

## Section 6: Capital Improvement Projects

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CIPs have been identified and developed based on anecdotal information provided by City staff, as well as through stormwater runoff and conveyance modeling. The model results have been used to develop pipe alignments and pipe sizes required to pass the design storm basin flows. The following improvements incorporate the estimated costs for the recommended capital improvement projects over the 20-year planning period. The CIP projects are intended to correct existing storm system deficiencies and provide the capacity to accommodate anticipated growth and development.

### 6.1 System Evaluation Approach

To evaluate the existing system, identify areas of inadequate capacity, and develop a list of CIPs, Kennedy/Jenks conducted interviews with City personnel and staff for anecdotal information, and used SSA modeling to evaluate existing stormwater infrastructure. Storm events were modeled for individual basins to analyze existing pipe networks and identify pipes susceptible to surcharging and areas prone to flooding. Future storm event flows were also developed in SSA, as discussed in Section 5, where additional development is anticipated during the planning period.

Required CIPs have been established by evaluating the severity of surcharging or flooding that develops in insufficiently sized pipe. These areas, as described below, are places where pipe upsizing or replacement is required. Timing of the CIPs is dependent on the future build out of the basins and priorities identified by the City. By evaluating different yearly flows, specific projects can be phased and scheduled as required by the growing population. The following sections discuss the specific projects and project basins that were developed from interviews with City personnel and the modeling work. Each section will discuss the basin assessment, the evaluation, the recommended improvements, the required phasing, and an estimated cost to complete the project.

### 6.2 System Evaluation Results

A total of 24 stormwater infrastructure improvement projects have been developed, including two flow-monitoring installations. While the CIP descriptions provided herein are aimed at increasing the capacity and functionality of the system through hydraulic upgrades, other non-CIP related activities are also recommended in this section, including comprehensive surveying of the existing system, development of an operation and maintenance manual, further coordination with Clackamas County and ODOT, and continued monitoring of storm conditions to aid in understanding changes over time.

### 6.3 Estimates of Probable Cost

Each CIP has an associated estimate of probable cost. These costs were developed through a combination of recent similar project costs, RS Means 2013, and applying the May 2013 Engineering News Record Construction Cost Index (ENR CCI) of 9440.52. A pipeline cost estimating tool has been developed and included in Appendix B. This tool uses line items associated with typical pipeline construction costs to develop an overall project specific cost. The cost listed on the CIP summary sheets represents the total project cost. For all CIP

components, the total cost was calculated by multiplying the base cost of construction times a non-construction cost factor (NCCF). This NCCF includes contractor mobilization, contractor overhead and profit, and a planning level contingency. These planning level cost estimates should be expected to range from 30% less than to 50% more than actual project costs. Total project costs also include 10% for contractor overhead and profit, 20% for contingency, and 25% for engineering and administration costs. In addition, the project costs have been rounded up to the nearest \$10,000. Detailed cost estimates for each of the CIPs can be found in Appendix B.

### 6.3.1 Pipe Costs

The line item costs for various pipe diameters are included in the cost estimates for each CIP in Appendix B. These costs include the total construction and installation cost per lineal foot (LF), including excavation, backfill, pipe placement, saw cutting, traffic control, and asphalt replacement. The cost assumes that pipe will be installed within the asphalt paved roadway, and at an average depth of 8 feet.

### 6.3.2 UIC Decommissioning

The lump sum (LS) cost for decommissioning a UIC assumes that the UIC to be decommissioned is free of pollution, and that the decommissioning includes the plugging of all inlet pipes to the UIC, backfilling the UIC with rock, removing the cone of the UIC manhole, and providing asphalt restoration. Note that if pollution is found and remediation is required, the cost for decommissioning could increase significantly. This will be highly dependent upon the type of pollution found and the extent of the pollution. Therefore, it is difficult to estimate potential remediation costs.

## 6.4 Project Prioritization

Prioritizing CIPs is an important step to creating a better functioning stormwater system. The overriding factors for stormwater project prioritization are severity of current conditions and implementing downstream improvements first. The current conditions model results can be used to evaluate those areas that require immediate response. These system parameters were used to define the priority ranking as seen on each CIP summary sheet.

## 6.5 Project Implementation

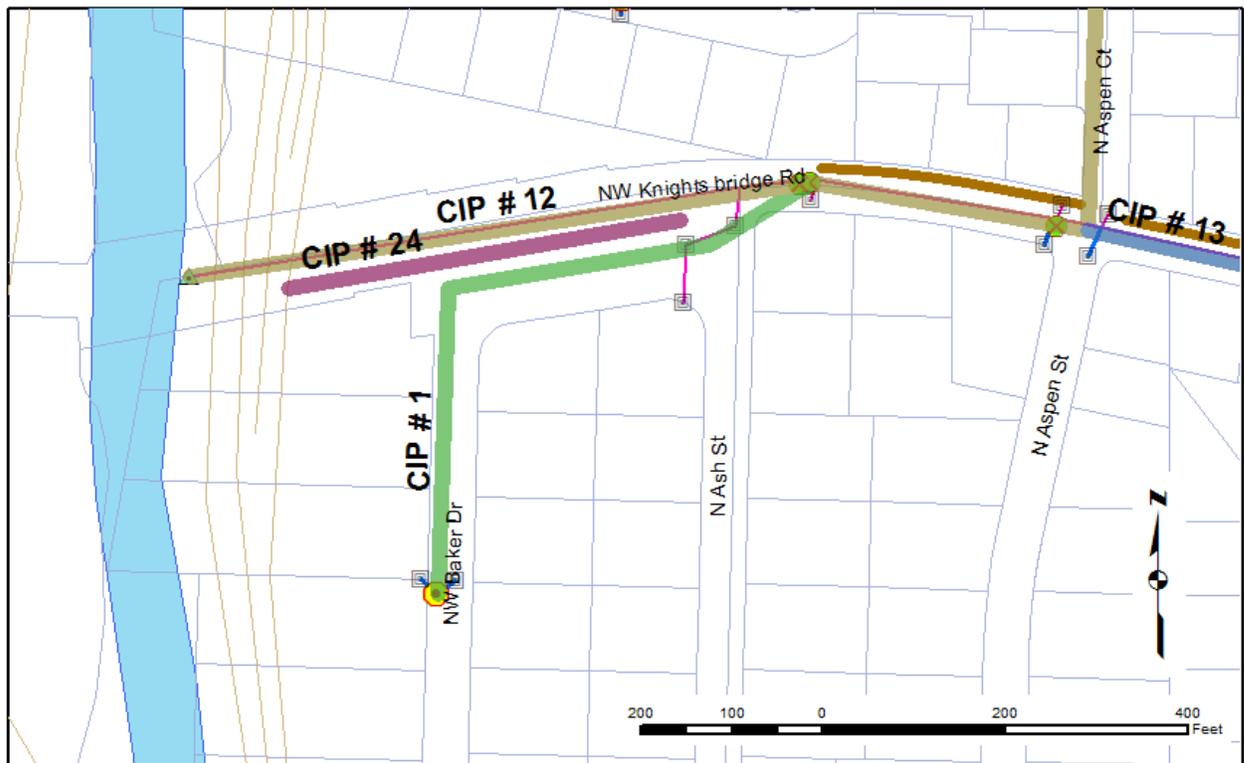
A descriptive breakdown of each CIP is presented below. Planning level estimates of probable cost are provided for individual CIP projects in Appendix B.

### 6.5.1 N Baker Dr. CIP #1

Currently, stormwater is observed to seep from the steep bank of the Molalla River, along the residential area of N Baker Dr. between NW 6<sup>th</sup> Pl. and N Baker St. It is believed that this seepage may be due to an inadequately sized storm system and along with overland flow of stormwater to the river is causing bank erosion. The UIC for this area lacks adequate capacity and is slow draining. The stormwater pipes in this area are also in poor condition

#### **Recommended Improvements**

The recommended improvements consist of replacement and rerouting of the existing stormwater pipes in the area. The new piping will consist of approximately 800 LF of 12-inch storm pipe and the installation of three stormwater manholes. The pipe alignment will begin at the existing UIC on N Baker Dr. and will follow N Baker Dr. until it connects to the existing stormwater conveyance system located at the intersection of N Baker Dr. and N Ash St. Catch basins should be installed on either side of the street at each manhole location. The installation of this new stormwater system will divert stormwater runoff away from the existing outfall and unstable bank, and convey it to the existing Contech Model CDS2015-4 hydrodynamic separator treatment system located at N Knights Bridge Rd. Total project costs are estimated to be \$180,000.



