

**Red Dale Drainage Basin Design Plan Amendment  
DR05-1452 / CIP 50025**

**Element 103**

Conveyance Element 103 is an **existing 54" RCP** in Canyon Lake Drive.

**Location:** Element 103 is an existing 54" RCP element that extends from Element 5006 to Element 5008. This element is in a portion of Canyon Lake Drive from Dale Drive to Red Dale Drive.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	4.5
<i>Depth (ft)</i>	4.5
<i>Length (ft)</i>	74
<i>Slope (ft/ft)</i>	0.001
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	63
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	187
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	189
<i>Q<sub>2,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, OVFL</sub> (cfs)</i>	14
<i>Q<sub>100,DBDP, OVFL</sub> (cfs)</i>	171
<i>Overflow Channel</i>	Street Flow
<b><i>Street Q<sub>100</sub> Depth (ft)</i></b>	0.92*
<b><i>Street V<sub>100</sub> (fps)</i></b>	3.58*

**Required Improvements:** The primary purpose is to collect flows from Red Dale Drive; however, the existing 54" RCP is not large enough to allow compliance with the 100-year street flow depths on Canyon Lake Drive set by the RCIDCM. The 100-year event produces 360 cfs at a depth of 1.6-feet. A proposed parallel storm sewer is to be constructed reducing the flow depths to 0.92 ft in the street, which complies with the allowed depth. The proposed system is called out by Conveyance Element 8046.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 105**

Conveyance Element 105 is an **existing 36" RCP** in Red Dale Drive.

**Location:** Element 105 is an existing 36" RCP element that extends from Element 5008 to Element 5010. This element is in a portion of Red Dale Drive from Canyon Lake Drive to West Saint Patrick Street.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	3
<i>Depth (ft)</i>	3
<i>Length (ft)</i>	1066
<i>Slope (ft/ft)</i>	0.024
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	59
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	188
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	246
<i>Q<sub>2,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>100,DBDP, OVFL</sub> (cfs)</i>	86
<i>Overflow Channel</i>	Street Flow
<b><i>Street Q<sub>100</sub> Depth (ft)</i></b>	0.73*
<b><i>Street V<sub>100</sub> (fps)</i></b>	6.69*

**Required Improvements:** The primary purpose is to collect flow from West Saint Patrick Street and northern end of Red Dale Drive. The existing 36" RCP produces 0.73 feet of street overflow during the 100-year storm event which complies with the RCIDCM. No improvements are necessary.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 107**

Conveyance Element 107 is an **existing 36" RCP** in West Saint Patrick Street.

**Location:** Element 107 is an existing 36" RCP element that extends from Element 5010 to Element 5012. This element is in a portion of West Saint Patrick Street from Hillsview Drive to Red Dale Drive.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	3
<i>Depth (ft)</i>	3
<i>Length (ft)</i>	200
<i>Slope (ft/ft)</i>	0.032
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	11
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	21
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	21
<i>Q<sub>2,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, OVFL</sub> (cfs)</i>	15
<i>Q<sub>100,DBDP, OVFL</sub> (cfs)</i>	42
<i>Overflow Channel</i>	Street Flow
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.54*
<i>Street V<sub>100</sub> (fps)</i>	5.05*

**Required Improvements:** The primary purpose is to collect flow from Hillsview Drive. The existing 36" RCP produces 0.54 feet of street overflow during the 100-year storm event which complies with the RCIDCM. No improvements are necessary.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 109**

Conveyance Element 109 is **existing street curb and gutter** on Hillsview Drive.

**Location:** Element 109 is an existing street (44<sup>th</sup> Street) element that extends from Element 5012 to Element 5014. This element is a portion of Hillsview Drive from West Saint Patrick Street to the crest of the hill.

**Modeled Element:**

<i>Type</i>	Street Flow
<i>Bottom Width/Diameter (ft)</i>	N/A
<i>Depth (ft)</i>	0.41
<i>Length (ft)</i>	764
<i>Slope (ft/ft)</i>	0.085
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.015
<i>Q<sub>2,DBDP, ELEM</sub> (cfs)</i>	7
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	25
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	44
<i>Overflow Channel</i>	N/A
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.55*
<i>Street V<sub>100</sub> (fps)</i>	5.15*

**Required Improvements:** The existing Hillsview Drive street conditions during the 100-year storm event produce a flow depth of 0.55 feet. The flow depth is less than the maximum allowed by the RCIDCM. No improvements are necessary.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 111**

Conveyance Element 111 is an **existing 36" RCP** in Red Dale Drive.

**Location:** Element 111 is an existing 36" RCP element that extends from Element 5010 to Element 5016. This element is in a portion of Red Dale Drive from West Saint Patrick Street to inlets approximately 60 feet north of the West Saint Patrick intersection.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	3
<i>Depth (ft)</i>	3
<i>Length (ft)</i>	126
<i>Slope (ft/ft)</i>	0.023
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	42
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	42
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	42
<i>Q<sub>2,DBDP, OVFL</sub> (cfs)</i>	6
<i>Q<sub>10,DBDP, OVFL</sub> (cfs)</i>	110
<i>Q<sub>100,DBDP, OVFL</sub> (cfs)</i>	227
<i>Overflow Channel</i>	Street Flow
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.96
<i>Street V<sub>100</sub> (fps)</i>	6.8

**Required Improvements:** The primary purpose is to collect flow from Subbasin 270. The existing 36" RCP produces 0.96 feet of street overflow during the 100-year storm event which complies with the RCIDCM. No improvements are necessary.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 113**

Conveyance Element 113 is an **existing 36" RCP** in Red Dale Drive.

**Location:** Element 113 is an existing 36" RCP element that extends from Element 5016 to Element 5018. This element is in a portion of Red Dale Drive 130 feet north of West Saint Patrick Street.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	3
<i>Depth (ft)</i>	3
<i>Length (ft)</i>	75
<i>Slope (ft/ft)</i>	0.05
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	30
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	48
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	48
<i>Q<sub>2,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, OVFL</sub> (cfs)</i>	36
<i>Q<sub>100,DBDP, OVFL</sub> (cfs)</i>	95
<i>Overflow Channel</i>	Street Flow
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.76*
<i>Street V<sub>100</sub> (fps)</i>	6.96*

**Required Improvements:** The primary purpose is to collect flow from Subbasin 268. The existing 36" RCP produces 0.76 feet of street overflow during the 100-year storm event which complies with the RCIDCM. No improvements are necessary.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 115**

Conveyance Element 115 is an **existing open channel** along Dale Drive.

