Granular Pipe Bedding	Tons	1,514	$25.00	$37,850.00
Reclaim Sattler Pond	LS	1	$5,000.00	$5,000.00
Topsoil Removal/Replacement	CY	2,600	$4.15	$10,790.00
Detention Pond Excavation	CY	21,000	$4.00	$84,000.00
Seeding	SY	13,300	$0.75	$9,975.00
Pond Control Structure	LS	1	$7,400.00	$7,400.00
			SUBTOTAL	**$587,815.00**

Centennial to Small WAPA Pond via I-94 Route

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
18" RCP Storm Sewer	LF	250	$50.00	$12,500.00
24" RCP Storm Sewer	LF	200	$60.00	$12,000.00
48" RCP Storm Sewer	LF	2,000	$165.00	$330,000.00
48" Flared End Section	EA	1	$1,500.00	$1,500.00
Concrete Inlets	EA	10	$4,000.00	$40,000.00
Concrete Manholes	EA	9	$4,000.00	$36,000.00
Channel Excavation	CY	3,500	$4.00	$14,000.00
Topsoil Removal/Replacement	CY	1,200	$4.00	$4,800.00
Granular Pipe Bedding	Tons	1,425	$25.00	$35,625.00
Seeding Class V	SY	6,900	$4.15	$28,635.00
Guardrail along Channel	LF	850	$30.00	$25,500.00
Concrete Lined Drainage Channel	SY	5,330	$60.00	$319,800.00
Roadway Asphalt	SY	300	$30.00	$9,000.00
			SUBTOTAL	**$869,360.00**

Chatham Drive Channel Improvement

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
10' x 4' RCP Box Culvert	LF	120	$600.00	$72,000.00
Channel Excavation	CY	3,800	$4.00	$15,200.00
Topsoil Removal/Replacement	CY	1,850	$4.15	$7,677.50
Seeding Class I	SY	8,300	$0.75	$6,225.00
			SUBTOTAL	**$101,102.50**

WAPA Channel Improvement

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
Topsoil Removal and Replace	CY	1,340	$4.15	$5,561.00
Excavation	CY	2,100	$4.00	$8,400.00
SSSP Drop Structure	SF	672	$35.00	$23,520.00
Seeding	SY	9,000	$0.75	$6,750.00
Rock Riprap and Fabric	Tons	50	$45.00	$2,250.00
Cable Concrete (Inlet)	SY	426	$100.00	$42,600.00
			SUBTOTAL	**$89,081.00**

Small WAPA Detention Pond

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
Excavation	CY	4,650	$4.00	$18,600.00
Compacted Embankment Fill	CY	3,000	$4.00	$12,000.00
Topsoil Removal and Replace	CY	1,600	$4.15	$6,640.00
Seeding	SY	13,300	$0.75	$9,975.00
Pond Outlet Structure	LS	1	$27,280.00	$27,280.00
			SUBTOTAL	**$74,495.00**

Mr. B's Coulee South of Interstate

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
Remove 48" Roadway Culvert	LF	100	$70.00	$7,000.00
60" RCP Class II	LF	670	$245.00	$164,150.00
Bedding	Tons	670	$25.00	$16,750.00
Energy Dissipator	LS	1	$28,900.00	$28,900.00
Inlet Headwall	LS	1	$3,000.00	$3,000.00
Manholes	EA	2	$6,000.00	$12,000.00
Stripping for Pipe	CY	1,000	$6.00	$6,000.00
Compacted Fill	CY	5600	$4.00	$22,400.00
			SUBTOTAL	**$260,200.00**

Total Construction	**$1,982,053.50**
Contingencies, Engineering and Administration @ 40%	**$792,821.40**
Total Estimated Construction Costs	**$2,774,874.90**
Land Cost For:	
Turnbow Detention Pond - 118,500 SF @ $6.00/SF	**$711,000.00**
Small WAPA Detention Pond - 126,000 SF @ $1/SF	**$126,000.00**
Small Miriam Ave Detention Pond - 70,000 SF @ LS	**$32,000.00**
Total Land Costs	**$869,000.00**

TOTAL PROJECT COST $3,643,874.90

NOTE: No costs are included in this estimate for the following items because they are being done solely to benefit the landowner and not for water management purposes:

1. Fill of the coulee south of I-94
2. Mitigation for placing fill in the coulee
3. Raising the MDU power line over the fill area and Miriam Avenue

Mr. B's Estates Watershed
Storm Water Master Plan Update

Elements of the Mr. B's Alternative B-1:

- Reclamation of Sattler Detention Pond
- Projected development of the trunk line storm sewers within the Turnbow Development
- Installation of trunk line storm sewers on east and west Century Avenue
- Installation of the 72″ Centennial Road storm sewer from the intersection of Century Avenue and Centennial Road to I-94
- 72″ storm sewer and a concrete-lined open channel adjacent to I-94 from Centennial Road to the large WAPA pond
- **No** improvements to the Chatham or WAPA open channels
- Construction of the large WAPA Detention Pond (18 ac-ft)
- Small McCormick Detention Pond (3.7 ac-ft)
- Filling 700 lineal feet of McCormick's Coulee to elevation 1714.5
- Installation of a 60″ storm sewer down McCormick's Coulee south of I-94 through the proposed fill area

*** **Note:** Breene's **Alternative B-2** has the same elements as B-1 except the 72″ storm sewer is longer and there is less concrete lined channel along I-94

