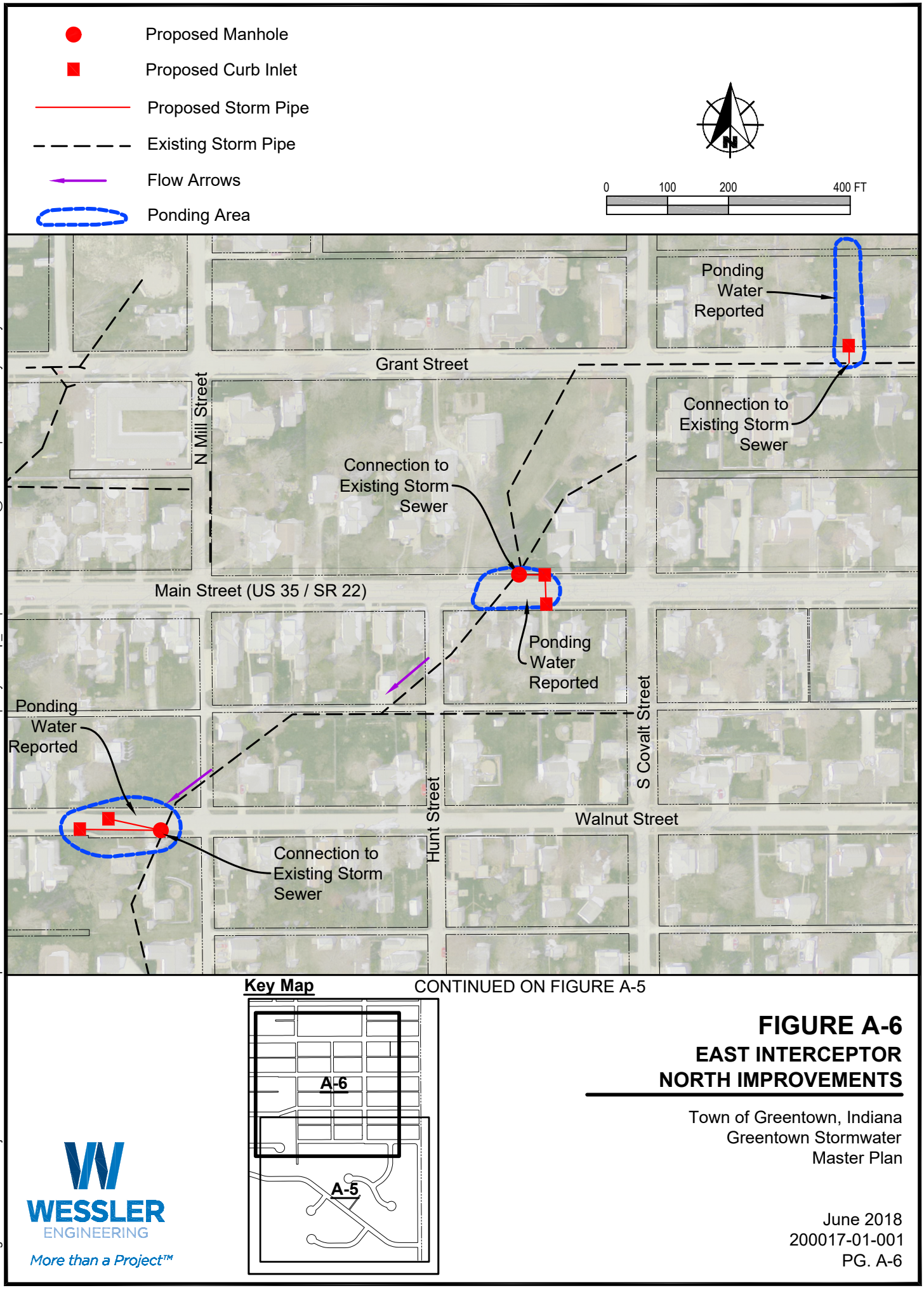

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Key Map

CONTINUED ON FIGURE A-5

WESSLER ENGINEERING
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FIGURE A-6
EAST INTERCEPTOR NORTH IMPROVEMENTS

Town of Greentown, Indiana
Greentown Stormwater Master Plan

June 2018
200017-01-001
PG. A-6

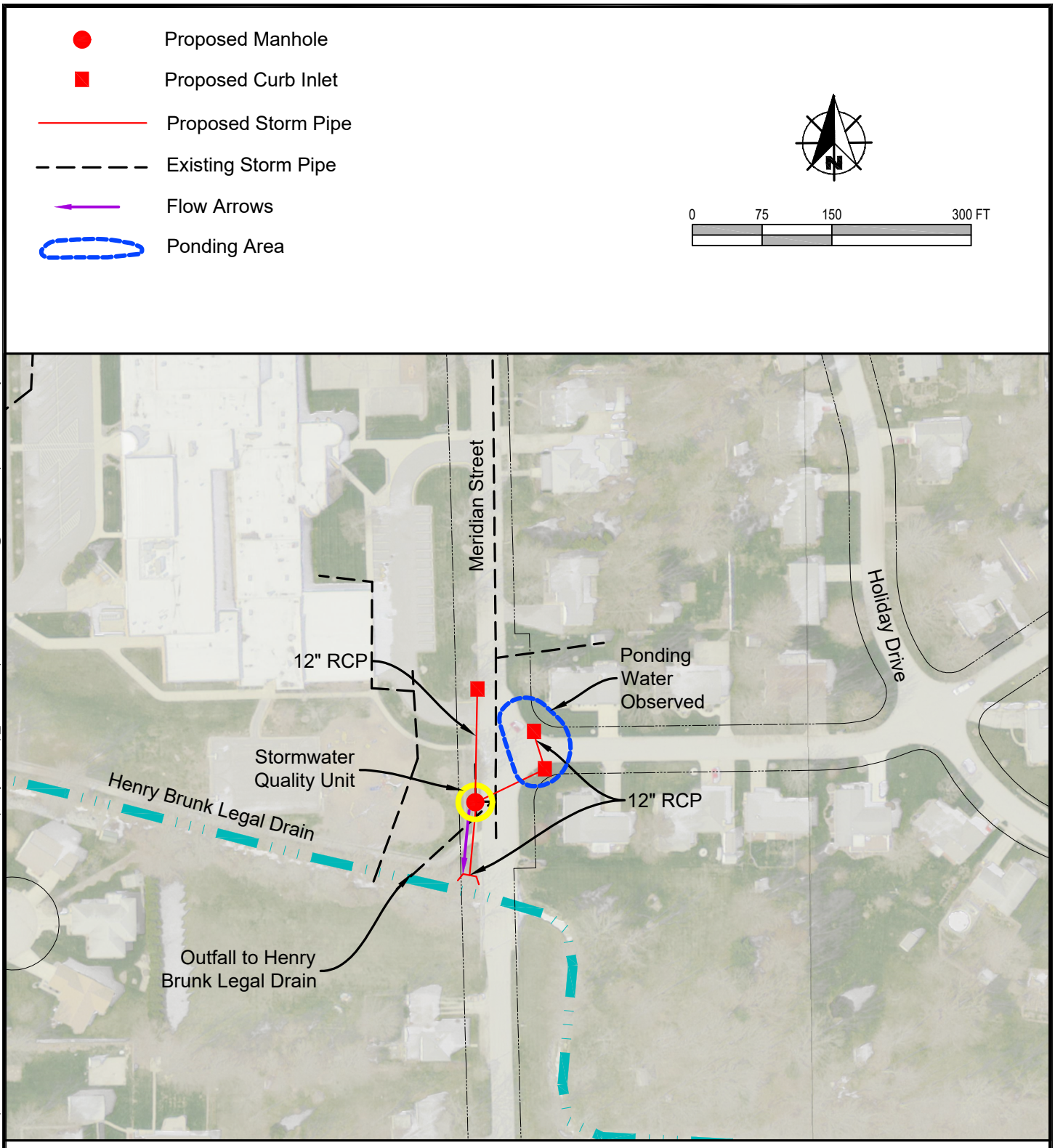

FIGURE A-7
MERIDIAN STREET IMPROVEMENTS

Town of Greentown, Indiana
Greentown Stormwater
Master Plan

WESSLER ENGINEERING
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June 2018
200017-01-001
PG. A-7