CIP #1: N Baker Dr.

**Description:** Address and mitigate the current Molalla River bank erosion concerns, as well as address the surrounding UIC capacity and pipe failures by installing approximately 800 LF of 12" diameter HDPE pipe, 3 manholes, and 8 catch basins

**Location:** N Baker Dr. from the existing UIC to Knights Bridge Rd.

**Existing System:** Slow draining UIC with insufficient capacity; Molalla River outfall; Storm drain pipes in poor condition

**Proposed System:** Add new 12" diameter HDPE storm drain pipe, and reroute the stormwater runoff to the Contech Model CDS2015-4 hydrodynamic separator treatment system at N. Knights Bridge Rd.

**Pipe Length:** Approximately 800 LF

**Cost:** \$180,000

**Priority:** High

**Schedule:** 0 to 5 years

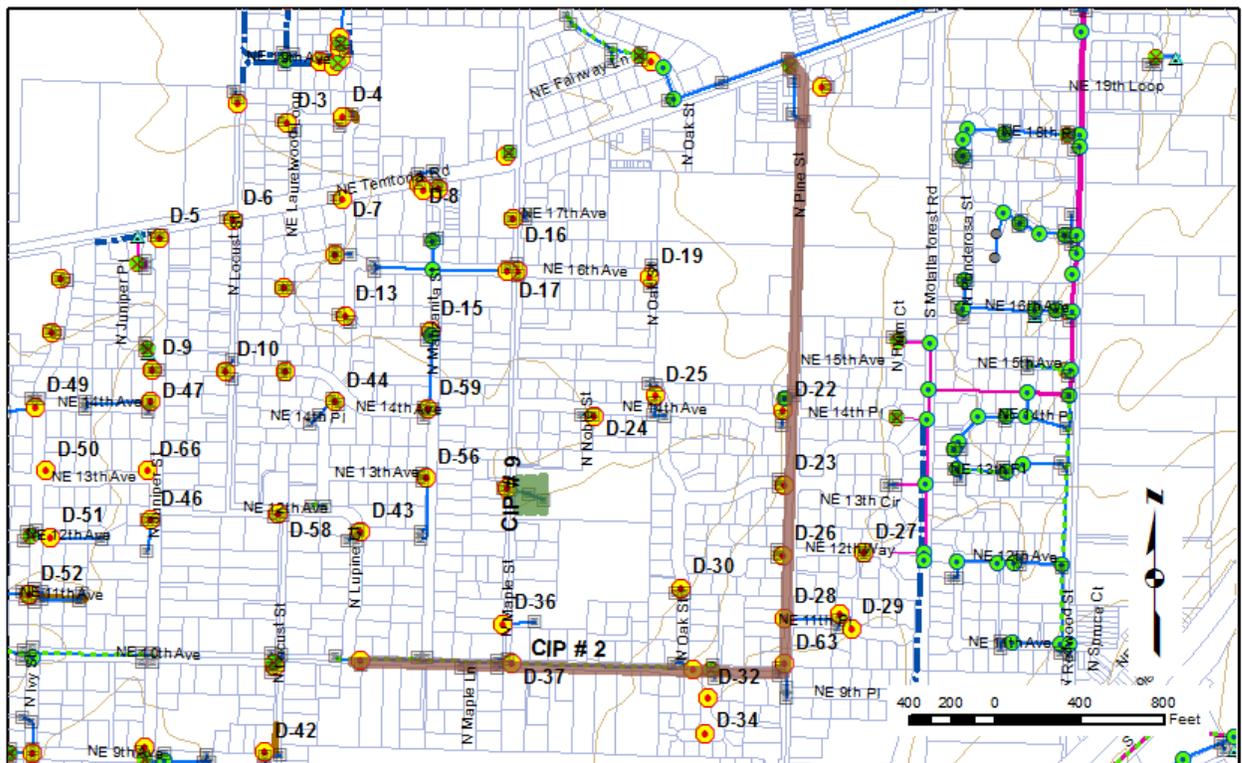
### 6.5.2 10th Ave. from N Locust St. to N Pine St. CIP #2

This street currently has gravel shoulders and no curb or sidewalks. Large puddles form during storm events, and the roadway often becomes flooded with stormwater runoff. This is due to the lack of capacity, poor infiltration abilities of the existing UICs. It is anticipated that when curb and gutter and sidewalks are added, problems with flooding will be worse. Furthermore, groundwater modeling and City observations have demonstrated that four UICs within this corridor are likely to have wet feet and should be decommissioned. Finally, UIC D-63 at the intersection of NE 10<sup>th</sup> Ave and N Pine St has been identified as high risk and must be decommissioned.

#### **Recommended Improvements**

The recommended improvements consist of decommissioning five UICs (D-31, D-63, D-28, D-26, D-23) and replacing the existing piping on NE 10<sup>th</sup> Ave from N Locust to N Pine St with new 12-inch and 18-inch piping. This piping will connect the remaining UICs in series from Locust to Pine St. At Pine St, a new pipeline alignment will convey runoff north on Pine St to Territorial Rd. The new alignment on Pine St will consist of 24-inch pipe. The system will also require the installation of fourteen new manholes. The project will require approximately 1,650 LF of 12" pipe, 370 LF of 18" pipe and 2,900 LF of 24" pipe. The total project cost is estimated at \$1,330,000.

N Pine St. is currently under the jurisdiction of Clackamas County. Approximately 60 percent of the cost of the proposed improvements should be allocated to Clackamas County based on the length of piping along N Pine St relative to the total length of piping for the CIP, and because four of the five drywells to be decommissioned are located on N Pine St. Clackamas County's share of the CIP is approximately \$801,000 and the City of Canby's share of the CIP is approximately \$529,000.



CIP #2: 10th Ave. from N Locust St. to N Pine St.

**Description:** Significant flooding occurs between the streets of N Locust St. and N Pine St. on NW 10<sup>th</sup> Ave. Groundwater modeling demonstrated that four UICs along this stretch that have wet feet and should be decommissioned, and one UIC that is high risk and must be decommissioned. The recommendation is to decommission the five UICs, install a new pipeline from N. Locust to N Pine St. on 10<sup>th</sup>, and along N Pine St. to Territorial Rd.

**Location:** 10<sup>th</sup> Ave. from N. Locust St. to N. Pine St, N. Pine St. from 10<sup>th</sup> Ave to Territorial Rd.

**Existing System:** Currently this area is served by UICs that are slow draining and lack capacity, and has undeveloped gravel shoulders. Furthermore, groundwater modeling demonstrated that one of the existing UICs is out of compliance and requires decommissioning. The condition of the existing piping that conveys flows to the existing UICs is unknown.

**Proposed System:** Decommission the five UICs and add 1,650 LF of 12" pipe and 370 LF of 18" pipe along NE 10<sup>th</sup> Ave. Install a new stormwater pipeline along N Pine St from NE 10<sup>th</sup> Ave to NE Territorial Rd, consisting of approximately 2,900 LF of 24" pipe. Approximately 14 new manholes will be required.