Elements Not Included in the Opinion of Cost:

1. Filling of Coulee South of I-94 to elevation 1714.5
2. Raising the MDU Power Line to provide for adequate clearance
3. Mitigation for placing fill within the coulee

Opinion of Probable Costs
Mr. B's Estates Watershed
Mr. B's Alternative B-1

North of Century Facilities

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
18" RCP Storm Sewer	LF	400	$50.00	$20,000.00
24" RCP Storm Sewer	LF	1,010	$60.00	$60,600.00
30" RCP Storm Sewer	LF	590	$80.00	$47,200.00
36" RCP Storm Sewer	LF	350	$100.00	$35,000.00
42" RCP Storm Sewer	LF	430	$140.00	$60,200.00
48" RCP Storm Sewer	LF	500	$165.00	$82,500.00
Concrete Inlets	EA	19	$4,000.00	$76,000.00
Concrete Manholes	EA	8	$6,000.00	$48,000.00
Granular Pipe Bedding	CY	1,460	$25.00	$36,500.00
Reclaim Sattler Pond	LS	1	$5,000.00	$5,000.00
			SUBTOTAL	**$471,000.00**

Centennial Road 72" Storm Sewer to WAPA Pond

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
18" RCP Storm Sewer	LF	250	$50.00	$12,500.00
24" RCP Storm Sewer	LF	200	$60.00	$12,000.00
72" RCP Storm Sewer	LF	2,090	$380.00	$794,200.00
Concrete Inlets	EA	10	$4,000.00	$40,000.00
Concrete Manholes	EA	9	$6,000.00	$54,000.00
Granular Pipe Bedding	Tons	2,915	$25.00	$72,875.00
72" Flared End Section	EA	1	$2,500.00	$2,500.00
Channel Excavation	CY	3,500	$4.00	$14,000.00
Concrete Lined Drainage Channel	SY	5,330	$60.00	$319,800.00
Guardrail along Channel	LF	850	$30.00	$25,500.00
Topsoil Stripping/Replacement	CY	840	$4.15	$3,486.00
Seeding	SY	4,300	$0.75	$3,225.00
Roadway Asphalt	SY	300	$30.00	$9,000.00
			SUBTOTAL	**$1,363,086.00**

Chatham Drive Channel Improvement

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
NONE				
			SUBTOTAL	**$0.00**

WAPA Open Channel Improvement

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
NONE				
			SUBTOTAL	**$0.00**

Large WAPA Detention Pond

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
Topsoil Stripping/Replacement	CY	4,800	$4.15	$19,920.00
Excavation	CY	10,500	$4.00	$42,000.00
Embankment Fill	CY	9,500	$4.00	$38,000.00
Seeding	SY	21,700	$0.75	$16,275.00
Pond Outlet Structure	LS	1	$68,470.00	$68,470.00
			SUBTOTAL	**$184,665.00**

Mr. B's Coulee South of Interstate

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
Remove 48" Roadway Culvert	LF	100	$70.00	$7,000.00
60" RCP Class II	LF	670	$245.00	$164,150.00
Bedding	Tons	670	$25.00	$16,750.00
Energy Dissipator	LS	1	$28,900.00	$28,900.00
Inlet Headwall	LS	1	$3,000.00	$3,000.00
Manholes	EA	2	$6,000.00	$12,000.00
Stripping for Pipe	CY	1,000	$6.00	$6,000.00
Compacted Fill	CY	5600	$4.00	$22,400.00
			SUBTOTAL	**$260,200.00**

Total Construction	**$2,278,951.00**
Contingencies, Engineering and Administration @ 40%	**$911,580.40**
Total Estimated Construction Costs	**$3,190,531.40**
Land Cost For:	
Large WAPA Detention Pond - 186,000 SF @ $1/SF	**$186,000.00**
Small Miriam Ave Detention Pond - 70,000 SF @ LS	**$32,000.00**
Total Land Costs	**$218,000.00**
TOTAL PROJECT COST	**$3,408,531.40**

NOTE: No costs are included in this estimate for the following items because they are being done solely to benefit the landowner and not for water management purposes:

1. Fill of the coulee south of I-94
2. Mitigation for placing fill in the coulee
3. Raising the MDU power line over the fill area and Miriam Avenue

Mr. B's Estates Watershed
Storm Water Master Plan Update

Elements of the Mr. B's Alternative B-2:

- Reclamation of Sattler Detention Pond
- Projected development of the trunk line storm sewers within the Turnbow Development
- Installation of trunk line storm sewers on east and west Century Avenue
- Installation of the 72″ Centennial Road storm sewer from the intersection of Century Avenue and Centennial Road to I-94
- 72″ storm sewer and a concrete-lined open channel adjacent to I-94 from Centennial Road to the large WAPA pond
- **No** improvements to the Chatham or WAPA open channels
- Construction of the large WAPA Detention Pond (18 ac-ft)
- Small McCormick Detention Pond (3.7 ac-ft)
- Filling 700 lineal feet of McCormick's Coulee to elevation 1714.5
- Installation of a 60″ storm sewer down McCormick's Coulee south of I-94 through the proposed fill area

*** **Note:** Mr. B's **Alternative B-2** has the same elements as B-1 except the 72″ storm sewer is longer and there is less concrete lined channel along I-94

Elements Not Included in the Opinion of Cost:

1. Filling of Coulee South of I-94 to elevation 1714.5
2. Raising the MDU Power Line to provide for adequate clearance
3. Mitigation for placing fill within the coulee

Opinion of Probable Costs
Mr. B's Estates Watershed
Mr. B's Alternative B-2

North of Century Facilities

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
18" RCP Storm Sewer	LF	400	$50.00	$20,000.00
24" RCP Storm Sewer	LF	1,010	$60.00	$60,600.00
30" RCP Storm Sewer	LF	590	$80.00	$47,200.00
36" RCP Storm Sewer	LF	350	$100.00	$35,000.00
42" RCP Storm Sewer	LF	430	$140.00	$60,200.00
48" RCP Storm Sewer	LF	500	$165.00	$82,500.00
Concrete Inlets	EA	19	$4,000.00	$76,000.00
Concrete Manholes	EA	8	$6,000.00	$48,000.00
Granular Pipe Bedding	CY	1,460	$25.00	$36,500.00
Reclaim Sattler Pond	LS	1	$5,000.00	$5,000.00
			SUBTOTAL	**$471,000.00**

Centennial Road 72" Storm Sewer to WAPA Pond

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
18" RCP Storm Sewer	LF	250	$50.00	$12,500.00
24" RCP Storm Sewer	LF	200	$60.00	$12,000.00
72" RCP Storm Sewer	LF	3,040	$380.00	$1,155,200.00
Concrete Inlets	EA	10	$4,000.00	$40,000.00
Concrete Manholes	EA	9	$6,000.00	$54,000.00
Granular Pipe Bedding	Tons	4,250	$25.00	$106,250.00
72" Flared End Section	EA	1	$2,500.00	$2,500.00
Channel Excavation	CY	3,500	$4.00	$14,000.00
Concrete Lined Drainage Channel	SY	2,070	$60.00	$124,200.00
Guardrail along Channel	LF	850	$30.00	$25,500.00
Topsoil Stripping/Replacement	CY	840	$4.15	$3,486.00
Seeding	SY	4,300	$0.75	$3,225.00
Roadway Asphalt	SY	300	$30.00	$9,000.00
			SUBTOTAL	**$1,561,861.00**

Chatham Drive Channel Improvement

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
NONE				
			SUBTOTAL	**$0.00**

WAPA Open Channel Improvement

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
NONE				
			SUBTOTAL	**$0.00**

Large WAPA Detention Pond

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
Topsoil Stripping/Replacement	CY	4,800	$4.15	$19,920.00
Excavation	CY	10,500	$4.00	$42,000.00
Embankment Fill	CY	9,500	$4.00	$38,000.00
Seeding	SY	21,700	$0.75	$16,275.00
Pond Outlet Structure	LS	1	$68,470.00	$68,470.00
			SUBTOTAL	**$184,665.00**

Mr. B's Coulee South of Interstate

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
Remove 48" Roadway Culvert	LF	100	$70.00	$7,000.00
60" RCP Class II	LF	670	$245.00	$164,150.00
Bedding	Tons	670	$25.00	$16,750.00
Energy Dissipator	LS	1	$28,900.00	$28,900.00
Inlet Headwall	LS	1	$3,000.00	$3,000.00
Manholes	EA	2	$6,000.00	$12,000.00
Stripping for Pipe	CY	1,000	$6.00	$6,000.00
Compacted Fill	CY	5600	$4.00	$22,400.00
			SUBTOTAL	**$260,200.00**

Total Construction	**$2,477,726.00**
Contingencies, Engineering and Administration @ 40%	**$991,090.40**
Total Estimated Construction Costs	**$3,468,816.40**
Land Cost for:	
Large WAPA Detention Pond - 186,000 SF @ $1/SF	**$186,000.00**
Small Miriam Ave Detention Pond - 70,000 SF @ LS	**$32,000.00**
	$218,000.00
TOTAL PROJECT COST	**$3,686,816.40**

NOTE: No costs are included in this estimate for the following items because they are being done solely to benefit the landowner and not for water management purposes:

1. Fill of the coulee south of I-94
2. Mitigation for placing fill in the coulee
3. Raising the MDU power line over the fill area and Miriam Avenue

Mr. B's Estates Watershed
Storm Water Master Plan Update

Elements of the McCormick Alternative:

- Reclamation of Sattler Detention Pond
- Projected development of the trunk line storm sewers within the Turnbow Development
- Installation of trunk line storm sewers on east and west Century Avenue
- Installation of trunk line storm sewer north on Centennial Road
- Collector storm sewer (54") south on Centennial Road
- Overflow culvert at the intersection of Century Avenue and Centennial Road
- Open channel along the west side of Centennial Road between the intersection of Century and Centennial and Mr. B's Detention Pond
- Mr. B's Detention Pond (8.9 ac-ft)
- Chatham Drive storm sewer (42")
- Chatham Drive open channel improvements
- Relocation of Chatham Drive to the north
- Improvements to the WAPA open channel including:
    - Regrading and enlargement
    - Grade stabilization structure
    - Two cable-concrete chute drops
- Regrade and fill McCormick's Coulee to elevation 1704.0
- Raise Miriam Avenue to elevation 1714.5 (11.6 ac-ft)
- Construct an embankment at the future Channel Drive with a 48" culvert (8.1 ac-ft)
- Raise the MDU high voltage line
- Mitigation for lost coulee habitat