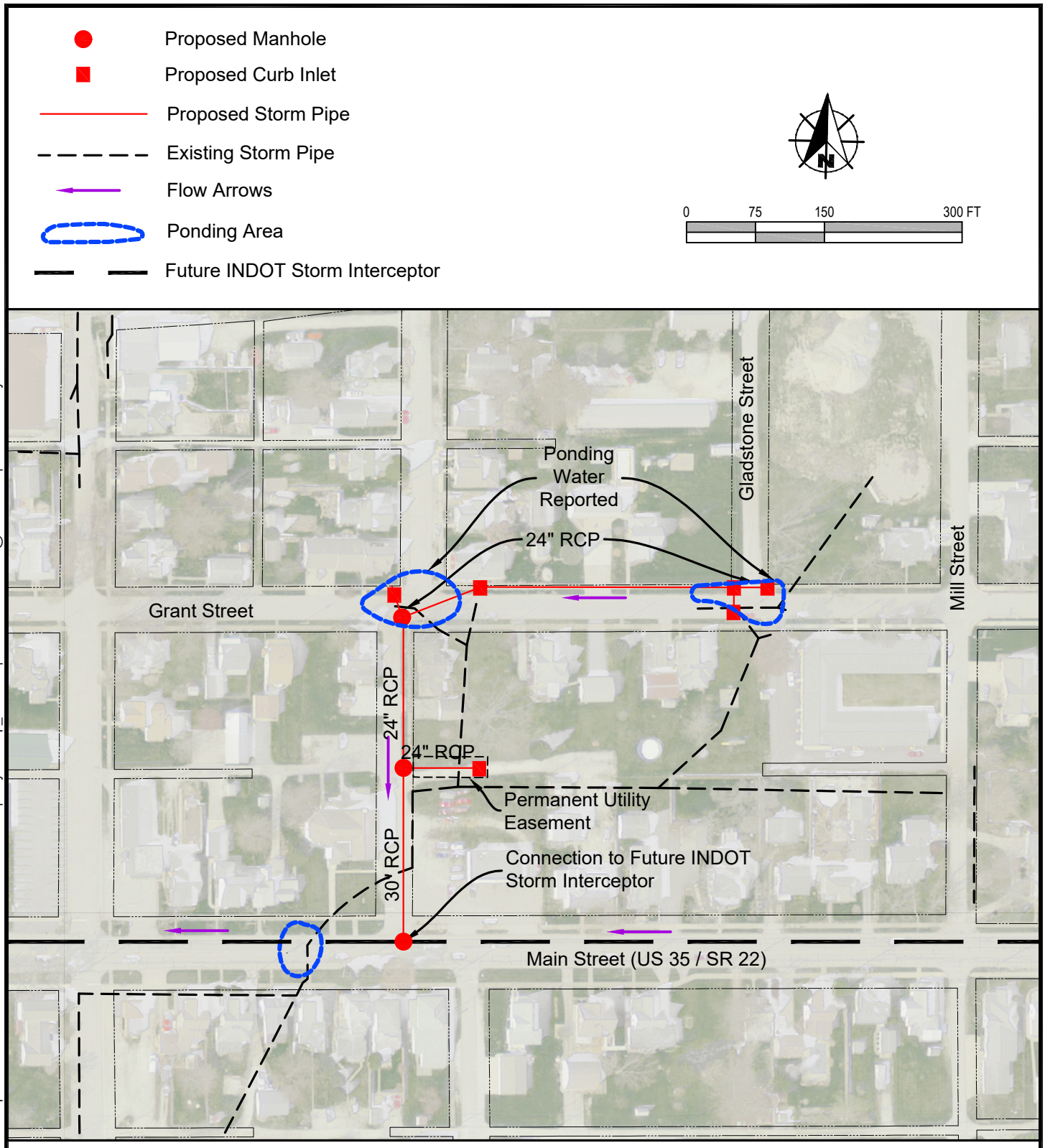

FIGURE A-8
INDIANA STREET IMPROVEMENTS

Town of Greentown, Indiana
Greentown Stormwater
Master Plan

WESSLER ENGINEERING
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June 2018
200017-01-001
PG. A-8

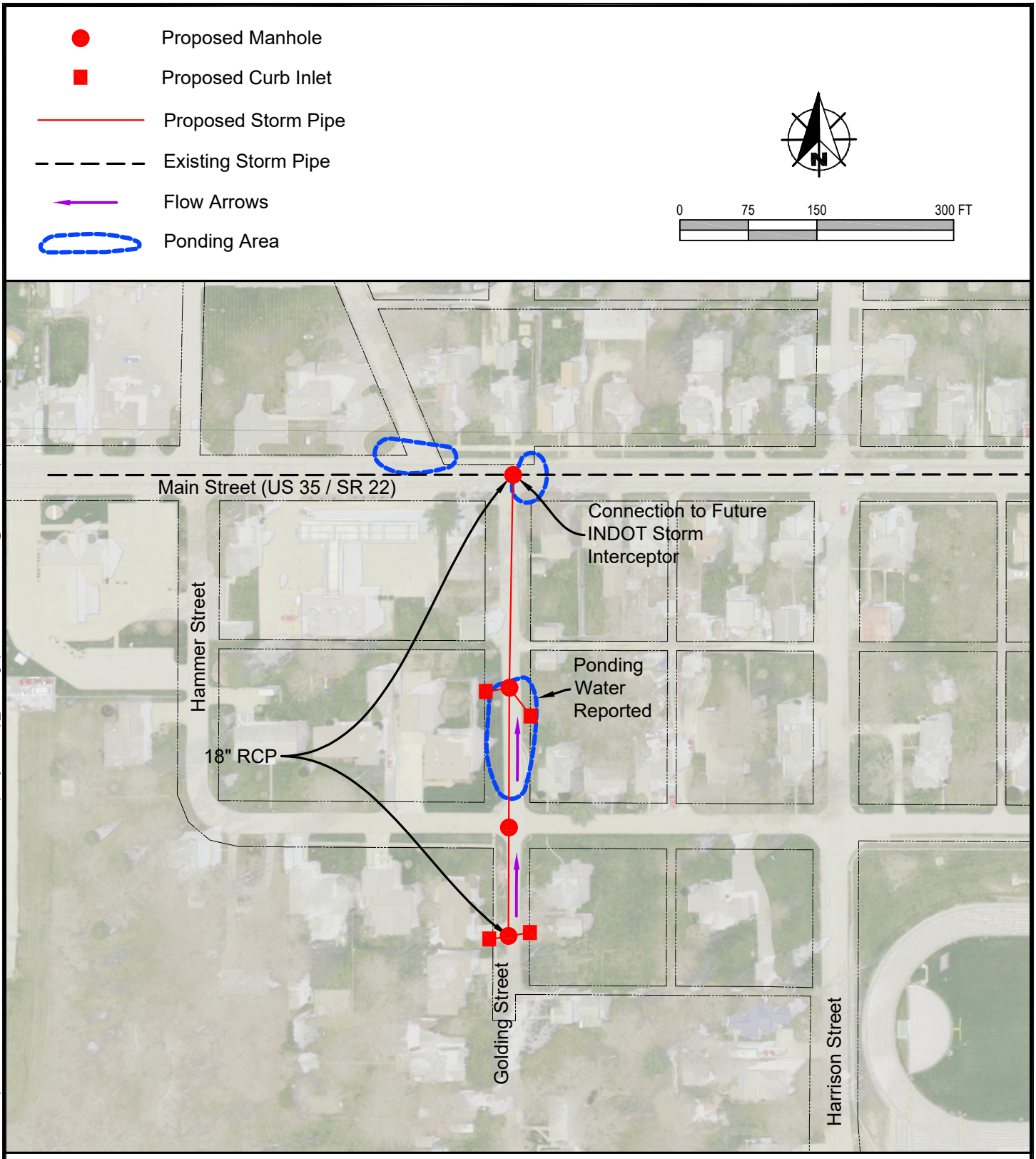

FIGURE A-9
GOLDING STREET IMPROVEMENTS

Town of Greentown, Indiana
Greentown Stormwater
Master Plan

WESSLER ENGINEERING
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June 2018
200017-01-001
PG. A-9