**Location:** Element 115 is an existing open channel element that extends from Element 5006 to Element 5020. This element located north of Dale Drive extends from Canyon Lake Drive to the end of Dale Drive.

**Modeled Element:**

<i>Type</i>	Rectangular Channel
<i>Bottom Width/Diameter (ft)</i>	4
<i>Depth (ft)</i>	N/A
<i>Length (ft)</i>	474
<i>Slope (ft/ft)</i>	0.02
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.035
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	2
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	4
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	7
<i>Overflow Channel</i>	N/A
<i>Q<sub>100</sub> Depth (ft)</i>	0.28*
<i>V<sub>100</sub> (fps)</i>	6.31*

**Required Improvements:** The primary function is to convey flows collected in the Cedar Canyon Flood Control Channel. The existing rectangular channel is composed of a 4-foot wide grass bottom and vertical stone walls. No Improvements are necessary.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 117**

Conveyance Element 117 is an **existing natural open channel**.

**Location:** Element 117 is an existing natural open channel element that extends from Element 5020 to Element 5022. This element extends west of Dale Drive to Cedar Canyon Dam.

**Modeled Element:**

<i>Type</i>	Triangular Channel
<i>Bottom Width/Diameter (ft)</i>	N/A
<i>Depth (ft)</i>	N/A
<i>Length (ft)</i>	1257
<i>Slope (ft/ft)</i>	0.045
<i>Side Slopes (H:V)</i>	2
<i>Manning's n</i>	0.035
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	0
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	2
<i>Overflow Channel</i>	N/A
<i>Q<sub>100</sub> Depth (ft)</i>	0.39*
<i>V<sub>100</sub> (fps)</i>	6.56*

**Required Improvements:** No improvements are necessary. The existing channel conveys flow from the upstream Cedar Canyon Dam when overflow occurs.

\*Values determined using computer program Bentley FLOWMASTER.



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**Element 119**

Conveyance Element 119 is a **proposed 36” RCP** in 38<sup>th</sup> Street.

**Location:** Element 119 is a proposed 36” RCP element that extends from Element 6000 to Element 6002. This element is in a portion of 38<sup>th</sup> Street from Jackson Boulevard to Lakeview Drive.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	3
<i>Depth (ft)</i>	3
<i>Length (ft)</i>	192
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	35
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	76
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	100
<i>Q<sub>2,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>100,DBDP, OVFL</sub> (cfs)</i>	230
<i>Overflow Channel</i>	Street Flow
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.96*
<i>Street V<sub>100</sub> (fps)</i>	5.0*

**Required Improvements:** The existing street under 100-year conditions does not comply with the RCIDCM. The 100-year event produces 330 cfs at a depth of 1.6-feet. It is recommended that a 36” RCP be constructed to comply with the street overflow criteria. Using the 36” RCP produces a street overflow depth of 0.96 feet, which complies with the RCIDCM. It was determined that a flow of 100 cfs should be taken from the street. Based on street conditions approximately four (4) Type “E” inlets would be needed. The four Type “E” inlets were included in the cost estimate.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 121**

Conveyance Element 121 is a **proposed 24” RCP** in 38<sup>th</sup> Street.

**Location:** Element 121 is a proposed 24” RCP element that extends from Element 6002 to Element 6004. This element is in a portion of 38<sup>th</sup> Street from Lakeview Drive to Sunset Drive.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	2
<i>Depth (ft)</i>	2
<i>Length (ft)</i>	290
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	17
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	37
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	50
<i>Q<sub>2,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>100,DBDP, OVFL</sub> (cfs)</i>	216
<i>Overflow Channel</i>	Street Flow
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.93*
<i>Street V<sub>100</sub> (fps)</i>	7.0*

**Required Improvements:** The existing street under 100-year conditions does not comply with the RCIDCM. The 100-year storm event produces 266 cfs at a 1.55-foot flow depth. It is recommended that a 24” RCP be constructed to comply with the street overflow criteria. Using the 24” RCP produces a street overflow depth of 0.93 feet, which complies with the RCIDCM. It was determined that a flow of 50 cfs should be taken from the street. Based on street conditions approximately four (4) Type “E” inlets would be needed. The four Type “E” inlets were included in the cost estimate.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 123**

Conveyance Element 123 is **existing street curb and gutter** on Sunset Drive.

**Location:** Element 123 is an existing street element that extends from Element 6004 to Element 6006. This element is a portion of Sunset Drive from 38<sup>th</sup> Street to Elmhurst Drive.

**Modeled Element:**

<i>Type</i>	Street Flow
<i>Bottom Width/Diameter (ft)</i>	N/A
<i>Depth (ft)</i>	0.76*
<i>Length (ft)</i>	375
<i>Slope (ft/ft)</i>	0.018
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.015
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	14
<i>Q<sub>10,DBDP,ELEM</sub> (cfs)</i>	30
<i>Q<sub>100,DBDP,ELEM</sub> (cfs)</i>	95
<i>Overflow Channel</i>	N/A
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.76*
<i>Street V<sub>100</sub> (fps)</i>	6.96*

**Required Improvements:** The existing street conditions during the 100-year storm event produce a flow depth of 0.76 feet. The flow depth is less than what is allowed by the RCIDCM. No improvements are necessary.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 131**

Conveyance Element 131 is existing street curb and gutter on Sunset Drive.

**Location:** Element 131 is an existing street element that extends from Element 6006 to Element 6014. This element is a portion of Sunset Drive from Elmhurst Drive to approximately 600-feet east of Canyon Lake Drive intersection.

**Modeled Element:**

<i>Type</i>	Street Flow
<i>Bottom Width/Diameter (ft)</i>	N/A
<i>Depth (ft)</i>	0.65*
<i>Length (ft)</i>	738
<i>Slope (ft/ft)</i>	0.018
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.015
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	6
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	12
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	67
<i>Overflow Channel</i>	N/A
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.65*
<i>Street V<sub>100</sub> (fps)</i>	6.07*

**Required Improvements:** The existing street conditions during the 100-year storm event produce a flow depth of 0.65 feet. The flow depth is less than what is allowed by the RCIDCM. No improvements are necessary.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 135**

Conveyance Element 135 is existing street curb and gutter on Lakeview Drive.

**Location:** Element 135 is a street element that extends from Element 6002 to Element 6018. This element is a portion of Lakeview Drive from 38<sup>th</sup> Street extending approximately 525-feet west.