Opinion of Probable Costs
Mr. B's Estates Watershed
McCormick's Alternative

North of Century Facilities

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
18" RCP Storm Sewer	LF	400	$50.00	$20,000.00
24" RCP Storm Sewer	LF	1,010	$60.00	$60,600.00
30" RCP Storm Sewer	LF	590	$80.00	$47,200.00
36" RCP Storm Sewer	LF	350	$100.00	$35,000.00
42" RCP Storm Sewer	LF	430	$140.00	$60,200.00
48" RCP Storm Sewer	LF	580	$165.00	$95,700.00
48" Flared End Sec	EA	2	$1,500.00	$3,000.00
Concrete Inlets	EA	19	$4,000.00	$76,000.00
Concrete Manholes	EA	8	$6,000.00	$48,000.00
Granular Pipe Bedding	Tons	1,514	$25.00	$37,850.00
Reclaim Sattler Pond	LS	1	$5,000.00	$5,000.00
			SUBTOTAL	**$488,550.00**

Century Avenue to West End of Chatham Drive (To WAPA Channel)

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
18" RCP Storm Sewer	LF	250	$50.00	$12,500.00
24" RCP Storm Sewer	LF	200	$60.00	$12,000.00
42" RCP Storm Sewer	LF	1,930	$140.00	$270,200.00
54" RCP Storm Sewer	LF	880	$220.00	$193,600.00
30" RCP Spillway Pipe	LF	180	$95.00	$17,100.00
10' x 4' RCP Box Culvert	LF	302	$600.00	$181,200.00
Concrete Inlets	EA	10	$4,000.00	$40,000.00
Concrete Manholes	EA	9	$6,000.00	$54,000.00
Concrete Headwall (2-30")	LS	1	$3,000.00	$3,000.00
Baffled Outlets (2-30")	EA	2	$1,500.00	$3,000.00
Riprap and Geotextile	Tons	40	$45.00	$1,800.00
42" Baffled Outlet	EA	1	$2,000.00	$2,000.00
Mr. B's Pond Excavation	CY	15,100	$4.00	$60,400.00
Mr. B's Embankment Fill	CY	2,600	$4.00	$10,400.00
Topsoil Removal/Replacement	CY	4,000	$4.15	$16,600.00
Granular Pipe Bedding	Tons	1,720	$25.00	$43,000.00
Seeding Class I	SY	24,500	$0.75	$18,375.00
Reconstruct Chatham @ 36' wide	LF	320	$210.00	$67,200.00
Chatham Channel Excavation	CY	3,800	$4.00	$15,200.00
Asphalt Removal	SY	1,320	$4.00	$5,280.00
			SUBTOTAL	**$1,026,855.00**

WAPA Channel Improvement

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
Topsoil Removal and Replace	CY	1,340	$4.15	$5,561.00
Excavation	CY	2,100	$4.00	$8,400.00
SSSP Drop Structure	SF	672	$35.00	$23,520.00
Cable Concrete	SY	1,350	$100.00	$135,000.00
Seeding	SY	9,000	$0.75	$6,750.00
Rock Riprap and Fabric	Tons	50	$45.00	$2,250.00
			SUBTOTAL	**$181,481.00**

Mr. B's Coulee South of Interstate

(Miriam Avenue and Channel Drive)

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
48" RCP Removal	LF	100	$70.00	$7,000.00
48" Roadway Culvert	LF	320	$165.00	$52,800.00
48" Flared End Section	EA	4	$1,500.00	$6,000.00
Rock Riprap and Fabric	Tons	425	$45.00	$19,125.00
Topsoil Stripping and	CY	800	$4.15	$3,320.00
Embankment Fill	CY	25,600	$4.00	$102,400.00
Seeding	SY	3,700	$0.75	$2,775.00
Raise MDU's Line	LS	1	$75,000.00	$75,000.00
			SUBTOTAL	**$268,420.00**

TOTAL CONSTRUCTION	**$1,965,306.00**
CONTINGENCIES, ENGINEERING AND ADMINISTRATION @ 40%	**$786,122.40**
TOTAL ESTIMATED CONSTRUCTION COSTS	**$2,751,428.40**

LAND COST FOR:	
Mr. B's Detention Pond - 122,100 SF @ $6/SF	**$732,600.00**
Miriam Avenue Detention - 177,900 SF @ LS	**$82,000.00**
Channel Drive Detention - 155,400 SF @ LS	**$72,000.00**
Mitigation of Site - 32,000 SF @ LS	**$15,000.00**
LAND COST SUBTOTAL	**$901,600.00**

TOTAL PROJECT COSTS $3,653,028.40

Mr. B's Estates Watershed
Storm Water Master Plan Update

Elements of the Carufel's Diversion:

- Reclamation of Sattler Detention Pond
- Projected development of the trunk line storm sewers within the Turnbow Development
- Installation of trunk line storm sewers on east and west Century Avenue
- Installation of trunk line storm sewer north on Centennial Road
- Install 500 lf of 72″ storm sewer south along Centennial Road to the north of Mr. B's 72″ storm sewer
- Install Mr. B's north storm sewer (72″)
- Diversion manhole
- 60″ storm sewer diversion to Carufel's Coulee
- Improvement to 800 lf of Carufel's Coulee
- I-94 Detention pond on Carufel's Coulee (22.7 ac-ft)
- Improvements to the WAPA open channel including:
    - Regrading and enlargement
    - Grade stabilization structure
    - Two cable-concrete chute drops
- Small WAPA Detention Pond
- Miriam Avenue street crossing with 48″ culvert