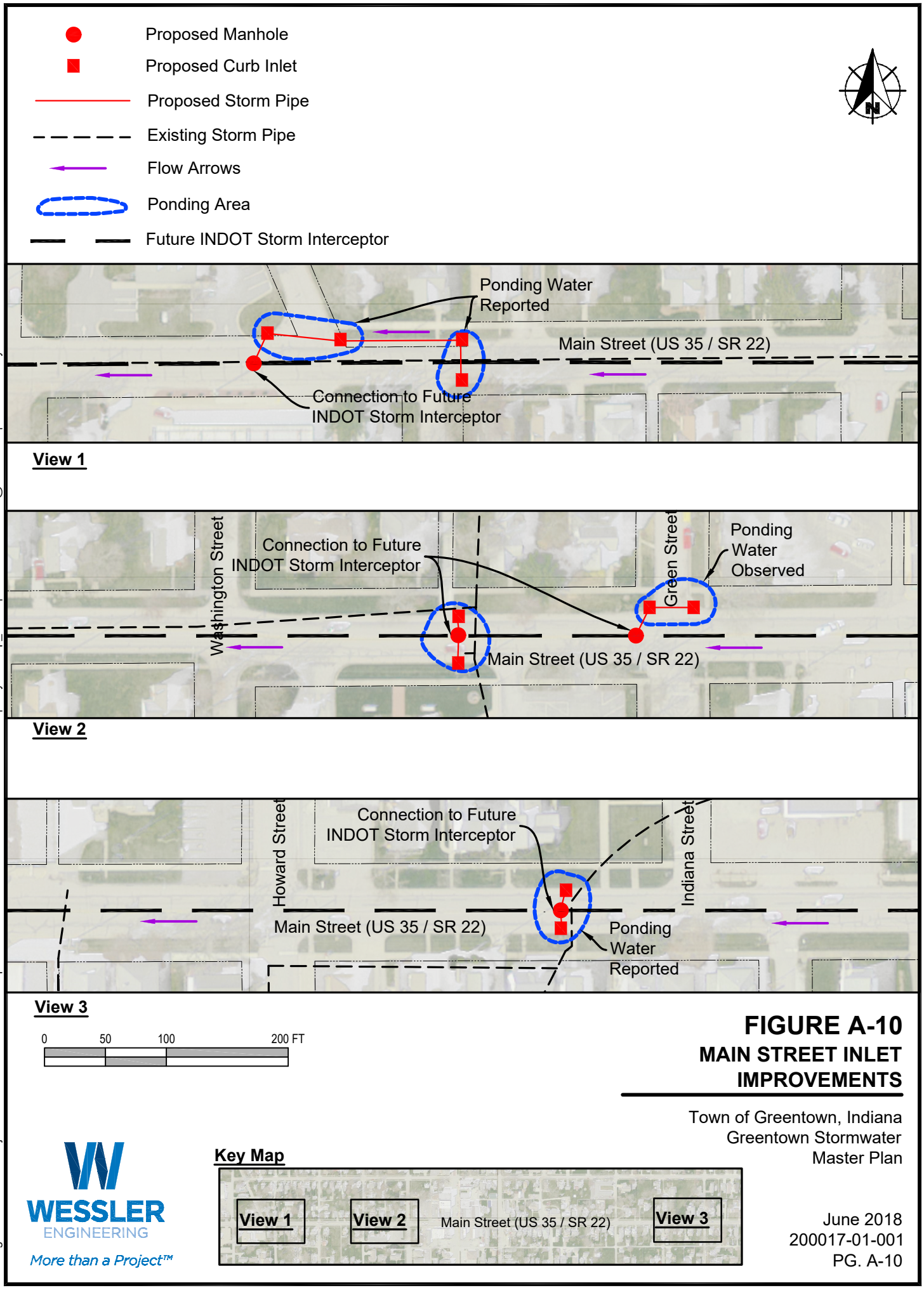

FIGURE A-10
MAIN STREET INLET IMPROVEMENTS

Town of Greentown, Indiana
Greentown Stormwater Master Plan

Key Map

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June 2018
200017-01-001
PG. A-10