**Modeled Element:**

<i>Type</i>	Street Flow
<i>Bottom Width/Diameter (ft)</i>	N/A
<i>Depth (ft)</i>	0.56*
<i>Length (ft)</i>	525
<i>Slope (ft/ft)</i>	0.012
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.015
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	13
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	27
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	45
<i>Overflow Channel</i>	N/A
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.56*
<i>Street V<sub>100</sub> (fps)</i>	5.19*

**Required Improvements:** The existing street conditions during the 100-year storm event produce a flow depth of 0.56 feet. The flow depth is less than what is allowed by the RCIDCM. No improvements are necessary.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 137**

Conveyance Element 137 is **existing street curb and gutter** on Lakeview Drive.

**Location:** Element 137 is an existing street element that extends from Element 6018 to Element 6020. This element is a portion of Lakeview Drive midway between 38<sup>th</sup> Street and Canyon Lake Drive.

**Modeled Element:**

<i>Type</i>	Street Flow
<i>Bottom Width/Diameter (ft)</i>	N/A
<i>Depth (ft)</i>	0.47*
<i>Length (ft)</i>	439
<i>Slope (ft/ft)</i>	0.011
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.015
<i>Q<sub>2,DBDP, ELEM</sub> (cfs)</i>	8
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	18
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	29
<i>Overflow Channel</i>	N/A
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.47*
<i>Street V<sub>100</sub> (fps)</i>	4.37*

**Required Improvements:** The existing street conditions during the 100-year storm event produce a flow depth of 0.47 feet. The flow depth is less than what is allowed by the RCIDCM. No improvements are necessary.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 139**

Conveyance Element 139 is an **existing 18” RCP** in Jackson Boulevard.

**Location:** Element 139 is an existing 18” RCP element that extends from Element 5024 to Element 5026. This element is in a portion of Jackson Boulevard approximately 180-feet west of 38<sup>th</sup> Street.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	1.5
<i>Depth (ft)</i>	1.5
<i>Length (ft)</i>	428
<i>Slope (ft/ft)</i>	0.01
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	12
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	12
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	12
<i>Q<sub>2,DBDP, OVFL</sub> (cfs)</i>	2
<i>Q<sub>10,DBDP, OVFL</sub> (cfs)</i>	16
<i>Q<sub>100,DBDP, OVFL</sub> (cfs)</i>	33
<i>Overflow Channel</i>	Street Flow
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.49*
<i>Street V<sub>100</sub> (fps)</i>	4.6*

**Required Improvements:** The primary purpose is collecting flow from Jackson Boulevard directing it to Meadowbrook Golf Course. The existing 18” RCP has a maximum capacity of 12-cfs under the existing conditions which results in a 33 cfs street overflow. The depth of flow for the 100-year conditions is 0.49 feet, which complies with the RCIDCM. No improvements are necessary.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 141**

Conveyance Element 141 is **existing street curb and gutter** on Jackson Boulevard.

**Location:** Element 141 is an existing street element that extends from Element 5030 to Element 5032. This element is a portion of Jackson Boulevard from half way between 6<sup>th</sup> and 7<sup>th</sup> Avenues to 5<sup>th</sup> Avenue.

**Modeled Element:**

<i>Type</i>	Street Flow
<i>Bottom Width/Diameter (ft)</i>	N/A
<i>Depth (ft)</i>	0.42*
<i>Length (ft)</i>	529
<i>Slope (ft/ft)</i>	0.003
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.015
<i>Q<sub>2,DBDP, ELEM</sub> (cfs)</i>	6
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	12
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	20
<i>Overflow Channel</i>	N/A
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.42*
<i>Street V<sub>100</sub> (fps)</i>	3.78*

**Required Improvements:** The primary purpose is to collect flows from Jackson Boulevard and discharge into Rapid Creek. The existing street conditions during the 100-year storm event produce a flow depth of 0.42 feet. The flow depth is less than what is allowed by the RCIDCM. No improvements are necessary.

\*Values determined using computer program Bentley FLOWMASTER.



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**Element 143**

Conveyance Element 143 is an **existing open channel** downstream of Cedar Canyon Dam.

**Location:** Element 143 is an existing open channel element that extends from Element 5002 to Cedar Canyon Dam.

**Modeled Element:**

<i>Type</i>	Triangular Channel
<i>Bottom Width/Diameter (ft)</i>	N/A
<i>Depth (ft)</i>	N/A
<i>Length (ft)</i>	1372
<i>Slope (ft/ft)</i>	0.055
<i>Side Slopes (H:V)</i>	2
<i>Manning's n</i>	0.035
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	0
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	2
<i>Overflow Channel</i>	N/A
<i>Q<sub>100</sub> Depth (ft)</i>	0.38*
<i>V<sub>100</sub> (fps)</i>	7.46*

**Required Improvements:** No improvements are necessary. The existing channel conveys flow from the upstream Cedar Canyon Dam when overflow occurs. The existing condition model estimates only 2.0 cfs discharges during a 100-year event, which can be handled by the existing natural drainage.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 147**

Conveyance Element 147 is an **existing triple 36” RCP** beneath Fremont Apartments.

**Location:** Element 147 is an existing triple 36” RCP element that extends from Element 7 to Element 1008. This element extends from a private pond south west of the intersection Evergreen Drive and West Saint Patrick Street to Fremont Street.

**Modeled Element:**

<i>Type</i>	<i>Pipe Flow</i>
<i>Bottom Width/Diameter (ft)</i>	4.5
<i>Depth (ft)</i>	4.5
<i>Length (ft)</i>	250
<i>Slope (ft/ft)</i>	0.021
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	12
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	28
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	162
<i>Overflow Channel</i>	N/A

**Required Improvements:** The primary purpose is to collect flows from Fremont Street and the overflow channel to the west and convey the flow under Fremont Apartments discharging into the private pond. The existing triple 36” RCPs were modeled as one 54” RCP. The modeled element contained no diversion flow. No improvements are necessary.

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**Element 8000**

Conveyance Element 8000 is a **proposed double 10' x 4' Box Culvert** east of Cottonwood Street dead end.

**Location:** Element 8000 is a proposed double 10' x 4' Box Culvert element that extends from Element 2000 to Element 7000. This element is an outlet structure east of Cottonwood Street and extends west to Rapid Creek.