Opinion of Probable Costs
Mr. B's Estates Watershed
Carufel's Diversion

North of Century Facilities

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
18" RCP Storm Sewer	LF	400	$50.00	$20,000.00
24" RCP Storm Sewer	LF	1,010	$60.00	$60,600.00
30" RCP Storm Sewer	LF	590	$80.00	$47,200.00
36" RCP Storm Sewer	LF	350	$100.00	$35,000.00
42" RCP Storm Sewer	LF	430	$140.00	$60,200.00
48" RCP Storm Sewer	LF	520	$165.00	$85,800.00
Concrete Inlets	EA	19	$4,000.00	$76,000.00
Concrete Manholes	EA	8	$6,000.00	$48,000.00
Granular Pipe Bedding	Tons	1,514	$25.00	$37,850.00
Reclaim Sattler Pond	LS	1	$5,000.00	$5,000.00
			SUBTOTAL	**$475,650.00**

Century Avenue to West End of Chatham Drive (To WAPA Channel)

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
18" RCP Storm Sewer	LF	250	$50.00	$12,500.00
24" RCP Storm Sewer	LF	200	$60.00	$12,000.00
30" RCP Storm Sewer	LF	450	$80.00	$36,000.00
72" RCP Storm Sewer	LF	2,720	$380.00	$1,033,600.00
Concrete Inlets	EA	10	$4,000.00	$40,000.00
Concrete Manholes	EA	4	$6,000.00	$24,000.00
Transition Manhole	EA	1	$20,000.00	$20,000.00
Granular Bedding	Tons	4,020	$25.00	$100,500.00
			SUBTOTAL	**$1,278,600.00**

Carufel's Diversion

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
60" RCP Storm Sewer	LF	850	$245.00	$208,250.00
Energy Dissipator	EA	1	$28,900.00	$28,900.00
Granular Bedding	Tons	850	$25.00	$21,250.00
Carufel's Detention Pond	LS	1	$160,000.00	$160,000.00
Channel Stabilization	LS	1	$65,000.00	$65,000.00
			SUBTOTAL	**$483,400.00**

WAPA Channel Improvement

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
Topsoil Removal and Replace	CY	1,340	$4.15	$5,561.00
Excavation	CY	2,100	$4.00	$8,400.00
SSSP Drop Structure	SF	672	$35.00	$23,520.00
Seeding	SY	9,000	$0.75	$6,750.00
Cable Concrete Inlet	SY	426	$100.00	$42,600.00
Rock Riprap and Fabric	Tons	50	$45.00	$2,250.00
			SUBTOTAL	**$89,081.00**

Small WAPA Detention Pond

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
Excavation	CY	4,650	$4.00	$18,600.00
Compacted Embankment Fill	CY	3,000	$4.00	$12,000.00
Topsoil Removal and Replace	CY	1,600	$4.15	$6,640.00
Seeding	SY	13,300	$0.75	$9,975.00
Pond Outlet Structure	LS	1	$27,280.00	$27,280.00
			SUBTOTAL	**$74,495.00**

Mr. B's Coulee South of Interstate

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
48" Culvert Removal	LF	100	$70.00	$7,000.00
48" Roadway Culvert	LF	200	$165.00	$33,000.00
48" Flared End Section	EA	2	$1,500.00	$3,000.00
Rock Riprap and Fabric	Tons	200	$45.00	$9,000.00
			SUBTOTAL	**$52,000.00**

TOTAL CONSTRUCTION	**$2,453,226.00**
CONTINGENCIES, ENGINEERING AND ADMINISTRATION @ 40%	**$981,290.40**
TOTAL ESTIMATED CONSTRUCTION COSTS	**$3,434,516.40**

Land Cost for:	
Small WAPA Detention Pond - 126,000 SF @ $1/SF	**$126,000.00**
Carufel's Coulee Detention Pond 293,100 SF @ LS	**$67,300.00**
Subtotal Land Costs	**$193,300.00**

TOTAL PROJECT COSTS $3,627,816.40

Mr. B's Estates Watershed
Storm Water Master Plan Update

Elements of the Alternative U-1:

- Reclamation of Sattler Detention Pond
- Projected development of the trunk line storm sewers within the Turnbow Development
- Installation of trunk line storm sewers on east and west Century Avenue
- Installation of the 72" Centennial Road storm sewer from the intersection of Century and Centennial to I-94
- Concrete lined open channel adjacent to I-94 from Centennial Road to the large WAPA pond
- **No** improvements to the Chatham or WAPA open channels
- Construction of the large WAPA detention pond (18 ac-ft)
- Miriam Avenue as a roadway embankment with a 48" roadway culvert and natural storage (no fill in McCormick's Coulee)

Opinion of Probable Costs
Mr. B's Estates Watershed
Alternative U-1

North of Century Facilities

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
18" RCP Storm Sewer	LF	400	$50.00	$20,000.00
24" RCP Storm Sewer	LF	1,010	$60.00	$60,600.00
30" RCP Storm Sewer	LF	590	$80.00	$47,200.00
36" RCP Storm Sewer	LF	350	$100.00	$35,000.00
42" RCP Storm Sewer	LF	430	$140.00	$60,200.00
48" RCP Storm Sewer	LF	500	$165.00	$82,500.00
Concrete Inlets	EA	19	$4,000.00	$76,000.00
Concrete Manholes	EA	8	$6,000.00	$48,000.00
Granular Pipe Bedding	CY	1,460	$25.00	$36,500.00
Reclaim Sattler Pond	LS	1	$5,000.00	$5,000.00
			SUBTOTAL	**$471,000.00**