**Cost:** Total: \$1,330,000 Total, City of Canby: \$ 529,000, Clackamas County: \$801,000

**Priority:** High

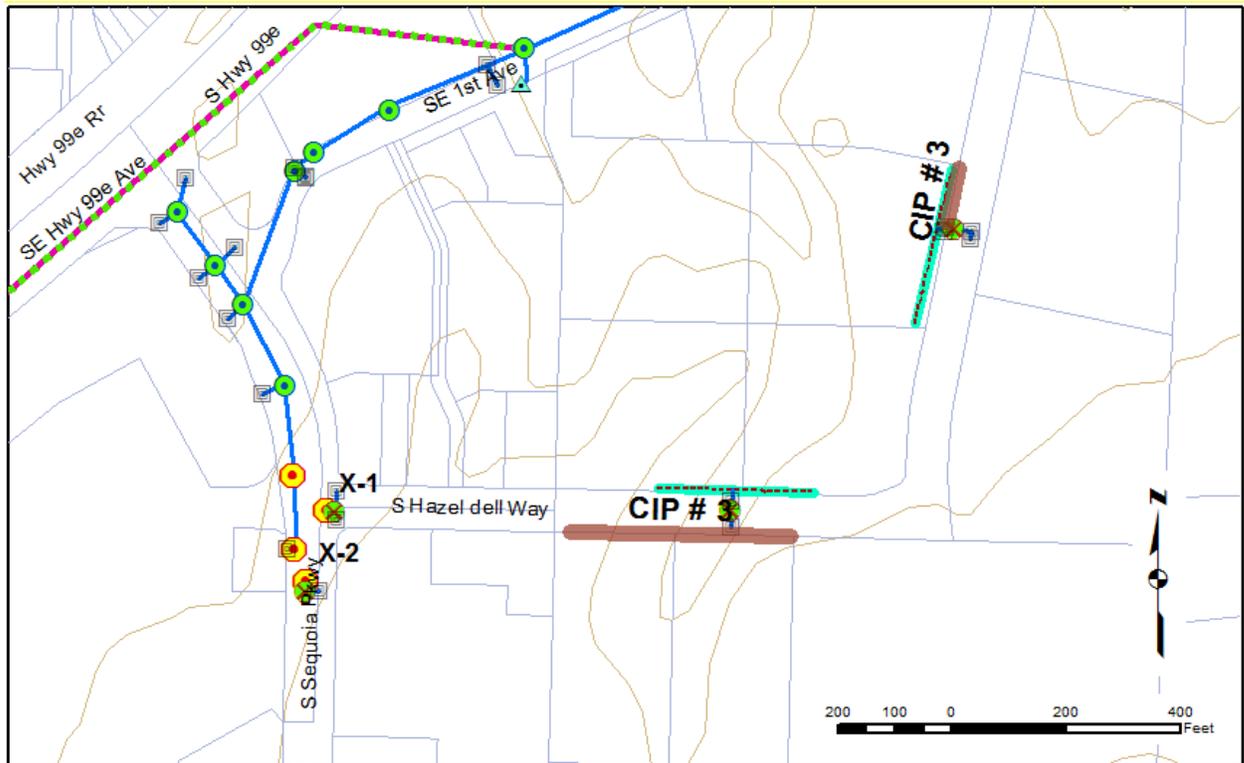
**Schedule:** 0 to 5 years.

### 6.5.3 SE Hazeldell Way CIP #3

Current conditions create flooding of the roadway along Hazeldell Way in the vicinity of the existing trench drains. The current stormwater infrastructure in the area consists of UICs and a piped system to the north, and sediment manholes and trench drains in the remainder of the area. The south end of S Sequoia Parkway, near S Walnut St. previously also had flooding problems but these have been resolved by repairing the trench drains. Groundwater modeling has demonstrated that the seasonal high groundwater table is relatively high in this area, at 20 feet depth.

#### **Recommended Improvements**

The recommended improvements consist of installing vegetated swales within the right-of-way of Hazeldell Way, on the opposite side of the street from the existing catch basins and catch drains. The total approximate length of swale to be installed is 400 feet (ft). The estimated cost of the project is \$90,000.



### CIP #3: SE Hazeldell Way

**Description:** Flooding on SE Hazeldell Way. The recommendation is to install vegetated swales to provide some detention and more infiltration capacity.

**Location:** SE Hazeldell Way

**Existing System:** The existing system consists of UICs and a piped system or sediment manholes and trench drains. Groundwater modeling has demonstrated the water table is relatively high in this area.

**Proposed System:** The proposed system is to install vegetated swales in the right-of-way across from the existing trench drains to provide more infiltration capacity and mitigate flooding. The estimate includes one 300 LF swale and one 100 LF swale. The total length of swales to be installed is approximately 400 ft.

**Cost:** \$90,000

**Priority:** High

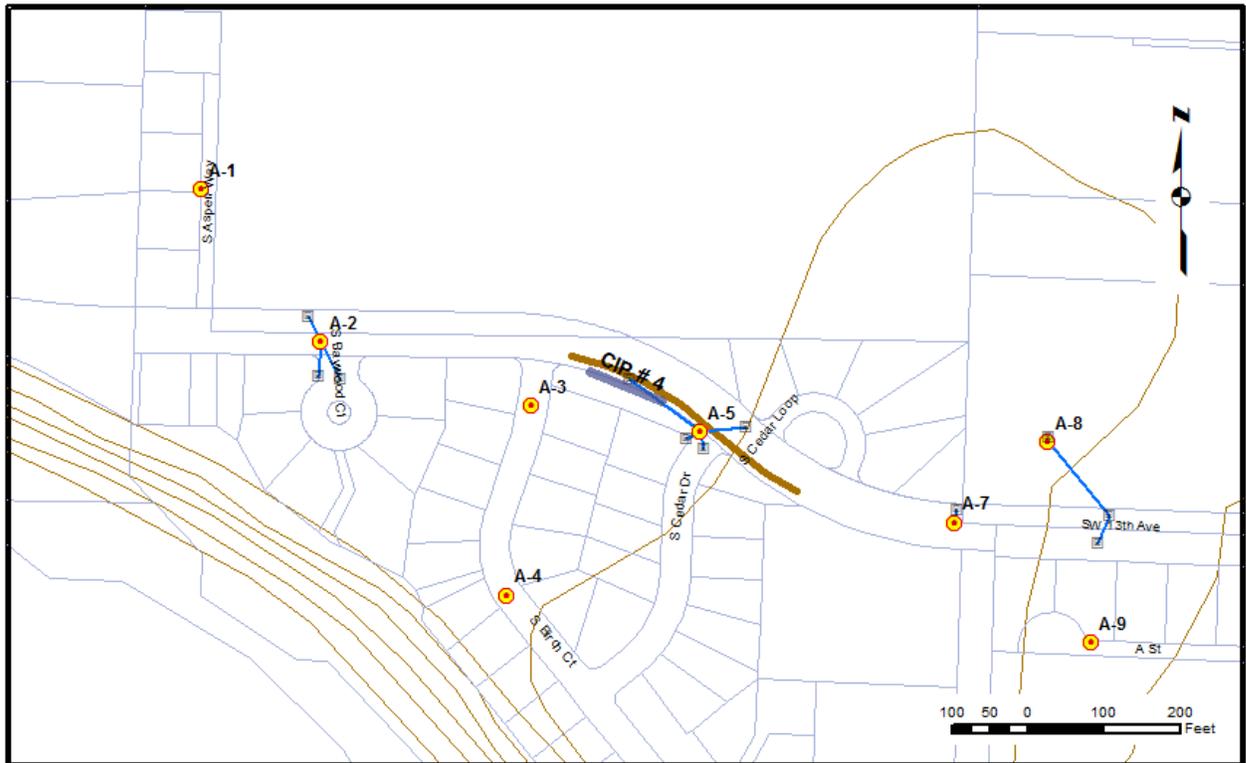
**Schedule:** 0 to 5 years.

#### 6.5.4 SW 13th Ave near Canby High School CIP #4

Currently, flooding occurs along this corridor because the existing UIC A-5 has insufficient capacity. The area often becomes overloaded with stormwater runoff.

##### **Recommended Improvements**

The recommended improvements consist of utilizing the width of the right-of-way and installing a swale for stormwater retention and infiltration to increase the infiltration capacity in the area. The estimated cost of the project is \$30,000.



**CIP #4: SW 13th Ave near Canby High School**

**Description:** This corridor has flooding issues, and the existing UICs have insufficient capacity to handle the stormwater runoff.

**Location:** SW 13<sup>th</sup> Ave near Canby High School

**Existing System:** The existing system consists of UICs

**Proposed System:** The proposed system is to create a 100 LF stormwater retention and infiltration swale in the right-of-way between S Birch Ct. and S Cedar Dr.