**Modeled Element:**

<i>Type</i>	Double 10' x 4' Box Culvert
<i>Bottom Width/Diameter (ft)</i>	20
<i>Depth (ft)</i>	4
<i>Length (ft)</i>	367
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	223
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	587
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	882
<i>Q<sub>2,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>100,DBDP, OVFL</sub> (cfs)</i>	0
<i>Overflow Channel</i>	N/A

**Required Improvements:** The primary purpose is to discharge flow collected from the existing private pond east of Evergreen, the existing Dover Street Drainage Channel, and flow collected off Canyon Lake Drive, Minnekahta Drive and Cottonwood Street. The proposed double 10-foot by 4-foot box culvert will exit into a designed hydraulic jump or drop structure to dissipate the energy. The flow will then be discharged into the proposed Heartland Court Detention. See conceptual plans for details.

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**Element 8002**

Conveyance Element 8002 is a **proposed double 10' x 4' Box Culvert** in Cottonwood Street.

**Location:** Element 8002 is a proposed double 10' x 4' Box Culvert element that extends from Element 7000 to Element 7002. This Element is in a portion of Cottonwood Street from the dead end on the east to 9<sup>th</sup> Avenue.

**Modeled Element:**

<i>Type</i>	Double 10' x 4' Box Culvert
<i>Bottom Width/Diameter (ft)</i>	20
<i>Depth (ft)</i>	4
<i>Length (ft)</i>	350
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	219
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	579
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	750
<i>Q<sub>2,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>100,DBDP, OVFL</sub> (cfs)</i>	114
<b><i>Street Q100 Depth (ft)</i></b>	0.83*
<b><i>Street V100 (fps)</i></b>	7.46*
<i>Overflow Channel</i>	Street Flow

**Required Improvements:** The proposed double 10-foot by 4-foot box culvert will be constructed and will carry 750 cfs. Cottonwood Street will carry the overflow. For this stretch of Cottonwood no inlets will be used. The street will contain a flow depth of 0.83 feet which complies with the RCIDCM. It is recommended that the street be reconstructed to contain the overflow between the curb and gutter. See conceptual plans for Details.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 8004**

Conveyance Element 8004 is a **proposed double 10' x 4' Box Culvert** in Cottonwood Street.

**Location:** Element 8004 is a proposed double 10' x 4' Box Culvert element that extends from Element 7002 to Element 7004. This element is in a portion of Cottonwood Street from 9<sup>th</sup> Avenue to Evergreen Drive.

**Modeled Element:**

<i>Type</i>	Double 10' x 4' Box Culvert
<i>Bottom Width/Diameter (ft)</i>	20
<i>Depth (ft)</i>	4
<i>Length (ft)</i>	388
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	215
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	570
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	750
<i>Q<sub>2,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>100,DBDP, OVFL</sub> (cfs)</i>	95
<b><i>Street Q100 Depth (ft)</i></b>	0.58*
<b><i>Street V100 (fps)</i></b>	6.69*
<i>Overflow Channel</i>	Street Flow

**Required Improvements:** The primary purpose is to collect flows from the proposed 9-foot by 4-foot box culvert from Evergreen Drive and the proposed storm sewer in Cottonwood Street from the west. The proposed double 10-foot by 4-foot box culvert will be constructed and will carry 750-cfs. Cottonwood Street will carry the overflow. For this stretch of Cottonwood no inlets will be used. The street will contain a flow depth of 0.58 feet which complies with the RCIDCM. It is recommended that the street be reconstructed to contain the overflow between the curb and gutter.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 8006**

Conveyance Element 8006 is a **proposed 42” RCP** in Schamber Street.

**Location:** Element 8006 is a proposed 42” RCP element that extends from Element 7004 to Element 7006. This element is in a portion of Schamber Street from Fremont Street to Evergreen Drive.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	3.5
<i>Depth (ft)</i>	3.5
<i>Length (ft)</i>	698
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP, ELEM</sub> (cfs)</i>	14
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	31
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	50
<i>Overflow Channel</i>	Street Flow

**Required Improvements:** The primary purpose is to collect flow from Twin Elm Drive and Schamber Street. The existing conditions allow flow to discharge north on Fremont Street. Collecting flow eliminates street flow issues received from the questionnaire responses. The proposed 42” RCP is to be constructed to capture flow from Conveyance Elements 29 and 31. To comply with the RCIDCM an estimated two (2) Type “E” inlets would be needed. The two inlets are included in the element cost estimate.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 8008**

Conveyance Element 8008 is a **proposed 72” RCP** in Cottonwood Street.

**Location:** Element 8008 is a proposed arched pipe, 72” equivalent RCP element that extends from Element 7004 to Element 7008. This element is in a portion of Cottonwood from Evergreen Drive to Fremont Street.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	6
<i>Depth (ft)</i>	6
<i>Length (ft)</i>	786
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	92
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	215
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	293
<i>Q<sub>2,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>100,DBDP, OVFL</sub> (cfs)</i>	35
<i>Overflow Channel</i>	Street Flow
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.50*
<i>Street V<sub>100</sub> (fps)</i>	4.7*

**Required Improvements:** The primary purpose is to collect flow from Cottonwood Street and the upstream elements carrying flow from Canyon Lake Drive. The proposed 72” RCP will carry 293 cfs and will produce street overflow. The 100-year conditions results in a 0.50 feet of street flow, complying with the RCIDCM. It is recommended that street improvements be made to maintain a level of flow equal to the top back of curb elevation. Inlets will be constructed for this stretch of Cottonwood Street. To collect enough street flow in the proposed 72” RCP and to comply with RCIDCM it is approximated based on street conditions that ten (10) Type “E” inlets would be needed along the stretch. Inlets are included in cost estimate.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 8010**

Conveyance Element 8010 is an **existing open channel** along Dover Street.

**Location:** Element 8010 is an existing open channel element that extends from Element 7012 to Element 7010. This element is a portion of Dover Street Drainage Channel north of Dover Street across from Sun Valley Drive.

**Modeled Element:**

<i>Type</i>	Trapezoidal Channel
<i>Bottom Width/Diameter (ft)</i>	3
<i>Depth (ft)</i>	N/A
<i>Length (ft)</i>	225
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	1.5
<i>Manning's n</i>	0.035
<i>Q<sub>2,DBDP, ELEM</sub> (cfs)</i>	6
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	12
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	101
<i>Overflow Channel</i>	N/A
<i>Q<sub>100</sub> Depth (ft)</i>	2.08*
<i>V<sub>100</sub> (fps)</i>	7.96*

**Required Improvements:** The existing trapezoidal open channel consists of a 3-foot base and 1.5H:1V side slopes. The open channel is consisted of grass side slopes and base. The channel is in good condition and requires no improvements. However, there are several small crossings that should be improved.

\*Values determined using computer program Bentley FLOWMASTER.