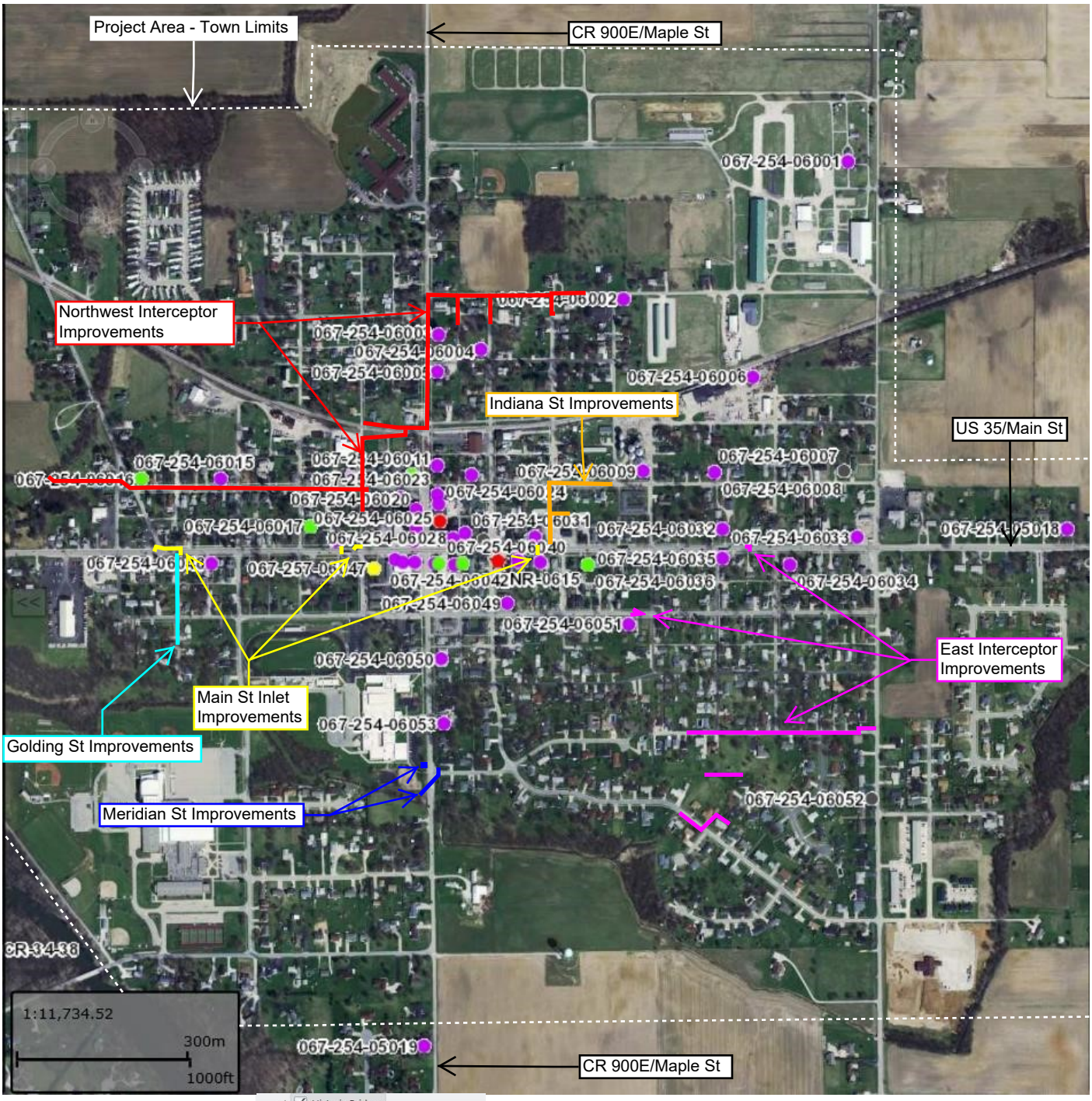

Image Source: Indiana DNR

FIGURE A-11: SHAARDGIS MAP

WESSLER ENGINEERING
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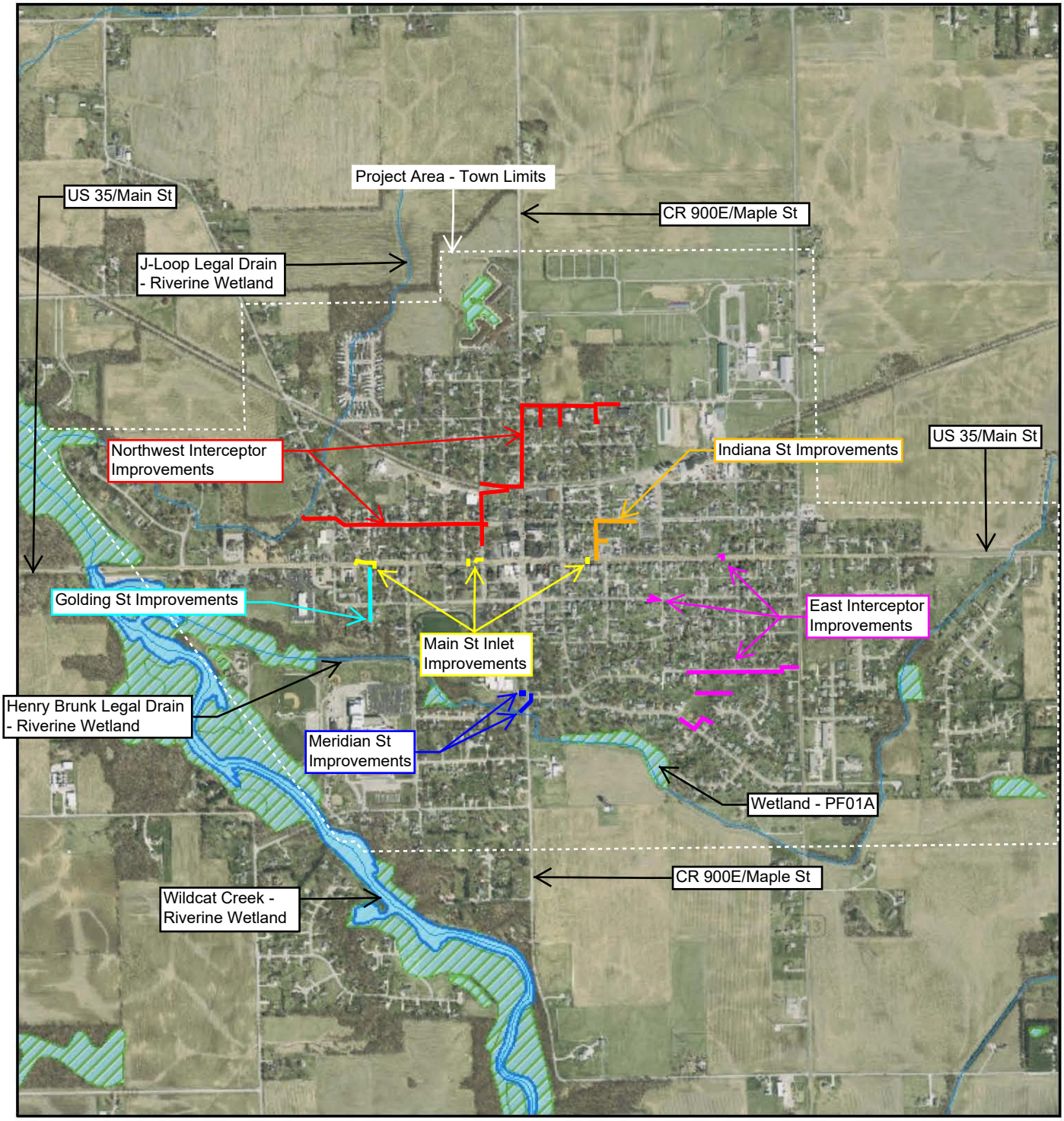
Town of Greentown, Indiana
Greentown Stormwater
Master Plan

June 2018
200017-01-001



Legend

- Streams (NHD)
- Rivers (NHD)
- Wetlands NWI (USFWS)

Image Source: IndianaMAP

0 0.125 0.25 0.5 mi

0 0.2 0.4 0.8 km

FIGURE A-12: WETLANDS MAP

WESSLER ENGINEERING

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Town of Greentown, Indiana
Greentown Stormwater
Master Plan
June 2018
200017-01-001