**Cost:** \$30,000

**Priority:** High

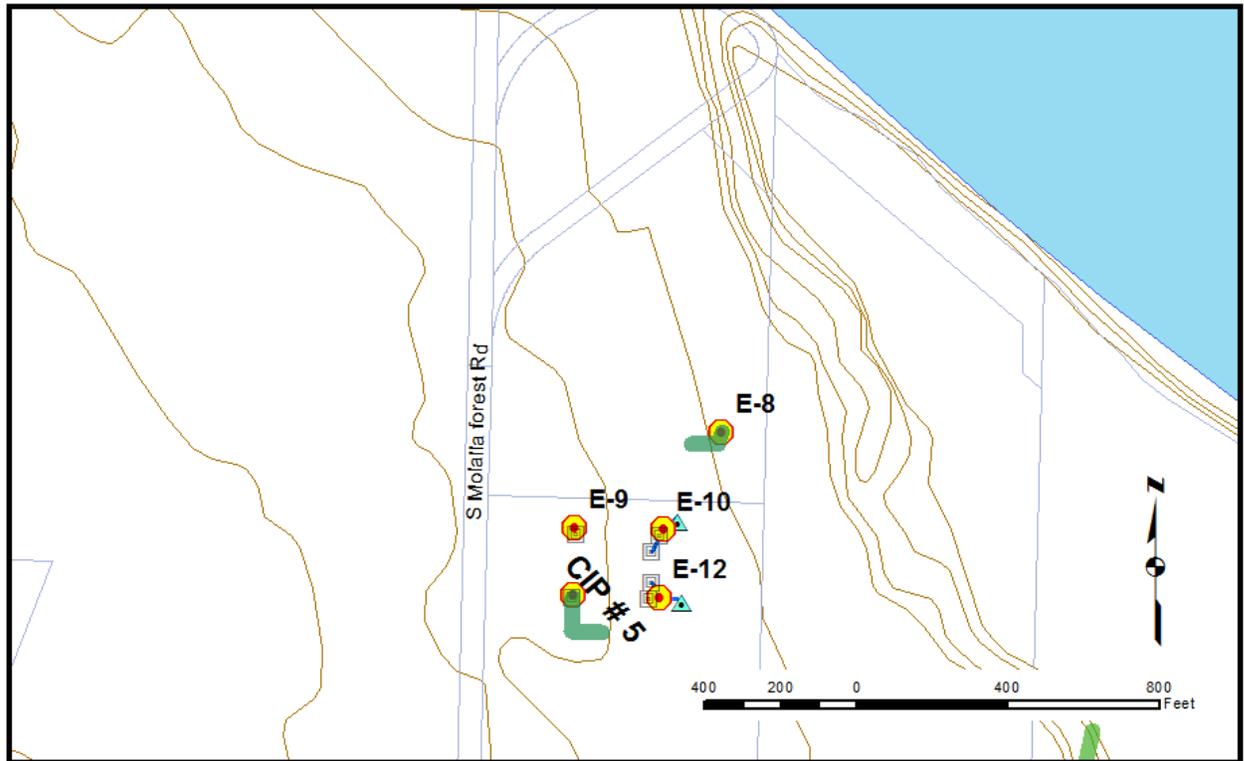
**Schedule:** 0 to 5 years.

#### 6.5.5 UIC E-8 and E-11 Decommission #5

Currently, there are two existing UICs (UIC E-8 and E-11) located within the property occupied by the Canby WWTP which are out of compliance and are required to be decommissioned.

#### **Recommended Improvements**

The recommended improvement is to decommission the two out of compliance UICs and install rain garden infiltration swales near the location of the decommissioned UICs. The estimated cost of the project is \$50,000.



**CIP #5: UIC E-8 and E-11 Decommission**

**Description:** The existing conditions consist of two UICs (E-8 and E-11) which are currently out of compliance and require decommissioning.

**Location:** City of Canby WWTP property

**Existing System:** The existing system consists of two UICs which are out of compliance.

**Proposed System:**

The proposed system is to decommission the UICs which are out of compliance (E-8 and E-11) and install rain garden infiltration swales near the location of the decommissioned UICs.

**Cost:** \$50,000

**Priority:** High

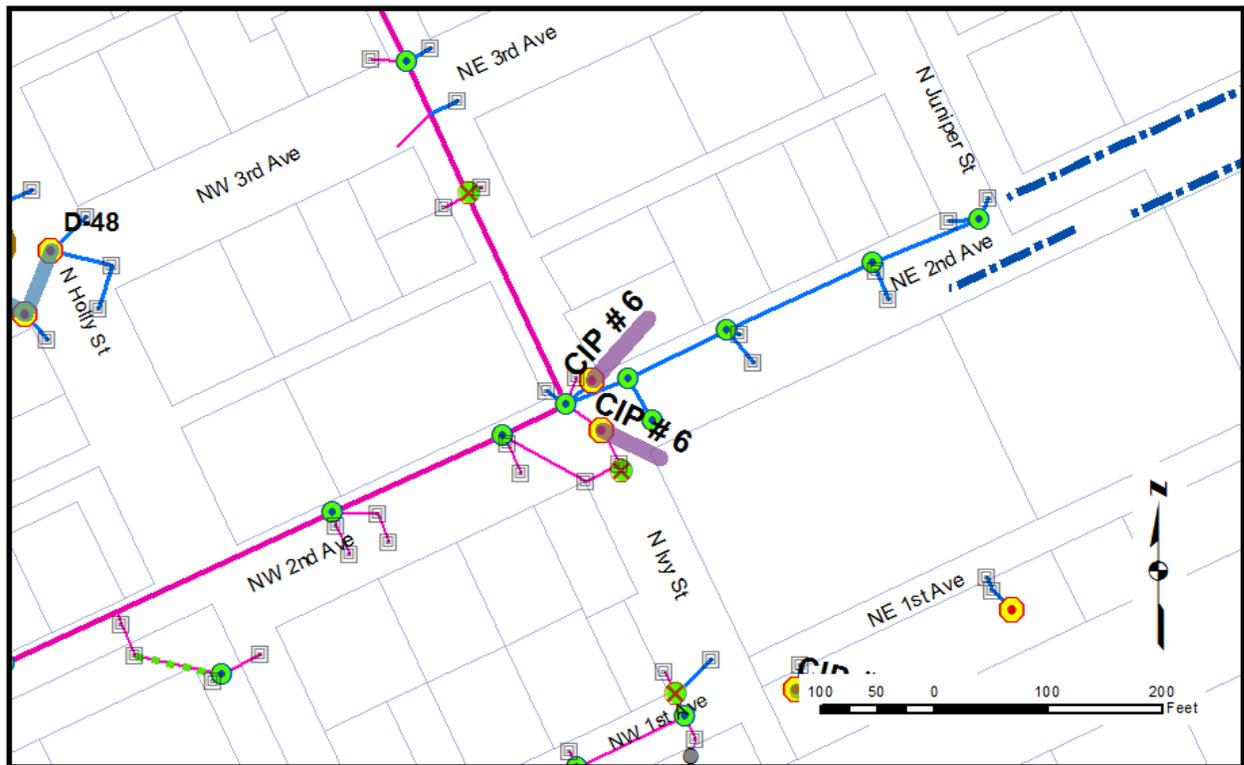
**Schedule:** 0 to 5 years.

#### 6.5.6 NW 2nd Ave and N Ivy St. UIC Decommission #6

Currently, there is one existing UIC (unnamed) located near the intersection of NW 2<sup>nd</sup> Ave and N Ivy St, which is out of compliance and is required to be decommissioned, and one UIC (unnamed) at the intersection identified to have wet feet and is recommended to be decommissioned.

#### **Recommended Improvements**

The recommended improvement is decommissioning of two UICs. New stormwater infrastructure is not anticipated to be required to handle existing stormwater runoff following the decommissioning of these UICs because runoff will be handled by the downtown stormwater system, which is addressed in CIPs #14 and #15. The estimated cost of the project is \$40,000.



CIP #6: NW 2nd Ave and N Ivy St. UIC Decommission

**Description:** The existing area has one UIC that has been determined to be out of compliance.

**Location:** NW 2<sup>nd</sup> Ave and N Ivy St

**Existing System:** The existing system consists of one UIC which is out of compliance.

**Proposed System:** The proposed system is to decommission the UIC. No Additional stormwater infrastructure is required.