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**Element 8012**

Conveyance Element 8012 is a **proposed 42” RCP** in Sun Valley Drive. *This facility is unnecessary if the Dover Street Channel water quality improvements discussed in Section 6.1 of this study are completed.*

**Location:** Element 8012 is a proposed 42” RCP in Sun Valley Drive that extends from the existing open channel along Dover Street to the proposed Hartland Court Stormwater Quality Facility.

**Modeled Element:**

Type	Pipe Flow
Bottom Width/Diameter (ft)	3.5
Depth (ft)	3.5
Length (ft)	806
Slope (ft/ft)	0.005
Side Slopes (H:V)	N/A
Manning's n	0.013
$Q_{2,DBDP,ELEM}$ (cfs)	19
$Q_{10,DBDP,ELEM}$ (cfs)	38
$Q_{100,DBDP,ELEM}$ (cfs)	71
Overflow Channel	N/A

**Required Improvements:** The proposed 42” RCP will collect all remaining flow from the existing channel. A drainage easement should be pursued for the south end of Sun Valley Drive. If the easement is not acquired, the proposed 42” RCP cannot be constructed. The existing Dover Street channel can handle the flow but the 42” line is preferred to help eliminate problems such as mosquito breeding areas and the stench pointed out by the questionnaire responses. Inlets are recommended to collect street flow off Sun Valley Drive; however the street flow does not violate the RCIDCM and therefore not needed. If it was decided to collect flow, an estimated two (2) Type “E” inlets would be needed. The inlets are included in the cost estimate.

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**Element 8014**

Conveyance Element 8014 is a **proposed 9-foot by 4-foot box culvert** in Evergreen Drive.

**Location:** Element 8014 is a proposed 9-foot by 4-foot box culvert element that extends from Element 7004 to Element 7014. This element is in a portion of Evergreen Drive from Cottonwood Street to West Saint Patrick Street.

**Modeled Element:**

<i>Type</i>	<i>Pipe Flow</i>
<i>Bottom Width/Diameter (ft)</i>	6
<i>Depth (ft)</i>	4.3
<i>Length (ft)</i>	452
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	106
<i>Q<sub>10,DBDP,ELEM</sub> (cfs)</i>	312
<i>Q<sub>100,DBDP,ELEM</sub> (cfs)</i>	442
<i>Overflow Channel</i>	N/A

**Required Improvements:** The primary purpose is to collect flow from the existing 48" RCP storm sewer, the existing private pond, and the proposed 60" RCP storm sewer from West Saint Patrick Street. The proposed 9-foot by 4-foot box culvert will be constructed to collect flows from conveyance elements 7, 37 and 8040. The proposed box culvert will capture all flows and direct them to the proposed double 10-foot by 4-foot box culvert. If diversion does occur, the existing Dover Street channel can handle 200 cfs.

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**Element 8016**

Conveyance Element 8016 is a **proposed 72” RCP** in Cottonwood Street.

**Location:** Element 8016 is a proposed 72” RCP element that extends from Element 7008 to Element 7016. This element is in a portion of Cottonwood Street from Fremont Street to 38<sup>th</sup> Street.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	6
<i>Depth (ft)</i>	6
<i>Length (ft)</i>	738
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	83
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	196
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	293
<i>Q<sub>2,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>100,DBDP, OVFL</sub> (cfs)</i>	158
<i>Overflow Channel</i>	Street Flow
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.72*
<i>Street V<sub>100</sub> (fps)</i>	7.34*

**Required Improvements:** The primary purpose is collecting flow from the existing rectangular channel to the north as well as Cottonwood Street Flow and upstream flow from Canyon Lake Drive. The proposed 72” RCP will carry 293 cfs and will produce street overflow. The 100-year conditions results in a 0.72 feet of street flow, complying with the RCIDCM. It is recommended that street improvements be made to maintain a level of flow equal to the top back of curb elevation. Inlets will be constructed for this stretch of Cottonwood Street to comply with the RCIDC manual. It is estimated that six (6) Type “E” inlets will be needed. The six inlets are included in the element cost estimate.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 8018**

Conveyance Element 8018 is a **proposed 60” RCP** in 38<sup>th</sup> Street.

**Location:** Element 8018 is a proposed 60” RCP element that extends from Element 7016 to Element 1014. This element is in a portion of 38<sup>th</sup> Street from Minnekahta Drive to the north approximately 520-feet.

**Modeled Element:**

<i>Type</i>	<i>Pipe Flow</i>
<i>Bottom Width/Diameter (ft)</i>	5
<i>Depth (ft)</i>	3.25
<i>Length (ft)</i>	529
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	67
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	121
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	137
<i>Overflow Channel</i>	N/A

**Required Improvements:** The primary purpose is to intercept flows from the existing rectangular channel to eliminate flow from the existing downstream 48” RCP. Redirecting the flow produces more capacity for the existing 48” RCP further downstream on West Saint Patrick Street. The proposed 60” RCP will capture all flow from the existing rectangular channel, Conveyance Element 15. The existing flow enters a 48” RCP and is transferred to Element 1044. The existing 48” line will be abandoned.

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**Element 8020**

Conveyance Element 8020 is a **proposed 48" RCP** in Minnekahta Drive.

**Location:** Element 8020 is a proposed 48" RCP element that extends from Element 7016 to Element 7018. This element is in a portion of Minnekahta Drive from 38<sup>th</sup> Street to Elmhurst Drive.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	4
<i>Depth (ft)</i>	4
<i>Length (ft)</i>	422
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	13
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	69
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	100
<i>Q<sub>2,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>100,DBDP, OVFL</sub> (cfs)</i>	201
<i>Overflow Channel</i>	Street Flow
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.83*
<i>Street V<sub>100</sub> (fps)</i>	8.77*

**Required Improvements:** The proposed 48" RCP will be constructed to capture flow from Minnekahta Drive and upstream flows collected from Canyon Lake Drive. Inlets will be constructed along this stretch of road at intersections and where needed. The depth of street flow during 100-year conditions is 0.83, which complies with the RCIDCM.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 8022**

Conveyance Element 8022 is a **proposed 48” RCP** in Minnekahta Drive.

**Location:** Element 8022 is a proposed 48” RCP element that extends from Element 7018 to Element 7020. This element is in a portion of Minnekahta Drive from Elmhurst Drive to Monte Vista Drive.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	4
<i>Depth (ft)</i>	4
<i>Length (ft)</i>	325
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	9
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	61
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	100
<i>Q<sub>2,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>100,DBDP, OVFL</sub> (cfs)</i>	188
<i>Overflow Channel</i>	Street Flow
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.81*
<i>Street V<sub>100</sub> (fps)</i>	8.54*

**Required Improvements:** The proposed 48” RCP will be constructed to capture flow from Minnekahta Drive as well as upstream flow collected from Canyon Lake Drive. Inlets will be constructed along this stretch of road at intersections and where needed. The depth of street flow during 100-year conditions is 0.81, which complies with the RCIDCM. An estimated four (4) Type “E” inlets are needed to capture the street flow. The four inlets are included in the cost estimate.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 8024**

Conveyance Element 8024 is a **proposed 36” RCP** in Minnekahta Drive.