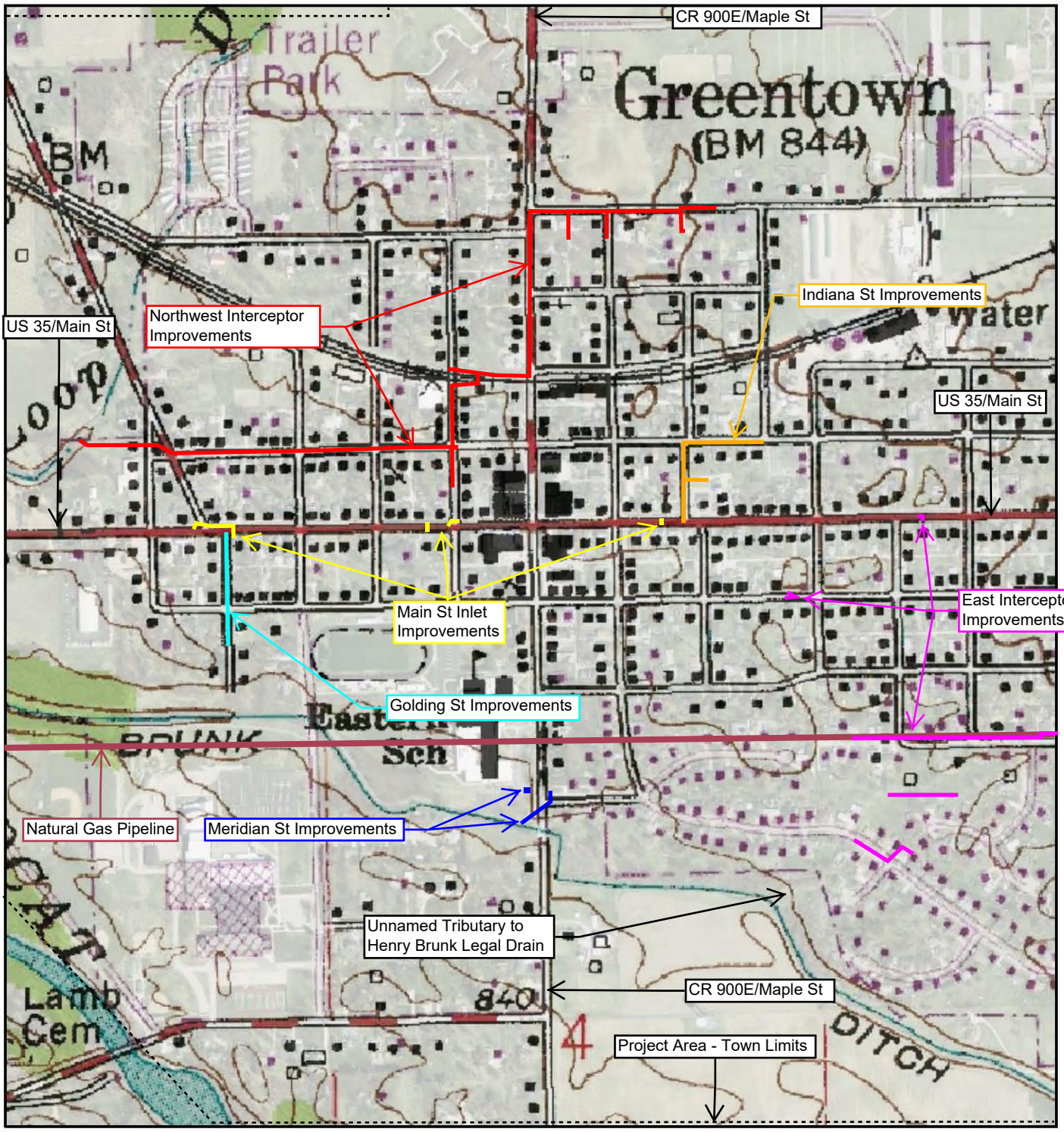


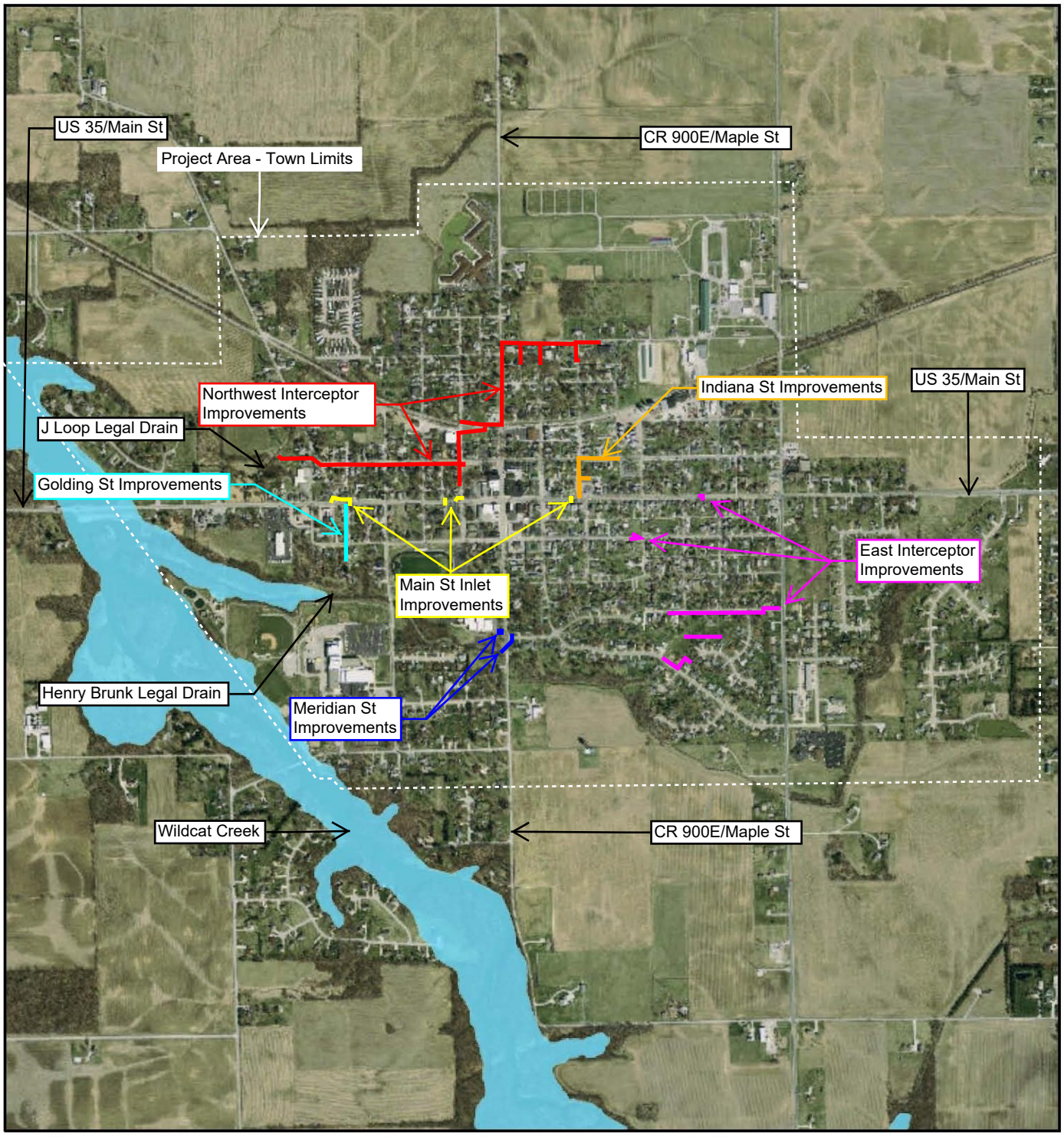
Image Source: IndianaMAP

0 0.05 0.1 0.2 mi
0 0.1 0.2 0.4 km

FIGURE A-13: TOPOGRAPHIC MAP

WESSLER ENGINEERING
More than a Project™

Town of Greentown, Indiana
Greentown Stormwater Master Plan
June 2018
200017-01-001



Legend

Floodplains - FIRM

- Floodway
- 1% Annual Chance Flood Hazard

Image Source: IndianaMAP

0 0.125 0.25 0.5 mi

0 0.2 0.4 0.8 km

FIGURE A-14: FLOODPLAINS MAP

WESSLER ENGINEERING

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Town of Greentown, Indiana
Greentown Stormwater
Master Plan

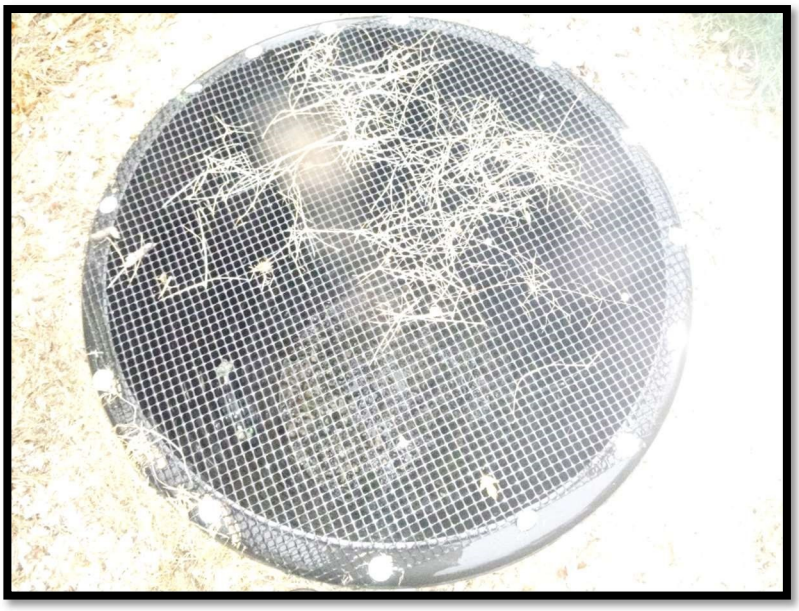
June 2018
200017-01-001

APPENDIX B

PHOTO LOG

Photo Log

Photo No. 1



Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
614 W Main St.

Description:
Dry well in detention pond behind new Dollar General development

Photo No. 2

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
614 W Main St., facing north

Description:
Standing at dry well looking toward outfall at J Loop

Photo No. 3

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
614 W Main St., facing east

Description:
Standing at dry well looking upstream in the detention pond

Photo No. 4

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
614 W Main St., facing southeast

Description:
Standing in detention pond looking upstream at the outlet to the pond from the Dollar General parking lot

Photo No. 5

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
614 W Main St., facing west

Description:
Standing at outfall from Dollar General looking downstream of the J Loop

Photo No. 6

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
614 W Main St., facing northeast

Description:
Standing at outfall from Dollar General looking upstream of the J Loop

Photo No. 7

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
614 W Main St., facing southwest

Description:
Outfall from Dollar General detention pond to the J Loop

Photo No. 8

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
614 W Main St., facing north

Description:
Outfall from Dollar General detention pond to the J Loop

Photo No. 9

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
401 N Carter St., facing northeast

Description:
6′ X 8.5′ culvert, J Loop crossing Carter St. looking upstream

Photo No. 10

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
401 N Carter St., facing southwest

Description:
Looking downstream of J Loop crossing Carter St.

Photo No. 11

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
500 W Payton St., facing northwest

Description:
6′ X 10′ culvert crossing Payton St. upstream to twin 42″ culverts crossing railroad downstream

Photo No. 12

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
500 W Payton St., facing southwest

Description:
Twin 42″ culverts crossing railroad downstream

Photo No. 13

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
500 W Payton St., facing southeast

Description:
6″ drain outfall to railroad culverts

Photo No. 14

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
500 W Payton St., facing north

Description:
6′ X 10′ culvert, looking upstream of J Loop crossing Payton St.

Photo No. 15

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
500 W Payton St., facing west

Description:
15" pipe draining runoff from the east on Payton St. to the J Loop

Photo No. 16

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
500 W Payton St., facing south

Description:
6' X 10' culvert, looking downstream of J Loop crossing Payton St. 15" outfall from Payton St. outfalling into culvert

Photo No. 17

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Across the street from 500 W Payton St.

Description:
Damaged downstream end of ~12" driveway culvert

Photo No. 18

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Across the street from 500 W Payton St., facing northwest

Description:
Damaged upstream end of ~12" driveway culvert

Photo No. 19

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Across the street from 500 W Payton St., facing east

Description:
Ponding water upstream of damaged ~12" driveway culvert

Photo No. 20

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
333 W Payton St., facing west

Description:
Ponding water on both side of Payton St. and in driveway approaches

Photo No. 21

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Payton St. and Washington St. intersection, facing northwest

Description:
Ponding water in intersection

Photo No. 22

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
306 W High St., facing west

Description:
Ponding water in front yard and driveway

Photo No. 23

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
306 W High St., facing northwest

Description:
Ponding water in driveway

Photo No. 24

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
324 N Green St., facing north

Description:
Ponding water on east sidewalk

Photo No. 25

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
303 N Meridian St., facing south

Description:
Main manhole draining storm sewer system north of railroad, possible bottleneck in system

Photo No. 26

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
303 N Meridian St.

Description:
Main manhole draining storm sewer system north of railroad, possible bottleneck in system

Photo No. 27

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
303 N Meridian St.