Centennial Road 72" Storm Sewer

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
18" RCP Storm Sewer	LF	250	$50.00	$12,500.00
24" RCP Storm Sewer	LF	200	$60.00	$12,000.00
72" RCP Storm Sewer	LF	2,090	$380.00	$794,200.00
Concrete Inlets	EA	10	$4,000.00	$40,000.00
Concrete Manholes	EA	9	$6,000.00	$54,000.00
Granular Pipe Bedding	Tons	2,915	$25.00	$72,875.00
72" Flared End Section	EA	1	$2,500.00	$2,500.00
Channel Excavation	CY	3,500	$4.00	$14,000.00
Concrete Lined Drainage Channel	SY	5,330	$60.00	$319,800.00
Guardrail along Channel	LF	850	$30.00	$25,500.00
Topsoil Stripping/Replacement	CY	840	$4.15	$3,486.00
Seeding	SY	4,300	$0.75	$3,225.00
Roadway Asphalt	SY	300	$30.00	$9,000.00
			SUBTOTAL	**$1,363,086.00**

Chatham Drive Channel Improvement

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
NONE				
			SUBTOTAL	**$0.00**

WAPA Open Channel Improvement

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
NONE				
			SUBTOTAL	**$0.00**

Large WAPA Detention Pond

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
Topsoil Stripping/Replacement	CY	4,800	$4.15	$19,920.00
Excavation	CY	10,500	$4.00	$42,000.00
Embankment Fill	CY	9,500	$4.00	$38,000.00
Seeding	SY	21,700	$0.75	$16,275.00
Cable Concrete (Inlet)	SY	426	$100.00	$42,600.00
Pond Outlet Structure	LS	1	$58,470.00	$58,470.00
			SUBTOTAL	**$217,265.00**

Mr. B's Coulee South of Interstate

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
48" Culvert Removal	LF	100	$70.00	$7,000.00
48" Roadway Culvert	LF	200	$165.00	$33,000.00
48" Flared End Section	EA	2	$1,500.00	$3,000.00
Rock Riprap and Fabric	Tons	200	$45.00	$9,000.00
			SUBTOTAL	**$52,000.00**

Total Construction	**$2,103,351.00**
Contingencies, Engineering and Administration @ 40%	**$841,340.40**
Total Estimated Construction Costs	**$2,944,691.40**
Land Cost for:	
Large WAPA Detention Pond - 186,000 SF @ $1/SF	**$186,000.00**
Miriam Avenue Storage - 69,700 SF LS	**$32,000.00**
Land Costs Subtotal	**$218,000.00**

TOTAL PROJECT COST $3,162,691.40

Mr. B's Estates Watershed
Storm Water Master Plan Update

Elements of the Alternative U-2:

- Reclamation of Sattler Detention Pond
- Projected development of the trunk line storm sewers within the Turnbow Development
- Installation of trunk line storm sewers on east and west Century Avenue
- Installation of the 72″ Centennial Road storm sewer from the intersection of Century Avenue and Centennial Road to I-94
- **No** improvements to the Chatham Drive open channel
- Increase the capacity of the WAPA channel to 350 cfs
- Construction of the large WAPA Detention pond (18 ac-ft)
- Miriam Avenue as a roadway crossing with a 48″ RCP roadway culvert and natural storage (21 ac-ft)

Opinion of Probable Costs
Mr. B's Estates Watershed
Alternative U-2

North of Century Facilities

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
18" RCP Storm Sewer	LF	400	$50.00	$20,000.00
24" RCP Storm Sewer	LF	1,010	$60.00	$60,600.00
30" RCP Storm Sewer	LF	590	$80.00	$47,200.00
36" RCP Storm Sewer	LF	350	$100.00	$35,000.00
42" RCP Storm Sewer	LF	430	$140.00	$60,200.00
48" RCP Storm Sewer	LF	500	$165.00	$82,500.00
Concrete Inlets	EA	19	$4,000.00	$76,000.00
Concrete Manholes	EA	8	$6,000.00	$48,000.00
Granular Pipe Bedding	CY	1,460	$25.00	$36,500.00
Reclaim Sattler Pond	LS	1	$5,000.00	$5,000.00
			SUBTOTAL	**$471,000.00**

Centennial Road 72" Storm Sewer

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
18" RCP Storm Sewer	LF	250	$50.00	$12,500.00
24" RCP Storm Sewer	LF	200	$60.00	$12,000.00
72" RCP Storm Sewer	LF	2,400	$380.00	$912,000.00
Concrete Inlets	EA	10	$4,000.00	$40,000.00
Concrete Manholes	EA	6	$6,000.00	$36,000.00
Granular Pipe Bedding	Tons	3,200	$25.00	$80,000.00
72" Flared End Section	EA	1	$2,500.00	$2,500.00
72" Baffel Ring Set	EA	1	$4,600.00	$4,600.00
Rock Riprap and Fabric	Tons	220	$45.00	$9,900.00
			SUBTOTAL	**$1,109,500.00**

Chatham Drive Channel Improvement

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
NONE				
			SUBTOTAL	**$0.00**