**Location:** Element 8024 is a proposed 36” RCP element that extends from Element 7020 to Element 7022. This element is in a portion of Minnekahta Drive from Monte Vista Drive to Forest Street.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	3
<i>Depth (ft)</i>	3
<i>Length (ft)</i>	417
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	6
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	34
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	50
<i>Q<sub>2,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>100,DBDP, OVFL</sub> (cfs)</i>	142
<i>Overflow Channel</i>	Street Flow
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.73*
<i>Street V<sub>100</sub> (fps)</i>	7.64*

**Required Improvements:** The proposed 36” RCP will be constructed to capture flow from Minnekahta Drive and the upstream flows collected from Canyon Lake Drive. Inlets will be constructed along this stretch of road at intersections and where needed. The depth of street flow during 100-year conditions is 0.73, which complies with the RCIDCM. An estimated six (6) Type “E” inlets are needed to capture the street flow. The six inlets are included in the cost estimate.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 8026**

Conveyance Element 8026 is a **proposed 36” RCP** in Minnekahta Drive.

**Location:** Element 8026 is a proposed 36” RCP element that extends from Element 7022 to Element 7024. This element is in a portion of Minnekahta Drive from Forest Street to Canyon Lake Drive.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	3
<i>Depth (ft)</i>	3
<i>Length (ft)</i>	483
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP,ELEM</sub> (cfs)</i>	12
<i>Q<sub>100,DBDP,ELEM</sub> (cfs)</i>	50
<i>Q<sub>2,DBDP,OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP,OVFL</sub> (cfs)</i>	0
<i>Q<sub>100,DBDP,OVFL</sub> (cfs)</i>	75
<i>Overflow Channel</i>	Street Flow
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.69*
<i>Street V<sub>100</sub> (fps)</i>	6.34*

**Required Improvements:** The proposed 36” RCP will be constructed to capture flow from Minnekahta Drive and the upstream flows collected from Canyon Lake Drive and Dale Drive. Inlets will be constructed along this stretch of road at intersections and where needed. The depth of street flow during 100-year conditions is 0.69, which complies with the RCIDCM. An estimated three (3) Type “E” inlets are needed to capture the street flow. The three inlets are included in the cost estimate.

\*Values determined using computer program Bentley FLOWMASTER.



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**Element 8030**

Conveyance Element 8030 is an **existing open channel**.

**Location:** Element 8030 is an existing open channel element that extends from Element 1010 to Element 7028. This element is an existing channel south of West Saint Patrick Street and west of Fremont Street.

**Modeled Element:**

<i>Type</i>	Trapezoidal Channel
<i>Bottom Width/Diameter (ft)</i>	1
<i>Depth (ft)</i>	N/A
<i>Length (ft)</i>	390
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	20
<i>Manning's n</i>	0.035
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	0
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	124
<i>Overflow Channel</i>	N/A
<i>Q<sub>100</sub> Depth (ft)</i>	1.54*
<i>V<sub>100</sub> (fps)</i>	2.54*

**Required Improvements:** The existing grass lined trapezoidal open channel serves as a diversion channel from Saint Patrick Street. Flows to the channel have been minimized by a proposed parallel storm sewer. No improvements are necessary.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 8034**

Conveyance Element 8034 is a **proposed 36” RCP** in 38<sup>th</sup> Street.

**Location:** Element 8034 is a proposed 36” RCP element that extends from Element 1054 to Element 7032. This element is in a portion of 38<sup>th</sup> Street from Clifton Street north to Debra Drive.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	3
<i>Depth (ft)</i>	3
<i>Length (ft)</i>	909
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	11
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	50
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	50
<i>Q<sub>2,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, OVFL</sub> (cfs)</i>	52
<i>Q<sub>100,DBDP, OVFL</sub> (cfs)</i>	160
<i>Overflow Channel</i>	Street Flow
<b><i>Street Q<sub>100</sub> Depth (ft)</i></b>	0.93*
<b><i>Street V<sub>100</sub> (fps)</i></b>	6.43*

**Required Improvements:** The existing Street overflow for the 100-year event is 210 cfs at a 1.8-foot depth. The proposed 36” RCP will be constructed to lower the street overflow depth. The flow is currently being diverted from Element 1050. Inlets will be constructed as needed and the resulting street overflow depth is 0.93. The depth is in compliance with the RCIDCM but it is recommended that street improvements are made to lower the depth of flow. An estimated five (5) Type “E” inlets are needed to capture the street flow. The five inlets are included in the cost estimate.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 8040**

Conveyance Element 8040 is a **proposed 60” RCP** in West Saint Patrick Street.

**Location:** Element 8040 is a proposed 60” RCP element that extends from Element 7014 to Element 7038. This element is in a portion of west Saint Patrick Street from Evergreen Drive to Canyon Lake Plaza Estates southern entrance.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	5
<i>Depth (ft)</i>	5
<i>Length (ft)</i>	1144
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	16
<i>Q<sub>10,DBDP,ELEM</sub> (cfs)</i>	130
<i>Q<sub>100,DBDP,ELEM</sub> (cfs)</i>	160
<i>Q<sub>2,DBDP,OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP,OVFL</sub> (cfs)</i>	0
<i>Q<sub>100,DBDP,OVFL</sub> (cfs)</i>	127
<i>Overflow Channel</i>	Street Flow
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.86*
<i>Street V<sub>100</sub> (fps)</i>	6.14*

**Required Improvements:** The proposed 60” RCP will be constructed in parallel with Conveyance Elements 37, 39 and 41. The existing conditions for Saint Patrick Street has street flow depths greater than what is allowed for 100-year storm conditions. Construction of the 60” RCP lowers the street flow depth to 0.86 feet, which complies with the RCIDCM. Inlets will be installed at intersections and where needed. It is recommended that street improvements occur under construction to lower the depth of flow in the street. An estimated four (4) Type “E” inlets are needed to capture the street flow. The four inlets are included in the cost estimate.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 8042**

Conveyance Element 8042 is a **proposed 54” RCP** in West Saint Patrick Street.