**Cost:** \$40,000

**Priority:** High

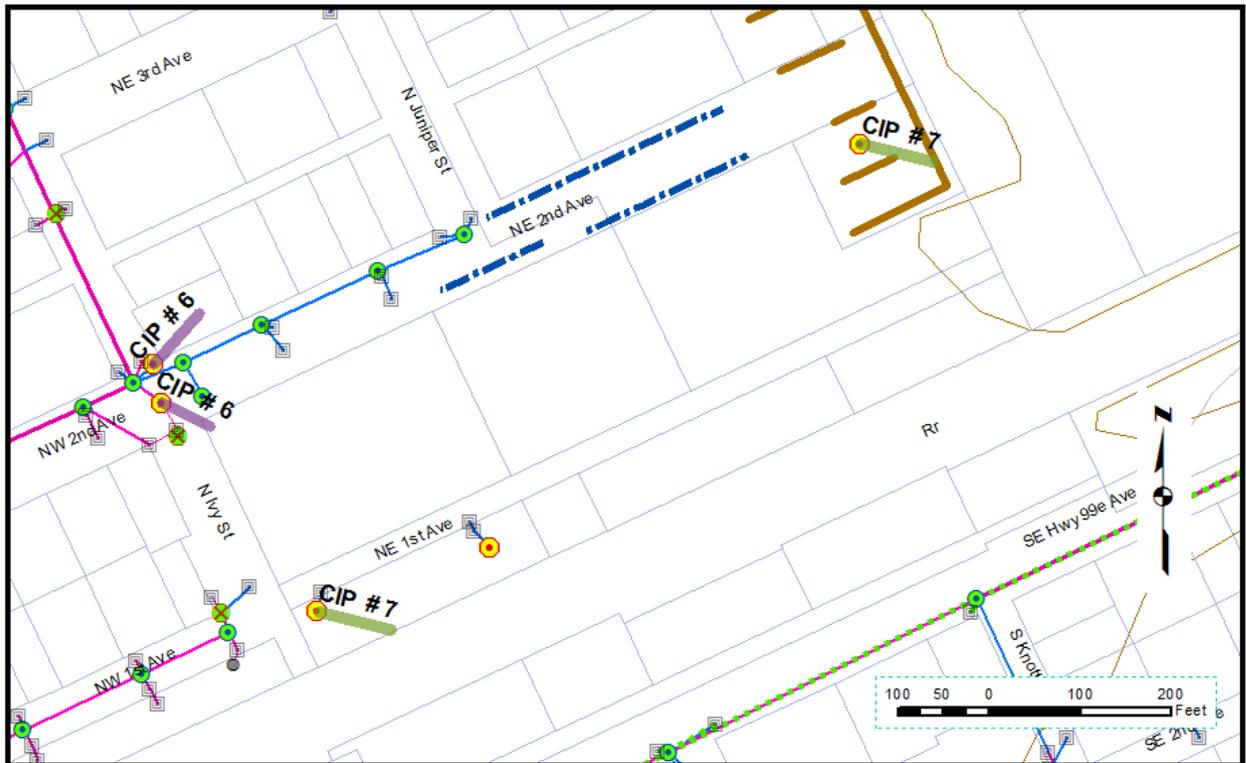
**Schedule:** 0 to 5 years.

### 6.5.7 Cinema and NW 1st and Ivy St UIC Decommission #7

Currently, there is one existing UIC (unnamed) located in the Canby Cinema parking lot near the intersection of NW 2<sup>nd</sup> Ave and N Knott St as well as one UIC located at the intersection NE 1<sup>st</sup> Ave and N Ivy St. The UIC located in the Cinema parking lot is unregistered and no longer in use and should be decommissioned, while the City would like to decommission the UIC located at NE 1<sup>st</sup> and N Ivy St. The exact location of the UICs to be decommissioned is uncertain and should be confirmed as the first step of this CIP.

#### **Recommended Improvements**

The recommended improvement is confirming the location of and decommissioning two UICs. No new or additional stormwater infrastructure is anticipated to be required to handle existing flows, as one of the UICs being decommissioned is currently not being used, and the other is located near existing stormwater infrastructure with excess capacity. The estimated cost of the project is \$40,000.



**CIP #7: Cinema Parking Lot UIC Decommission and NW 1st and Ivy St UIC Decommission**

**Description:** The existing area has one UIC that is unregistered and is currently not used as well as one UIC that is requested to be decommissioned by the City.

**Location:** Cinema Parking Lot near NW 2<sup>nd</sup> Ave and N Knott St. and the intersection of NW 1<sup>st</sup> Ave and N Ivy St.

**Existing System:** The existing system consists of one UIC that is unregistered and no longer in use as well as one UIC that is requested to be decommissioned by the City.

**Proposed System:**

The proposed system is to decommission two UICs. No additional stormwater infrastructure is required.

**Cost:** \$40,000

**Priority:** High

**Schedule:** 0 to 5 years.

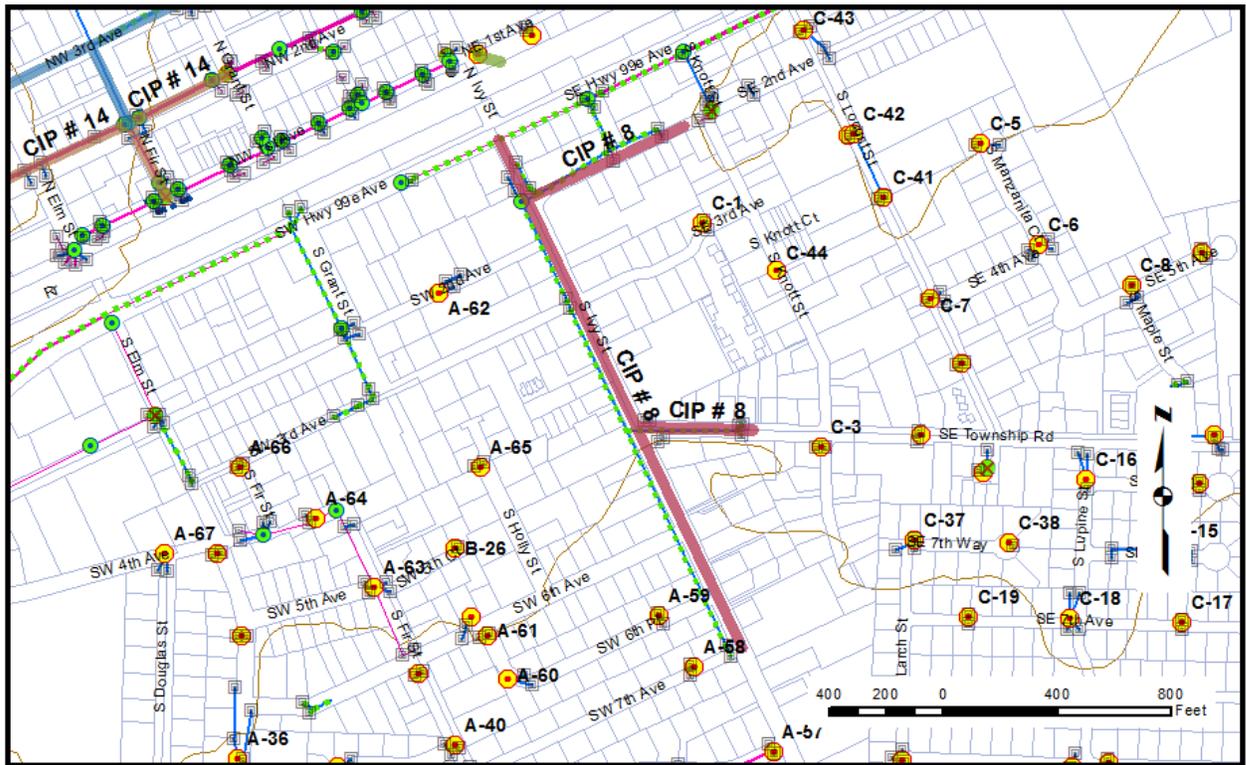
### 6.5.8 S Ivy St. CIP #8

Currently, periodic and minor flooding occurs in this area. The roadway can become overloaded with stormwater runoff. The current stormwater infrastructure consists of a county-owned pipe system with no manholes that is inaccessible and may be full of mud. The system ties into the ODOT system along 99E but the condition of the system is completely unknown. Groundwater modeling indicates this area may have high groundwater. The roadway in this area is under county jurisdiction and all CIPs will require coordination with the County authority. S Ivy St south of approximately SW 7<sup>th</sup> Ave is served by existing drywells that are functioning well.