WAPA Open Channel Improvement

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
Channel Excavation	CY	8,200	$4.00	$32,800.00
Topsoil Stripping/Replacement	CY	1,600	$4.15	$6,640.00
Seeding	SY	10,600	$0.75	$7,950.00
			SUBTOTAL	**$47,390.00**

Large WAPA Detention Pond

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
Topsoil Stripping/Replacement	CY	4,800	$4.15	$19,920.00
Excavation	CY	10,500	$4.00	$42,000.00
Embankment Fill	CY	9,500	$4.00	$38,000.00
Seeding	SY	21,700	$0.75	$16,275.00
Cable Concrete (Inlet)	SY	800	$100.00	$80,000.00
Pond Outlet Structure	LS	1	$58,470.00	$58,470.00
			SUBTOTAL	**$254,665.00**

Mr. B's Coulee South of Interstate

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED COST
48" Culvert Removal	LF	100	$70.00	$7,000.00
48" Roadway Culvert	LF	200	$165.00	$33,000.00
48" Flared End Section	EA	2	$1,500.00	$3,000.00
Rock Riprap and Fabric	Tons	200	$45.00	$9,000.00
			SUBTOTAL	**$52,000.00**

Total Construction	**$1,934,555.00**
Contingencies, Engineering and Administration @ 40%	**$773,822.00**
Total Estimated Construction Costs	**$2,708,377.00**
Land Cost for:	
Large WAPA Detention Pond - 186,000 SF @ $1/SF	**$186,000.00**
Miriam Avenue Storage - 69,700 SF LS	**$32,000.00**
Land Costs Subtotal	**$218,000.00**

TOTAL PROJECT COST $2,926,377.00

Appendix C
Landowner Comments

Property Owner's Comments Regarding
"Mr. B's Estate Watershed Draft Storm Water Master Plan Update"

Presented by: Mr. Chuck Huber Representing Real Properties LLC (Owner of Mr. B's Mobile Home Park and Adjacent Property - see attached drawing for ownership tract)

Date: October 12, 2009

The following comments are divided into two categories 1.) assessment and 2.) technical.

Assessment Questions & Comments:

- We realize that the masterplan does not address how the costs will be assessed, but how costs will be spread will influence which alternative we will support and which alternatives we will oppose.

- Our comments are based on the fact that the majority of our client's property is already developed with channels, culverts and overland flow that work well for their property and; therefore, our client has no need for additional storm water improvements across their property. The improvements to Century Avenue and Centennial Road (which is a city wide benefit) plus the development of upstream property, is what is causing the proposed improvements through their property.

- We understand that our client has a responsibility for participating in storm sewer improvement costs downstream of their property and they are willing to pay their prorated cost based on square footage for those improvements that do not directly benefit a downstream property owner.

- We oppose any alternative that includes our client being assessed for any improvements upstream of their property.

- We oppose any unfair distribution of assessments for storm sewer improvements on Century Avenue and Centennial Road. Currently, the ditches and culverts on Century Avenue and Centennial Road provide sufficient control of storm water. Century Avenue and Centennial Road are being improved to service a larger area than the adjacent property owners. Assessments need to follow benefit.

- We oppose being assessed for any improvements within or around Mr. B's property, with the exception of the proposed WAPA pond and outfall structure. We understand that runoff from our client's property will be a part of that structure, which is necessary to control runoff through the Interstate's 60" culvert.

- In lieu of receiving payment for easement or purchase of property, our client would prefer to receive a credit against their share of downstream assessments.

- How can our client be assured of the method for assessment distribution. Can all of the upstream storm sewer improvements be separated into its own project so that it will be easier to define benefit?

Technical Comments & Questions:

- Page 13 of 34 indicates that "the existing infrastructure handles the modeled events and . . . .". Not only does the existing infrastructure through Mr. B's property handle their development to date, but their infrastructure is currently handling some upstream developed property runoff as well.

- We do not want to accept any additional upstream flow in our current infrastructure than we currently have, plus we would prefer to have the surface flow on to our client's property limited to pre-development upstream flow.

- We have approximately 15 acres of undeveloped property between Mr. B's mobile home park and Century Avenue and Centennial Road. We want to preserve any existing capacity in our client's infrastructure to handle future runoff from our client's undeveloped property.

- We do not want to have our client's undeveloped property runoff included in the proposed 72" storm sewer (we do not want to contribute flow to the 72" pipe because we do not want to be assessed for it).

- We would prefer to construct our clients own storm sewer improvements to the proposed WAPA pond as and if needed.

- Our clients preference (if assessment issues are resolved) is Alternate U-1. Alternate U-2 is not favored as it will require easements or land acquisition that will divide our client's property. A 72" encumbrance through our client's property will cost our client additional funds to work around the 6 foot pipe for water lines, sewer lines, road crossings, etc.