**Location:** Element 8042 is a proposed 54” RCP element that extends from Element 7038 to Element 7036. This element is in a portion of West Saint Patrick Street from the southern parking lot entrance for Canyon Lake Plaza Estates to 38<sup>th</sup> Street.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	4.5
<i>Depth (ft)</i>	4.5
<i>Length (ft)</i>	198
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	16
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	130
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	130
<i>Q<sub>2,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, OVFL</sub> (cfs)</i>	31
<i>Q<sub>100,DBDP, OVFL</sub> (cfs)</i>	194
<i>Overflow Channel</i>	Street Flow
<b><i>Street Q<sub>100</sub> Depth (ft)</i></b>	0.98*
<b><i>Street V<sub>100</sub> (fps)</i></b>	6.86*

**Required Improvements:** The proposed 54” RCP will be constructed in parallel with Conveyance Element 43. The existing conditions for Saint Patrick Street has street flow depths greater than what is allowed for 100-year storm conditions. Construction of the 54” RCP lowers the street flow depth to 0.98 feet, which complies with the RCIDCM. Inlets will be installed at intersections and where needed. It is recommended that street improvements occur under construction to lower the depth of flow in the street. An estimated two (2) Type “E” inlets are needed to capture the street flow. The two inlets are included in the cost estimate.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 8044**

Conveyance Element 8044 is a **proposed 48” RCP** in 38<sup>th</sup> Street.

**Location:** Element 8044 is a proposed 48” RCP element that extends from Element 7036 to Element 7034. This element is in a portion of 38<sup>th</sup> Street from West Saint Patrick Street to Canyon Lake Drive.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	4
<i>Depth (ft)</i>	4
<i>Length (ft)</i>	337
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	16
<i>Q<sub>10,DBDP, ELEM</sub> (cfs)</i>	100
<i>Q<sub>100,DBDP, ELEM</sub> (cfs)</i>	100
<i>Q<sub>2,DBDP, OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP, OVFL</sub> (cfs)</i>	61
<i>Q<sub>100,DBDP, OVFL</sub> (cfs)</i>	224
<i>Overflow Channel</i>	Street Flow
<b><i>Street Q<sub>100</sub> Depth (ft)</i></b>	0.96*
<b><i>Street V<sub>100</sub> (fps)</i></b>	7.26*

**Required Improvements:** The proposed 48” RCP will be constructed in parallel with Conveyance Element 45. The existing conditions for Saint Patrick Street has street flow depths greater than what is allowed for 100-year storm conditions. Construction of the 48” RCP lowers the street flow depth to 0.96 feet, which complies with the RCIDCM. Inlets will be installed at intersections and where needed. It is recommended that street improvements occur under construction to lower the depth of flow in the street. An estimated four (4) Type “E” inlets are needed to capture the street flow. The four inlets are included in the cost estimate.

\*Values determined using computer program Bentley FLOWMASTER.

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**Element 8046**

Conveyance Element 8046 is a **proposed 36” RCP** in Canyon Lake Drive.

**Location:** Element 8046 is a proposed 36” RCP element from Element 7040 to Element 7024. This element is in a portion of Canyon Lake Drive, crossing from Minnekahta Drive to Red Dale Drive.

**Modeled Element:**

<i>Type</i>	Pipe with Overflow
<i>Bottom Width/Diameter (ft)</i>	3
<i>Depth (ft)</i>	3
<i>Length (ft)</i>	430
<i>Slope (ft/ft)</i>	0.005
<i>Side Slopes (H:V)</i>	N/A
<i>Manning's n</i>	0.013
<i>Q<sub>2,DBDP,ELEM</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP,ELEM</sub> (cfs)</i>	13
<i>Q<sub>100,DBDP,ELEM</sub> (cfs)</i>	50
<i>Q<sub>2,DBDP,OVFL</sub> (cfs)</i>	0
<i>Q<sub>10,DBDP,OVFL</sub> (cfs)</i>	0
<i>Q<sub>100,DBDP,OVFL</sub> (cfs)</i>	121
<i>Overflow Channel</i>	Street Flow
<i>Street Q<sub>100</sub> Depth (ft)</i>	0.92*
<i>Street V<sub>100</sub> (fps)</i>	3.13*

**Required Improvements:** The proposed 36” RCP will be constructed in parallel with Conveyance Elements 101 and 103. The existing conditions for Canyon Lake Drive has street flow depths greater than what is allowed for 100-year storm conditions. Construction of the 36” RCP in conjunction with storm inlets lowers the street flow depth to 0.92 feet, which complies with the RCIDCM. Inlets will be installed at intersections and where needed. An estimated five (5) Type “E” inlets are needed to capture the street flow. The inlets are included in the cost estimate. Modifications to the existing 54" inlet at the Red Dale/Canyon Lake Drive intersection will also be required.

\*Values determined using computer program Bentley FLOWMASTER.

### **4.3 Direct Flow / Diversion Elements**

Direct flow (junctions) elements are used to model the confluence of flows at specified points within a model. Direct flow elements combine storm hydrographs by using time and flow ordinates from conveyance elements and/or subbasins. The resultant hydrograph is used as an input hydrograph for the next downstream element. Direct flow elements also serve as terminal elements for flow prediction at a basin outlet, in this case elements 1000, 2000, and 3000 all discharge into Rapid Creek.

Direct flow elements can also serve as Diversion elements. Diversion elements are used to better represent actual field conditions. For example an existing storm sewer may not have the capacity for a 100-year storm event and overflow occurs onto the street. The overflow or diversion flow can be addressed for compliance with the RCIDC.

Table 8 presents a summary of Diversion Elements. The table provides the 2-, 10-, and 100-year flows through each downstream element as well as the diverted flow.

Table 9 presents a summary of Direct/Diversion Elements. The table provides the contributing elements and subbasins as well as the outflow conveyance and/or diversion elements. It also summarizes the peak flows for the 2-, 10- and 100-year Design Plan flows for each element. A basic description is also given for each element.