Description:
Another inlet draining back of Blondie's Cookies' property that ties into main manhole north of railroad

Photo No. 28

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
303 N Meridian St.

Description:
Ditch between railroad and Blondie's Cookies draining to main manhole north of railroad

Photo No. 29

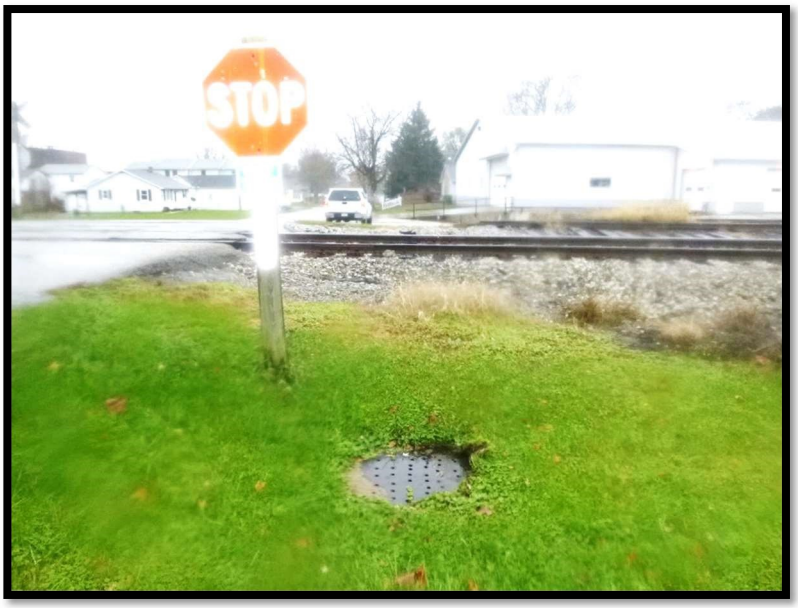
Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
308 N Green St., facing southwest

Description:
Inlet on west side of Green St. and north of the railroad

Photo No. 30



Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
313 N Green St., facing south

Description:
Inlet on east side of Green St. and north of the railroad

Photo No. 31

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Grant St. and Green St. intersection, facing northwest

Description:
Ponding water in intersection

Photo No. 32

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Grant St. and Green St. intersection, facing west

Description:
Ponding water in intersection next to inlet

Photo No. 33

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Grant St. and Green St. intersection, facing north

Description:
Ponding water in intersection

Photo No. 34

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Grant St. and Green St. intersection, facing east

Description:
Ponding water in intersection

Photo No. 35

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
128 W Grant St., facing west

Description:
Ponding water in intersection along curb to next inlet

Photo No. 36

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Main St. and Green St. intersection, facing northeast

Description:
Ponding water in intersection

Photo No. 37

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Main St. and Green St. intersection, facing east

Description:
Ponding water in intersection

Photo No. 38

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Main St. and Green St. intersection, facing west

Description:
Ponding water in intersection

Photo No. 39

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
404 W Walnut St., facing west

Description:
Ponding water in street

Photo No. 40

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
324 W Walnut St., facing west

Description:
Evidence of previous culvert crossing Harrison St. now more than half full of sediment

Photo No. 41

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
417 W Walnut St., standing on Harrison St. facing north

Description:
Ponding water in street

Photo No. 42

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
411 S Meridian St., facing east

Description:
Henry Brunk crossing Meridian St., looking upstream

Photo No. 43

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
411 S Meridian St., facing south

Description:
Some ponding water in street

Photo No. 44

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
411 S Meridian St., facing west

Description:
Henry Brunk crossing Meridian St., looking downstream

Photo No. 45

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Holiday Dr. and Meridian St. intersection, facing south

Description:
Ponding water in intersection

Photo No. 46

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Holiday Dr. and Meridian St. intersection, facing east

Description:
Ponding water in intersection

Photo No. 47

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Holiday Dr. and Meridian St. intersection, facing south

Description:
Ponding water in intersection

Photo No. 48

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Holiday Dr. and Meridian St. intersection, facing south

Description:
Ponding water around sanitary manhole with a solid lid casting

Photo No. 49

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
224 N Howard St., facing south

Description:
Ponding water along street

Photo No. 50

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
224 N Howard St., facing north

Description:
Ponding water along street

Photo No. 51

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
224 N Howard St.

Description:
Inlet in fire station back parking lot

Photo No. 52

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
224 N Howard St., facing south

Description:
Ponding water in driveway and street

Photo No. 53

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
224 N Howard St., facing north

Description:
Inlet serving runoff from the south, east side of Meridian St.

Photo No. 54

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
212 N Howard St., facing south

Description:
Ponding water in low spot of driveway and east side of the street

Photo No. 55

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
212 N Howard St., facing south

Description:
Ponding water in low spot of driveway and west side of the street

Photo No. 56

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Railroad St. and Howard St. intersection

Description:
Existing condition of inlet structure

Photo No. 57

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Railroad St. and Howard St. intersection, facing west

Description:
Existing condition of inlet structure, looking downstream

Photo No. 58

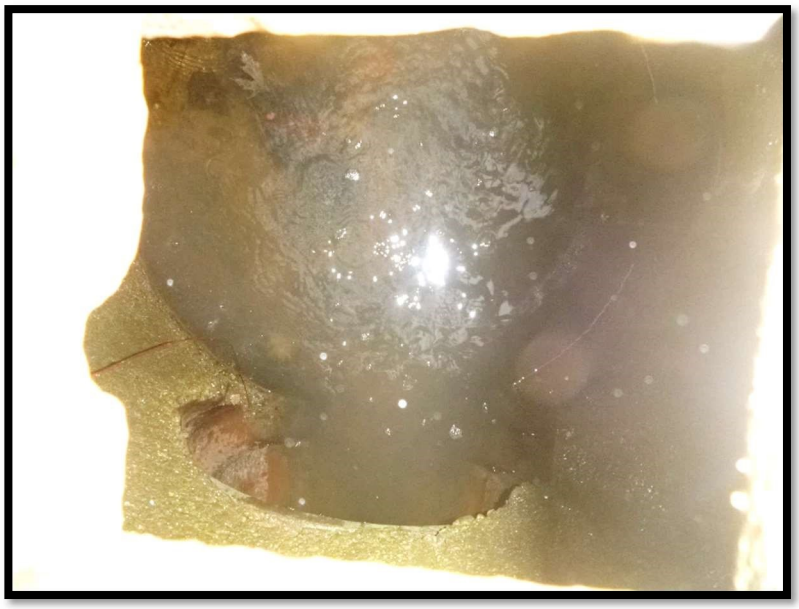
Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
428 N Howard St.

Description:
Inlet serving east side of Howard St.

Photo No. 59



Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
428 N Howard St.

Description:
Inlet serving east side of Howard St.

Photo No. 60

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
428 N Howard St.

Description:
East end section of culvert crossing Howard St.

Photo No. 61

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
428 N Howard St., facing south

Description:
Standing above culvert crossing Howard St.

Photo No. 62

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
419 N Howard St.

Description:
Inlet serving west side of Howard St.

Photo No. 63

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
419 N Howard St.

Description:
West end section of culvert crossing Howard St.

Photo No. 64

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
624 W Main St., facing south

Description:
Outfall to J Loop of main storm sewer system serving the north side of Greentown

Photo No. 65

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
624 W Main St.

Description:
Inside of dog house structure just before the outfall to J Loop

Photo No. 66

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
624 W Main St., facing south

Description:
18" outfall to J Loop of main storm sewer system serving the north side of Greentown

Photo No. 67

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
418 Grant St., facing north

Description:
Property floods frequently

Photo No. 68

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
418 Grant St., facing east

Description:
Ponding water in driveway

Photo No. 69

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
419 Grant St., facing south

Description:
Curb inlet along south side of Grant St.

Photo No. 70

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
419 Grant St., facing north

Description:
Manhole collecting stormwater runoff from curb inlets along Grant St.

Photo No. 71

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
303 N Meridian St., Blondies Cookies Inc.

Description:
Inlet in parking lot

Photo No. 72

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
303 N Meridian St., facing southeast

Description:
Standing in Blondies Cookies Inc. parking lot, looking at inlet and street condition

Photo No. 73

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
303 N Meridian St.

Description:
Main manhole draining storm sewer system north of railroad, possible bottleneck in system, out pipe at 6 o'clock to the south

Photo No. 74

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
306 E Grant St.