#### **Recommended Improvements**

The recommended improvements consist of installing pavement piped stormwater system including new manholes and catch basins along S Ivy St. Because of the large number of unknowns this system was not modeled. The drainage basin served is approximately 5 acres and all pipe was assumed to be 18" diameter. Approximately 3000 feet of piping is required. The estimated cost of the project is \$730,000. Because S Ivy St. is currently under Clackamas County Jurisdiction this cost is considered the responsibility of Clackamas County.

In addition to the unknowns along S Ivy St., The ODOT system along Hwy 99E is also of unknown condition and capacity and was not evaluated as part of this Stormwater Master Plan. Therefore, future investigation, and analysis is required before proceeding with this CIP.



**CIP #8: S Ivy St**

**Description:** The existing drainage system lacks sufficient capacity, and periodic flooding occurs, and the condition of the system is unknown. The recommendation is to install pavement new piped system tied into the ODOT Hwy 99E system.

**Location:** S Ivy St. from Hwy 99E to approximately SW 7<sup>th</sup> Ave.

**Existing System:** The existing system consists of capacity county owned and maintained pipe system of unknown condition and capacity.

**Proposed System:** The proposed system is to install a piped stormwater system. Approximately 3,000 LF of pipe is required.

**Cost:** \$730,000 (preliminary estimate) responsibility of Clackamas County

**Priority:** Medium

**Schedule:** 6 to 10 years.

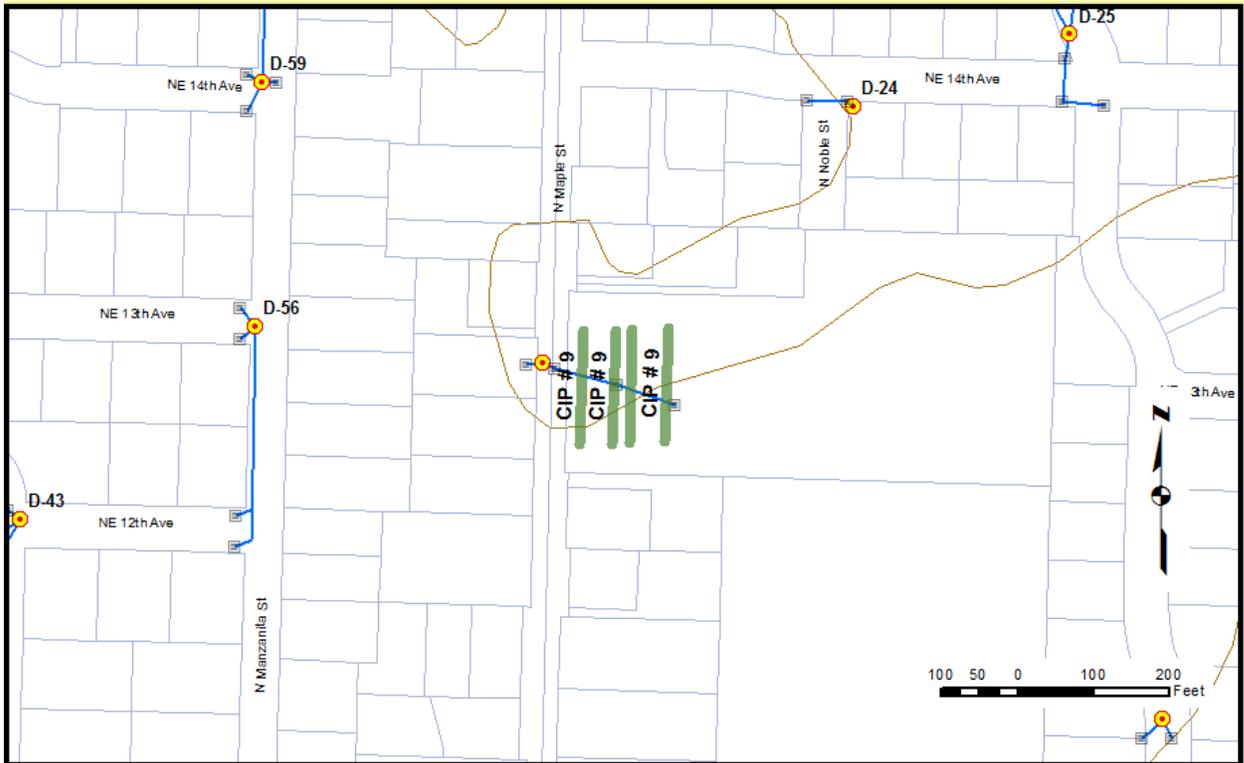
**Requirements:** Further investigation into the condition and capacity of this system and the ODOT system on Hwy 99E should be completed prior or proceeding with this CIP.

#### 6.5.9 N Maple St. at Maple St. Park CIP #9

Currently, minor and periodic flooding occurs in the parking lot of the Maple St Park. The current stormwater infrastructure consists of a slow draining UIC with insufficient capacity.

#### **Recommended Improvements**

The recommended improvements consist of installing pervious pavement within the parking lot to increase infiltration capacity. The pervious pavement should be located within the parking areas. The total approximate area of pervious pavement to be installed is 4,800 ft<sup>2</sup>. The estimated cost of the project is \$30,000.



**CIP #9: N Maple St. at Maple St. Park**

**Description:** The existing UIC drainage system lacks sufficient capacity, and periodic and minor flooding occurs. The recommendation is to install pervious pavement to increase infiltration capacity.

**Location:** N Maple St. at the Maple St. Park

**Existing System:** The existing system consists of a UIC.

**Proposed System:** The proposed system is to install pervious pavement in parking area, to provide more infiltration capacity and mitigate flooding. The total pervious pavement to be installed is approximately 4,800 ft<sup>2</sup>.

**Cost:** \$30,000

**Priority:** Medium

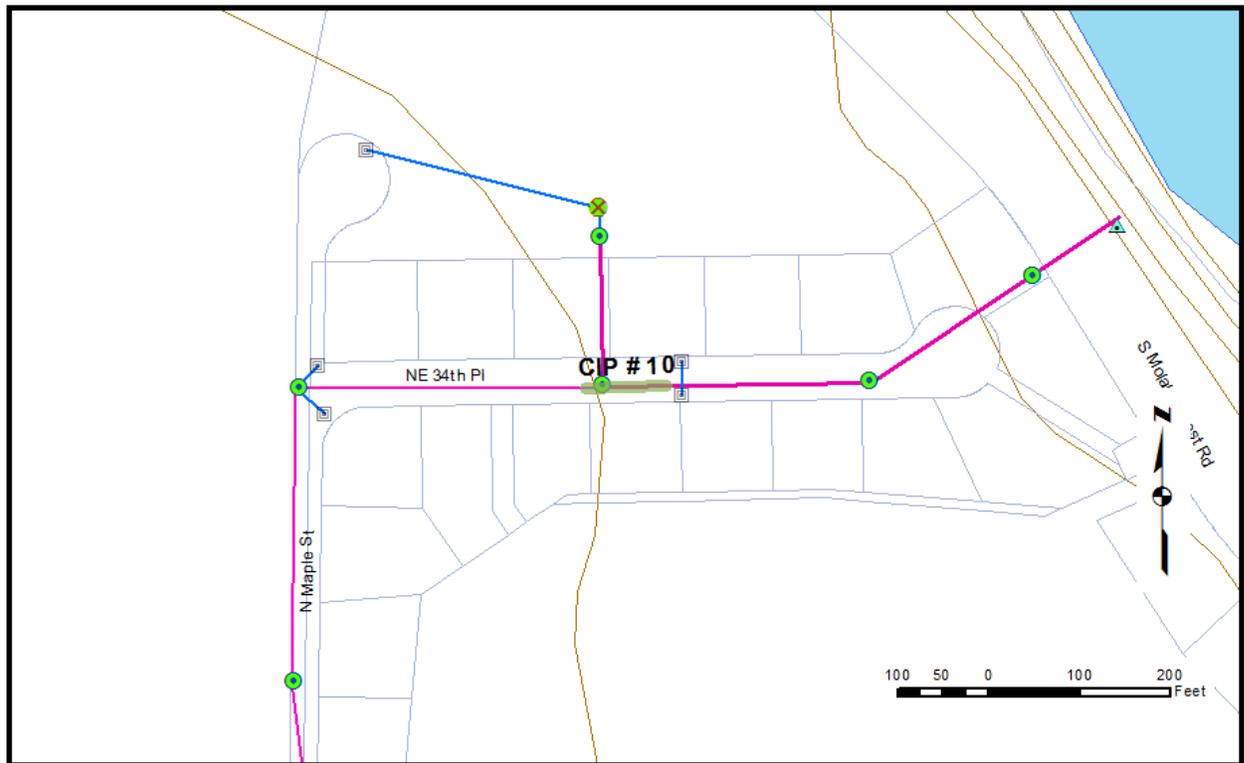
**Schedule:** 6 to 10 years.