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**Table 8. Diversion Elements Peak Flow Summary**

Element Number	DBDP Conditions					
	2 yr (cfs)		10 yr (cfs)		100 yr (cfs)	
	Diverted	Outflow	Diverted	Outflow	Diverted	Outflow
1002	0	41	15	71	111	71
1004	*	*	*	*	*	*
1014	0	68	0	121	0	137
1018	0	57	26	96	87	96
1020	0	19	0	34	0	38
1022	0	12	13	23	38	24
1024	0	4	18	4	50	4
1038	0	80	5	133	53	133
1040	0	76	0	129	0	169
1042	0	67	0	113	157	139
1044	0	60	0	100	45	230
1046	17	50	161	50	324	50
1048	13	28	27	28	39	28
1050	11	34	102	36	210	36
1052	0	3	0	14	11	15
1054	14	25	159	25	322	25
1064	0	31	14	50	53	50
2002	*	*	*	*	*	*
2004	*	*	*	*	*	*
2006	*	*	*	*	*	*
3002	0	14	0	28	12	33
3004	9	2	21	2	35	2
3006	0	9	5	14	29	14
4002	0	35	63	40	147	40
4004	0	18	39	21	89	21
4006	0	13	10	29	41	29
4008	0	13	23	15	52	15
4010	0	7	0	15	11	15
4012	0	4	0	9	0	15
4014	9	11	44	11	84	11
5002	0	74	0	213	47	249
5004	0	72		207		285
5006	0	68	9	189	143	189
5008	0	64	14	189	171	189



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**Table 8 (cont). Diversion Elements Peak Flow Summary**

Element Number	DBDP Conditions					
	2 yr (cfs)		10 yr (cfs)		100 yr (cfs)	
	Diverted	Outflow	Diverted	Outflow	Diverted	Outflow
5010	0	59	0	188	86	246
5012	0	11	15	21	42	21
5016	6	42	110	42	227	42
5018	0	30	36	48	95	48
5024	0	14	14	14	31	14
5026	2	12	16	12	33	12
5030	0	12	0	25	6	35
5034	0	4	0	9	0	14
6002	0	35	0	76	230	100
6004	0	17	0	38	216	50
6008	*	*	*	*	*	*
6016	*	*	*	*	*	*
7000	0	223	0	589	0	883
7002	0	219	0	580	114	750
7004	0	215	0	570	95	750
7006	0	15	0	31	0	51
7008	0	92	0	216	35	293
7012	0	19	0	38	63	71
7014	0	106	0	313	87	442
7016	0	83	0	197	158	293
7018	0	13	0	69	201	100
7020	0	9	0	62	188	100
7022	0	6	0	35	142	50
7024	0	0	0	13	75	50
7032	0	11	52	50	160	50
7034	0	17	61	100	224	100
7036	0	16	31	130	194	130
7038	0	16	0	130	127	160
7040	0	0	0	14	121	50

**TABLE 9. DIRECT FLOW / DIVERSION ELEMENTS**

Direct Flow Elements	Inflow Element(s) / and Subbasins	Outflow Element(s)	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>100</sub> (cfs)	Description	Diversion
1000	CE. 1, Sub. 166 Div. 1002	-	46	98	199	Outfall to Rapid Creek tributary channel	N
1002	CE. 63, Sub. 154, Sub. 156, Div. 7012	CE. 1, Div. 1000	41	86	182	Summing flows for input to downstream connection	Y
1008	CE. 9	CE. 147	12	28	162	Inlet of triple 36" RCP	N
1010	CE. 8030, Sub. 132, Sub. 134, Div. 7006	CE. 9	12	28	162	Summing flows for input to downstream connection	N
1014	CE. 15	CE. 8018, Div. 1032	68	121	137	Inlet of proposed 72" RCP	Y
1016	CE. 17, Sub. 178, Sub. 180	CE. 15	66	115	127	Summing flows for input to downstream connection	N
1018	CE. 15, CE. 19, Sub. 176	CE. 17, Div. 7020	57	122	183	Confluence of Elements 19 and 25	Y
1020	CE. 21, CE. 23, Sub. 174	CE. 19, Div. 7020	19	34	38	Confluence of Elements 21 and 23	Y
1022	Sub. 274	CE. 21, Div. 1024	12	36	62	Subbasin 274 outfall	Y
1024	Sub. 172, Div. 1022	CE. 23, Div. 7022	4	22	54	Subbasin 172 Outfall	Y
1026	Sub. 276	CE. 25	30	71	117	Subbasin 276 outfall	N
1030	Sub. 128	CE. 31	3	6	10	Subbasin 128 outfall	N
1032	Sub. 130, Div. 1014	CE. 29	4	9	14	Subbasin 130 outfall	N
1038	CE. 39, Sub. 146	CE. 37, Div. 7014	80	138	186	Summing flows for input to downstream connection	Y
1040	CE. 41, CE. 55, Sub. 136	CE. 39, Div. 1038	76	129	169	Summing flows for input to downstream connection	Y
1042	CE. 43, Sub. 184	CE. 41, Div. 7038	67	113	296	Summing flows for input to downstream connection	Y
1044	CE. 45, Div. 7036	CE. 43, Div. 1042	60	100	275	Summing flows for input to downstream connection	Y
1046	CE. 53, CE. 47, Div. 1054	CE. 45, Div. 7034	67	211	374	Summing flows for input to downstream connection	Y
1048	CE. 49, Sub. 286	CE. 47, Div. 1054	41	55	67	Summing flows for input to downstream connection	Y
1050	CE. 51, Sub. 282, Div. 1052	CE. 49, Div. 7032	45	138	246	Summing flows for input to downstream connection	Y
1052	Sub. 278	CE. 51, Div. 1050	3	14	26	Subbasin 278 outfall	Y
1054	CE. 8034, Sub. 284, Div. 1046, Div. Div. 7032	CE. 53, Div. 1046	39	184	347	Summing flows for input to downstream connection	Y
1056	Sub. 138	CE. 55	4	8	14	Subbasin 138 outfall	N
1060	Sub. 108, Sub. 170, Sub. 188	CE. 59	10	24	40	Subbasins 108, 170, and 188 outfall	N
1062	CE. 59, Sub. 168	-	14	32	53	Summing flows for input to downstream connection	N
1064	CE. 65, Sub. 148, Sub. 150	CE. 63, Div. 1002	31	64	103	Summing flows for input to downstream connection	Y
1066	CE. 67, Sub. 142, Sub. 144	CE. 65	18	37	59	Summing flows for input to downstream connection	N
1068	Sub. 140	CE. 67	4	9	15	Subbasin 140 outfall	N
2000	CE. 8000, CE. 8021, Sub. 100, Div. 7000	-	244	639	982	Summing flows for input to downstream connection	N
3000	CE. 75, CE. 79	-	22	41	46	Confluence for Elements 75 and 79	N
3002	CE. 77, Sub. 164, Div. 3004	CE. 75, Div. 3006	14	28	45	Summing flows for input to downstream connection	Y
3004	Sub. 158	CE. 77, Div. 3002	11	23	37	Subbasin 158 outfall	Y