Description:
Curb inlet full of debris, out pipe buried

Photo No. 75

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
306 E Grant St., facing east

Description:
Some ponding water in intersection of Indiana St. and Grant St.

Photo No. 76

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
303 E Grant St., facing southeast

Description:
Inlet casting sunken a few inches below street

Photo No. 77

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
303 E Grant St.

Description:
Undersized pipes though inlet

Photo No. 78

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
303 E Grant St., facing southeast

Description:
Inlet casting sunken a few inches below street

Photo No. 79

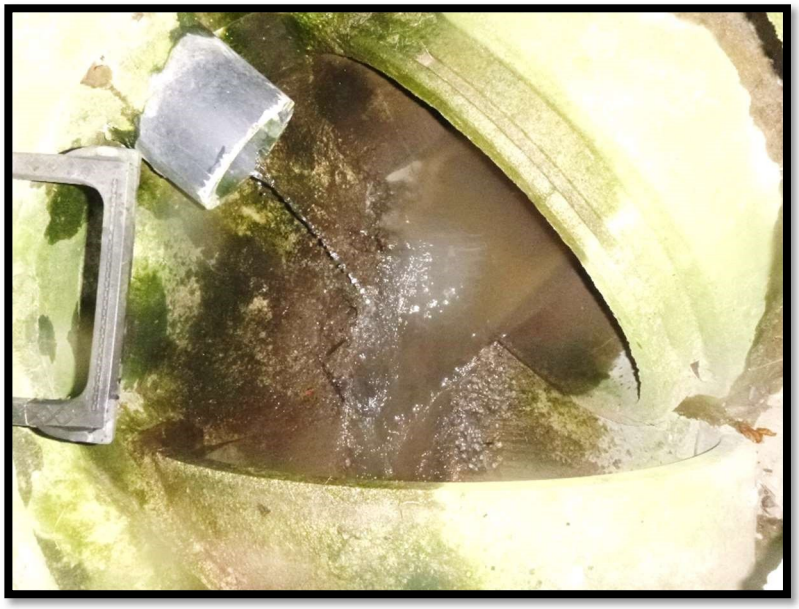
Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Intersection of Indiana and Grant St., facing west

Description:
Ponding water in intersection

Photo No. 80



Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
412 E Walnut St.

Description:
48-inch pipe in and out, out pipe at 6 o'clock to the south

Photo No. 81

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
412 E Walnut St., facing north

Description:
View of surface surrounding inlet with 48-inch through pipe

Photo No. 82

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
412 E Walnut St., facing southwest

Description:
Walnut St., standing near inlet with 48-inch though pipe

Photo No. 83

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
412 E Walnut St.

Description:
Curb inlet full of debris, out pipe buried, 48-inch pipe downstream

Photo No. 84

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
412 E Walnut St., facing northwest

Description:
Curb inlet not located in low spot of Walnut St.

Photo No. 85

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
419 E Walnut St.

Description:
Curb inlet full of debris, out pipe buried, 48-inch pipe downstream

Photo No. 86

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Intersection of Hall and Covalt St., facing northeast

Description:
Ponding water in intersection

Photo No. 87

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
622 E Hall St., facing north

Description:
Ponding water in low spots of yard, may be addressed by eliminating low spots

Photo No. 88

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
609 W Avalon Ct., facing west

Description:
Debris at driveway entrance, evidence of ponding water next to inlet

Photo No. 89

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Cul-de-sac of Avalon Ct.

Description:
18-inch pipe out from inlet in cul-de-sac, clear of debris

Photo No. 90

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
Cul-de-sac of Avalon Ct.

Description:
18-inch pipe out from inlet in cul-de-sac, clear of debris

Photo No. 91

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
609 W Avalon Ct., facing east

Description:
In backyard along storm sewer path, parallel to sanitary sewer

Photo No. 92

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
508 Holiday Dr., facing southeast

Description:
In backyard along storm sewer path, standing in swale line running parallel

Photo No. 93

Date Taken:
November 15, 2017

Rainfall Data:
0.49 inches in 24 hours
2.11 inches in 10 days

Location:
508 Holiday Dr., facing south

Description:
In side yard along storm sewer path, standing in swale line running parallel, 48-inch pipe through inlet

APPENDIX C

GREEN INFRASTRUCTURE TOOLBOX

GREEN INFRASTRUCTURE OPTIONS

As an alternative to, or an augmentation of, the "gray" infrastructure option recommended, green infrastructure (GI) can be incorporated into the design to reduce peak flows, decrease pipe sizes, reduce outfall velocities, and increase the water quality of the stormwater effluent. Technologies include permeable pavement, tree boxes, aggregate recharge and detention beds, and perforated pipe underdrains.

Trees and Silva Cell Systems

Silva cells, like tree boxes, are green infrastructure stormwater control measures that are designed to collect runoff and treat the runoff prior to discharging into a storm sewer system or infiltrating into the subsoil while providing a support structure for certain loading requirements. "The Silva Cell is a modular suspended pavement system that uses soil volumes to support large tree growth and provide powerful on-site stormwater management through absorption, evapotranspiration, and interception".[11] The cells function as compact bioretention systems, which are low impact development stormwater control best management practices (BMPs). They can be utilized in urban environments where a small footprint is desired and can be modified to accommodate infiltration when direct connection to the existing storm sewer is not preferred or feasible.

These systems may replace individual inlets in the storm sewer design. As a result, the flow to the pipe will be decreased, potentially allowing the pipe size to be decreased. In addition to the reduced pipe size benefit, because the Silva Cell allows trees room to grow, the life span of the tree is increased to 50+ years rather than 10-15 as with typical tree boxes. The extended life span of the trees results in the appreciation of stormwater control and quality value. As the trees grow, they will remove more stormwater from the system through absorption. Case studies show that the improvement of water quality is substantial with suspended solids removal of up to an estimated 90%.

Permeable Pavement Parking Lanes and Sidewalks

Permeable pavement is specifically designed to allow stormwater runoff to infiltrate through the pavement into an underground storage system or into the ground and recharge the ground water table. There are three main types of permeable pavement: pervious concrete, porous pavers, and porous asphalt.

Pervious concrete and porous asphalt are both structural pavements that are manufactured without fine materials which allows for larger interconnected voids resulting in stormwater

[1] "Silva Cell Overview." Silva Cell Tree and Stormwater Management System from Deeproot. 2016. Accessed October 14,2016. http://www.deeproot.com/products/silva-cell/overview.

infiltration. Porous paver systems consist of structural modular units that are designed with voids and include a variety of commercially available products.

Figure 1: Porous Asphalt Example

Permeable pavement allows rain and snowmelt to pass through the pavement material while providing water quality benefits by filtering pollutants from stormwater runoff via infiltration into the underlying soil substrate and through microbial action. In a permeable pavement system, stormwater runoff moves through several layers of bedding after passing through the porous surface and infiltrates into the subgrade soil. The layers of all permeable pavement applications are similar. The first layer is the uncompacted subgrade soil followed by an optional geotextile layer. The next layer is the open-graded subbase reservoir including an underdrain, as required. On top of the subbase layer is an open-graded base reservoir then a bedding course and finally the permeable pavement application. The use of permeable pavement has been found to reduce stormwater runoff, replenish groundwater, and reduce pollutants in runoff.

Permeable pavement technologies could be implemented into a storm sewer design by replacing the shoulder or parking lanes with porous asphalt, aggregate detention, and underdrains systems below. Permeable pavement may also be used in sidewalk applications.

Subsurface Detention

Subsurface detention systems capture flow and retain it until it infiltrates into the soil or is released slowly over time, decreasing peak flows and associated flooding problems. Subsurface detention systems are commonly used in areas such as parking lots or other developed sites in highly urbanized areas where storing water underground on site may be the best option. These systems can be used in linear applications, such as under streets, and can also be used in conjunction with surface measures such as bioretention to increase the runoff storage volume. Examples of these systems include chamber systems, perforated pipes, and aggregate recharge beds.

Aggregate recharge/detention beds are another option for green technology. These are constructed by excavating a broad area and filling it with uniformly graded aggregate and are typically located under other surfaces such as parking lots and lawns. Runoff is designed to flow into the recharge bed and is then stored within the void spaces of the aggregate and eventually infiltrates into the surrounding soil or is conveyed through an underdrain within

the aggregate bed. Recharge beds may be used where space is limited. In areas with a high water table, shallow soil mantle, or poorly draining soils, an underdrain is necessary since the runoff is less likely to infiltrate into the surrounding soil. Aggregate recharge/detention beds should be used in combination with pretreatment BMPs because they provide minimal water quality treatment.