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MEMO

TO: Houston Engineering and Steve McCormick, Northern Improvement

FROM: Steve Hoetzer, PE and Scott Schneider, PE, CFM SS

SUBJECT: Questions/Answers
Mr. B's Watershed Study
UEI No. 08.30231

DATE: November 11, 2009

cc: Keith Demke, PE and Linda Oster, PE

The following questions were submitted to Ulteig at the October 16, 2009 meeting at Bismarck Public Works and have been addressed as follows:

- *It appears the Alternatives were evaluated on the basis of peak flows at the outfall, what happens at Divide Avenue on Hay Creek and why was this not considered?*

  The recommended alternative reduces the peak discharges from Mr. B's coulee just above Divide Avenue. The Hay Creek model provided to Ulteig was dated November 2004 and had not been updated to reflect major developments in the upper reaches of the watershed. Development examples include North 4th Street, Carufels, Boulder Ridge, etc. Updating the Hay Creek hydrology model with these major developments was beyond the scope of this study. However after the recommended alternative is accepted, it will be incorporated into the current Hay Creek model to analyze any impacts at Divide Avenue.

- *Why was the Channel Drive Crossing left out of the selected alternative, since it is a proposed facility for platting and construction?*

  The proposed water management feature upstream of I-94 greatly reduces the need for detention downstream of I-94. Miriam Avenue detention does provide sufficient detention to meet the design parameter set in the study.

- *Would not Channel Drive further decrease peak flows and offset the impacts already created by existing development?*

  The need to meet the flow target at the I-94 crossing greatly reduced the need for regulation downstream. If the objective of this project were to reduce peak flows in the main channel of Hay Creek, Channel Drive may be able to do this

to a small degree. Timing would be a critical factor in reducing flows on Hay Creek.

- *If Channel Drive is constructed is the City going to purchase the upstream properties as they would be utilized to further control and reduce peak stormwater flows?*

  The City of Bismarck's policy is to purchase land for regional facilities in the past. But as Channel Drive is not required for regional storm water management, this would not be a cost of the regional storm water system.

- *What culverts and/or storm sewer are required under the proposed master plan for Channel Drive?*

  Channel Drive was not an element of the preferred alternative, U-2 because it is not required for regional storm-water management. In the McCormick Alternative submitted by Houston Engineering, the culvert was a 48" RCP.

- *In the preferred alternative if Channel Drive is unnecessary will is the City willing to sign off on it not needing to be constructed for access?*

  This is a transportation and planning policy decision for the City of Bismarck and is not within the scope of this study.

- *Were the costs included for the Miriam Avenue Crossing based on stormwater needs, roadway needs or both?*

  Costs for the Miriam Avenue Crossing were included in the cost estimates for all of the alternatives. Only the costs to meet stormwater management needs were included. It was assumed that the existing 48" RCP at Miriam Avenue was removed and a new pipe installed. A percentage of the earthwork will be included for the roadway embankment depending on the detention provided by Miriam Avenue.

- *Given the Miriam Avenue Crossing is a 48" RCP and the plan calls for a 48" RCP is there a need to change, modify or upgrade the current installation and how was this included in the project costs?*

  It was assumed that the existing 48" RCP would be removed and replaced.

- *If the existing 48" RCP under Miriam Avenue Crossing remains part of the storm water management plan for the watershed will the developer receive a special assessment credit or compensation for what has already been installed or existing materials?*

  This is a policy decision for the City of Bismarck. The current plan calls for replacing the existing culvert at Miriam Avenue.

- *Please explain the distribution of cost for stormwater runoff control as the facilities south of Interstate #94 are related more to the control and conveyance of runoff from upstream, rather than from properties south of the interstate.*

  The City policy has been that the cost of storm water management projects be distributed equally across the watershed. This is a policy issue for the City of Bismarck and outside the scope of this report.

- *Is there a value to trading off a portion of the 18 ac-feet storage, north of Interstate #94 storage, for the 8.1 acre-feet Channel Drive?*

  The storage north of Interstate 94 is required to ensure that the design capacity of the 60" RCP culvert through I-94 is not exceeded and the ditch block in the I-94 right of way to the west is not overtopped. Therefore, the detention storage at Channel Drive cannot be exchanged for storage upstream of I-94.

- *What are the property boundaries for the purchase of Miriam Avenue property, and is there a map you could provide?*

  Exact property boundaries will be determined after this project moves in the design phase and a more detailed design is developed.

- *What was the basis of the price to be paid for the properties? Is a copy of the appraisal available for review?*

  See attached "Preliminary Cost Estimates" for the detention pond area in the report. This is not an appraisal, rather, a preliminary estimate of costs, similar to highway projects.

  There was additional discussion about the price included for the Miriam Avenue detention storage area in the McCormick Alternative versus Alternatives U1 and U2. In the McCormick Alternative opinion of cost, the entire parcel as laid out in the submitted document by Houston Engineering is proposed to be purchased at the recommended "Preliminary Cost Estimate" price. There is a typo on page 2 of 2 for the McCormick Alternative Opinion of Cost; the Miriam Avenue Detention should have been 177,900 SF @ LS, not

70,200 LS. For Alternatives U1 and U2, only the flood pool (Elev 1708 and below) is proposed to be purchased.

- *When would the City be in a position to purchase these properties, and would it require a plat or could they just purchase a specified parcel?*

  This is a City of Bismarck policy issue and not part of the study.

  Additional Comment/Question:
  During the meeting a question was asked that if moving the MDU Power Line was included in the McCormick Alternative opinion of costs, why was it not included in Alternatives U1 and U2 because the embankment height is the same at 1714.5. The reason is that the water surface elevation for U1 and U2 behind the Miriam Avenue embankment is approximately 1706.0. After adding two feet of free-board, the required embankment height for storm-water management is 1708.0. This results in adequate clearance to the MDU Transmission Line. Raising the embankment up to 1714.5 is roadway grade issue.