#### 6.5.10 N Maple St. and NW 34th PI CIP #10

The current stormwater infrastructure collects runoff from the surrounding residential area as well as runoff from the adjacent farm fields and outfalls to the Willamette River. Although the quality of the stormwater has not been analyzed, it is reasonable to assume that the stormwater has high turbidity due to the runoff from the adjacent agriculture fields. It is anticipated that ORDEQ may require the installation of a flow-through treatment system prior to the outfall.

#### **Recommended Improvements**

The recommended improvement consists of installing a flow through treatment system at the third manhole upstream from the Willamette River outfall approximately half way along NE 34<sup>th</sup> PI. This location will treat the majority of the basin but the storm system is not excessively deep. The estimated cost of the project is \$30,000.



CIP #10: N Maple St. and N 34th Pl

**Description:** The existing drainage system collects runoff from the surrounding residential area, as well from nearby farm fields and outfalls to the Willamette River. It is assumed that the outfall will be required to have flow through treatment in the future.

**Location:** N Maple St. and N 34<sup>th</sup> Pl

**Existing System:** The existing system consists of UICs connected in series via stormwater pipes and manholes; the system outfalls to the Willamette River.

**Proposed System:** The proposed system involves the installation of a flow-through treatment system for suspended solids removal, at the manhole upstream from the existing outfall approximately half way along NE 34<sup>th</sup> Pl.

**Cost:** \$30,000

**Priority:** Medium

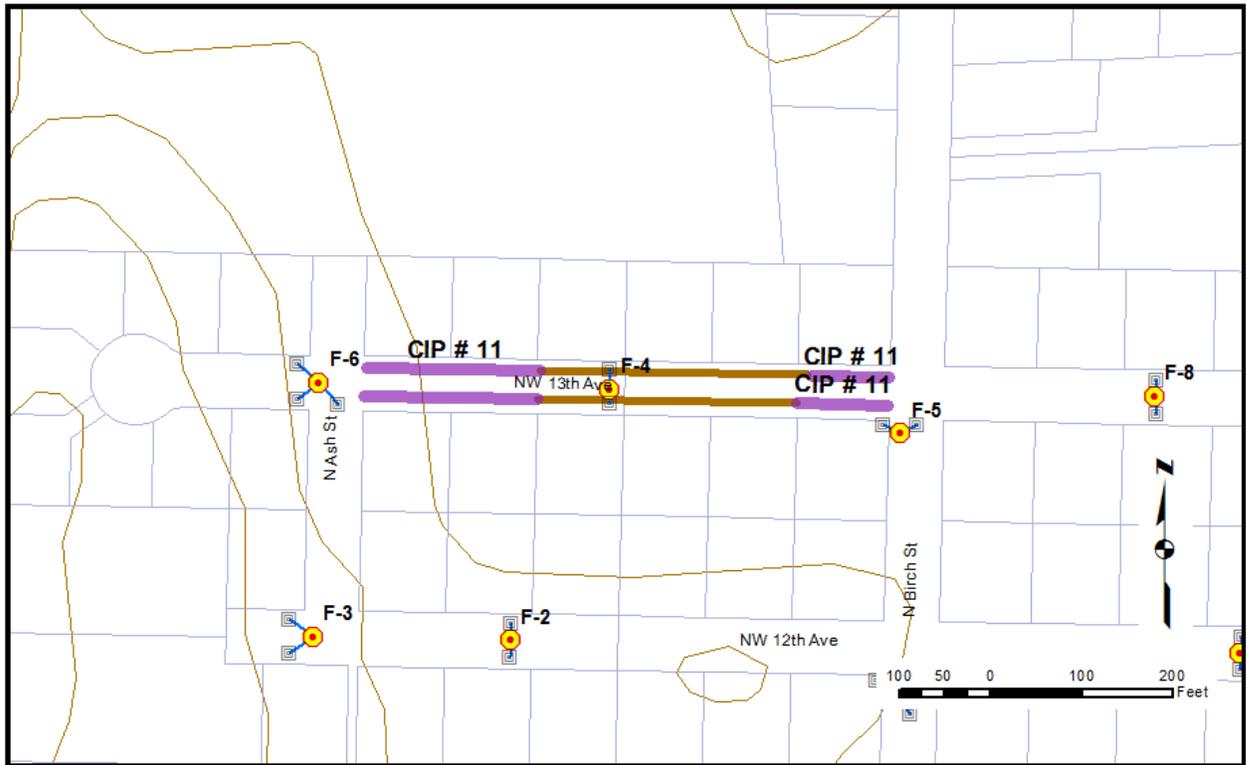
**Schedule:** 6 to 10 years. The priority level of this project may change, depending on ORDEQ requirements.

#### 6.5.11 NW 13th Ave from N Ash to N Birch St. CIP #11

Currently, periodic and minor flooding occurs along this corridor. The roadway can become overloaded with stormwater runoff. The current stormwater infrastructure consists of UICs with insufficient capacity and some pervious pavement.

#### **Recommended Improvements**

The recommended improvements consist of installing additional pervious pavement within the existing right-of-way, within the bike lane, road shoulder, and parking lane to increase infiltration capacity. The pervious pavement should be located on NW 13th Ave, between the N Ash St and N Birch St. The total approximate area of pervious pavement to be installed is 4,800 ft<sup>2</sup>. The estimated cost of the project is \$40,000.



CIP #11: NW 13th Ave from N Ash to N Birch St.

**Description:** The existing UIC drainage system lacks sufficient capacity, and periodic flooding occurs. The recommendation is to increase the infiltration capacity of the area through the installment of stretches of pervious pavement.

**Location:** Along NW 13<sup>th</sup> Ave from N Ash to N Birch St.

**Existing System:** The existing system consists of UICs and some pervious pavement.

**Proposed System:** The proposed system is to install pervious pavement in the bike lane, shoulder and parking lanes of all the street, to provide more infiltration capacity and mitigate flooding. The total pervious pavement to be installed is approximately 4,800 ft<sup>2</sup>.

**Cost:** \$30,000

**Priority:** Medium

**Schedule:** 6 to 10 years.

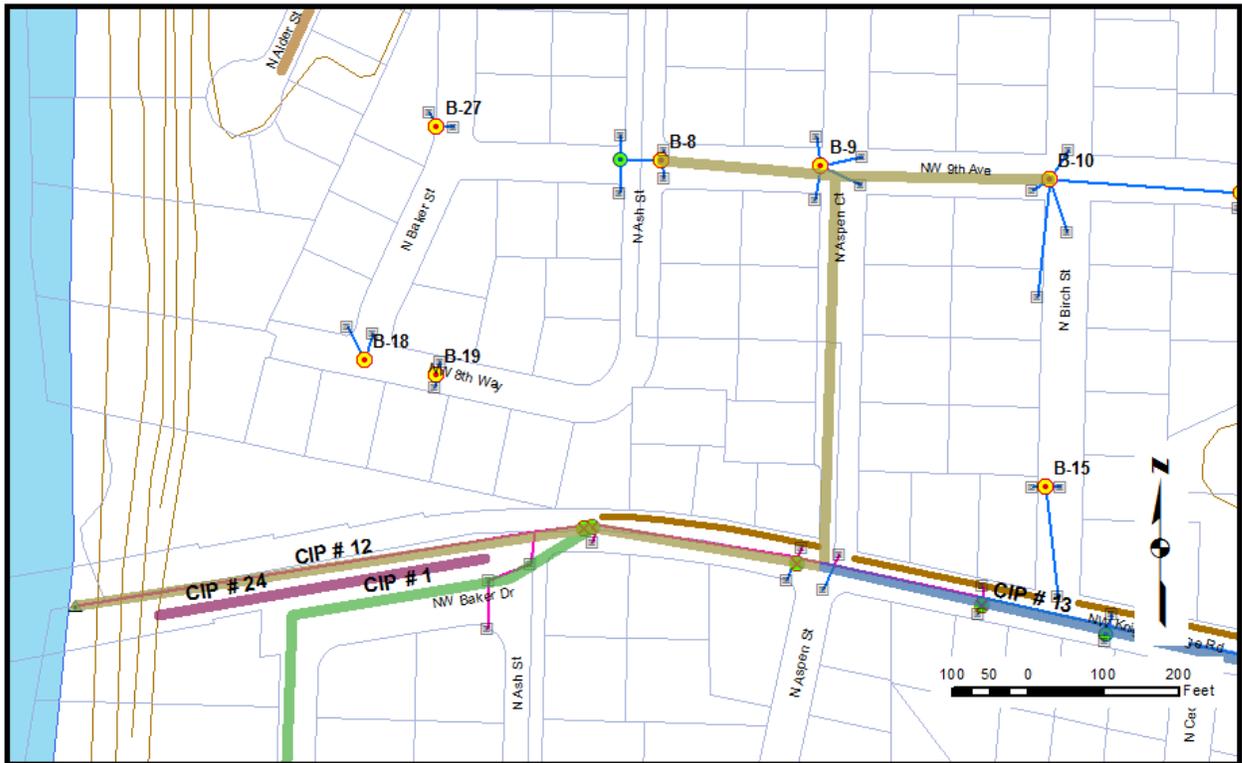
### 6.5.12 NW 9th Ave from N Ash to N Birch St. CIP #12