Figure 2: Aggregate Recharge Bed Example

Rain Garden Bump Outs

Rain gardens are small bioretention systems that utilize both soils and plants to remove pollutants from stormwater runoff. Stormwater runoff enters these systems as sheet flow, is collected in the rain garden and either infiltrates into the soil media substrate or ponds on the surface. Some rain gardens incorporate subsurface drainage in the soil media to allow for the removal of the treated stormwater. Rain gardens are also typically designed to allow for bypass flow of large storm events.

Rain gardens are designed to treat stormwater runoff from impervious surfaces and can be easily incorporated into several different designs, including street bump outs. A street bump out is a curb extension that protrudes into the street at intersections or in the middle of blocks. A rain garden can be implemented within the curb extension with curb cuts allowing stormwater runoff to flow into the bioretention system. In addition to stormwater capture and infiltration benefits, the bump outs provide safety benefits such as the slowing of traffic and pedestrian safety by reducing street crossing distances at intersections.

Green Infrastructure Benefits

An accurate cost comparison between the "gray" and "green" alternatives is impractical without designing the various components of green infrastructure.

The non-monetary benefits of green infrastructure may include:

- Stormwater runoff reduction
- Peak flow reduction
- Storm sewer pipe size and depth reduction
- Water quality improvement
- Increased or improved wildlife habitat
- Rise in adjacent property values
- Improved aesthetics

- Pedestrian and bicycle traffic promotion
- Groundwater recharge
- Flood risk mitigation
- Increased resilience to climate change

Below is an example street cross-section incorporating a complete street design.

Figure 3: Complete Street Example

At the surface, a permeable multi-use path and sidewalk incorporating trees and/or rain gardens promote pedestrian and bicycle traffic and aesthetic benefits. Beneath the surface, perforated pipes, aggregate beds, Silva Cell systems, and plant roots promote infiltration, storage, absorption, and conveyance of excess stormwater to an outfall.

APPENDIX D

OPERATION AND MAINTENANCE MANUAL

Inspection and Maintenance. Easy. Convenient.

When it rains, oils, sediment and other contaminants are captured and contained by over 40,000 Stormceptor units operating worldwide. While Stormceptor's patented scour prevention technology ensures captured pollutants remain in the unit during all rainfall events, the accumulated pollutants must eventually be removed as part of a regular maintenance program.

If neglected, oil and sediment gradually build up and diminish any BMP's efficiency, harming the environment and leaving owners and operators vulnerable to fines, surcharges and bad publicity.

Maintenance is a must

Ease, frequency and cost of maintenance are often overlooked by specifiers when considering the merits of a stormwater treatment system. In reality, maintenance is fundamental to the long-term performance of any stormwater quality treatment device.

While regular maintenance is crucial, it shouldn't be complicated. An ongoing maintenance program with Stormceptor is convenient and practically effortless. With virtually no disruptions, you can concentrate on your core business.

Quick inspections

Inspections are easily carried out above ground from any standard surface access cover through a visual inspection of the orifice and drop tee components. A sludge judge and oil dip-stick are all that are needed for sediment and oil depth measurements.

Easy unit access

Maintenance is typically conducted from the same surface access cover, eliminating the need for confined space entry into the unit. Your site remains undisturbed, saving you time and money.

No muss, no fuss and fast

Maintenance is performed quickly and inexpensively with a standard vacuum truck. Servicing usually takes less than two hours, with no disruption to your site.

A complete stormwater management plan for Stormceptor extends beyond installation and performance to regular maintenance. It's the smart, cost-effective way to ensure your unit continues to remove more pollutants than any other separator for decades to come.

Stormceptor maintenance recommendations

- Units should be inspected post-construction, prior to being put into service.
- Inspect every six months for the first year of operation to determine the oil and sediment accumulation rate.
- In subsequent years, inspections can be based on first-year observations or local requirements.
- Cleaning is recommended once the sediment depth reaches 15% of storage capacity, (generally taking one year or longer). Local regulations for maintenance frequency may vary.
- Inspect the unit immediately after an oil, fuel or chemical spill.
- A licensed waste management company should remove captured petroleum waste products from any oil, chemical or fuel spills and dispose responsibly.

With over 40,000 units operating worldwide, Stormceptor performs and protects every day, in every storm.

imbrium

www.imbriumsystems.com

USA: (888) 279 8826
CANADA: (800) 565 4801

Downstream Defender®

Your Best Option when Washout isn't an Option.

Product Profile

The Downstream Defender® is an advanced vortex separator used to treat stormwater runoff in pretreatment or stand-alone applications. Its unique flow-modifying internal components distinguish the Downstream Defender® from conventional and simple swirl separators that typically bypass untreated peak flows to prevent washout of captured pollutants. Its wide treatment flow range, low headloss, small footprint and low-profile make it a compact and economical solution for capturing nonpoint source pollution.

Components

1. Inlet to Precast Vortex Chamber
2. Cylindrical Baffle
3. Center Shaft
4. Outlet Pipe
5. Sediment Storage Sump
6. Access Lid

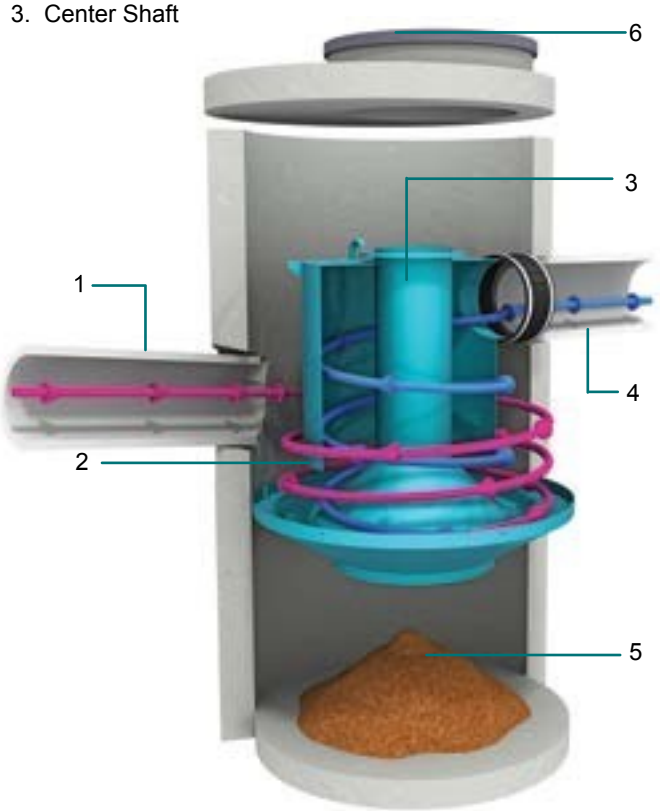


Fig.1 The Downstream Defender® has internal components designed to maximize pollutant capture and minimize pollutant washout.

Applications

- Removal of total suspended solids (TSS), floatable trash and petroleum products from stormwater runoff
- New construction or redevelopment of commercial and residential sites
- Pollutant hotspots such as maintenance yards, parking lots, gas stations, streets, highways, airports and transportation hubs
- Site constrained LID or green infrastructure based developments
- LEED® development projects

Advantages

- Special internal components maximize pollutant capture and minimize footprint, headloss and washout
- Captures and retains a wide range of TSS particles
- High peak treatment flow rates
- Treats the entire storm with no washout or untreated bypass flows
- Low maintenance requirements - no dredging required, and no screens or media to block
- Variable inlet/outlet angles for ease of site layout

How it Works

Advanced hydrodynamic vortex separation is a complex hydraulic process that augments gravity separation with low-energy rotary forces. The flow modifying internal components used in the Downstream Defender® harness the energy from vortex flow and maximize the time for separation to occur while deflecting high scour velocities (Fig.1).

Polluted stormwater is introduced tangentially into the side of the precast vortex chamber to establish rotational flow. A cylindrical baffle with an inner center shaft creates an outer (magenta arrow) and inner (blue arrow) spiraling column of flow and ensures maximum residence time for pollutant travel between the inlet and outlet.

Oil, trash and other floating pollutants are captured and stored on the surface of the outer spiraling column. Low energy vortex motion directs sediment into the protected sump region. Only after following a long three-dimensional flow path is the treated stormwater discharged from the outlet pipe. Maintenance ports at ground level provide access for easy inspection and clean-out.