Flooding has occurred in this area, especially at each intersection. The flooding has currently been mitigated through installation of pervious pavement on NW 9<sup>th</sup> Ave. near N Cedar Ct. and through cleaning of the drywells, however it is anticipated that flooding is likely to occur again in the future. The roadway can become overloaded with stormwater runoff. The current stormwater infrastructure consists of slow draining UICs with insufficient capacity. Depending on the storm intensity this area experiences, flooding can remain in the area for six hours, up to three days.

#### **Recommended Improvements**

The recommended improvements consist of connecting this drainage area to the stormwater line located along N Knights Bridge Rd. The existing UICs should be connected in series along NW 9<sup>th</sup> St, and then piped down N Aspen Court (Ct) to tie into the stormwater conveyance system on N Knights Bridge Rd. An accurate survey of elevations in this system should be completed to confirm the proposed construction can be accommodated within existing grades prior to initiating any other activity for this CIP.

The additional runoff to the Knights Bridge Rd system will require that the storm drain pipe along Knights Bridge Rd from N Aspen Ct to the outfall be upsized as well. The total approximate length of pipe to be installed is 500 LF of 12" diameter and 1,500 LF of 18" diameter HDPE pipe. The estimated cost of the project is \$420,000.



CIP #12: NW 9th Ave from N Ash to N Cedar St.

**Description:** The existing UIC drainage system lacks sufficient capacity and is slow draining. Insufficient capacity leads to flooding, especially at the intersections. The recommendation is to connect the existing UICs via storm drain piping, and connect the drainage area to the Knights Bridge drainage and outfall system. This will require that the storm drain pipe along Knights Bridge Rd from N Aspen Ct to the outfall be upsized as well.

**Location:** NW 9<sup>th</sup> Ave from N Ash to N Birch St, from N Aspen St to Knights Bridge Rd, and from Knights Bridge road to the outfall to the Molalla located on Knights Bridge.

**Existing System:** The existing system consists of UICs. UIC's B-11 and B-10 are connected by existing piping, which may be 10" diameter concrete.

**Proposed System:** The proposed system for mitigating the existing flooding consists of 12" diameter HDPE pipe connecting the existing UICs in series along NW 9<sup>th</sup> St from N Ash to N Birch St. The NW 9<sup>th</sup> UICs will be connected to NW Knights Bridge Rd via an 18" diameter HDPE pipe along N Aspen Ct, connecting this drainage basin to the existing system on NW Knights Bridge Rd, which will require upsizing to an 18" diameter HDPE pipe from N Aspen Ct to the outfall. The total length of pipe to be installed is approximately 500 LF of 12" diameter HDPE and approximately 1,500 LF of 18" diameter HDPE.

**Cost:** \$420,000

**Priority:** High

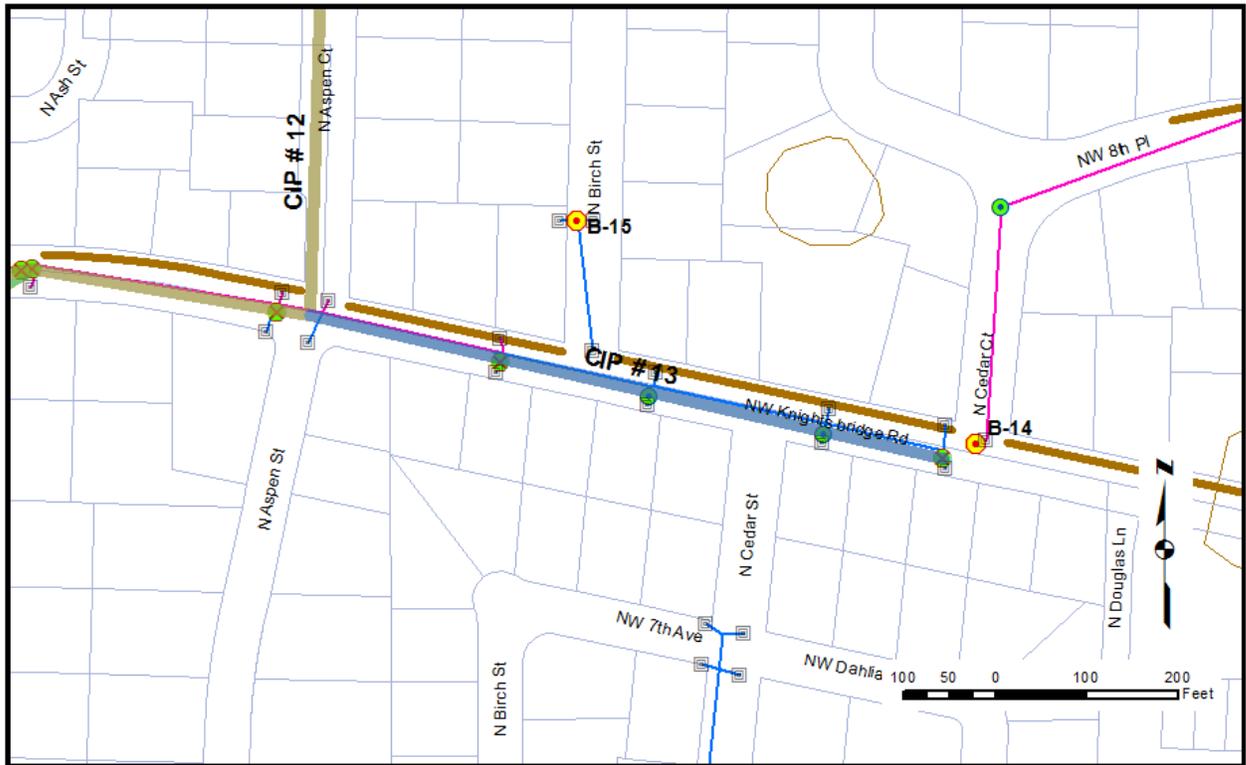
**Schedule:** 0 to 5 years. A survey of the existing system should be completed before initiating any other work.

### 6.5.13 N Knights Road CIP #13

The existing 8" diameter pipe located beneath Knights Bridge Rd from N Aspen Ct to N Cedar Ct currently has misaligned joints and has been infiltrated with tree roots. This greatly reduces the capacity of the existing pipe and the efficiency of the system.

#### **Recommended Improvements**

The recommended improvements consist of replacing the existing 8" diameter pipe with new 12" diameter HDPE pipe. The alignment should tie into the existing alignment at Knights Bridge Rd and N Aspen Ct., which outfalls to the Molalla River. The alignment consists of approximately 750 LF of 12" diameter HDPE. The estimated cost of the project is \$130,000.



**CIP #13: N Knights Bridge Rd**

**Description:** The existing 8" diameter storm drain pipe has misaligned joints and has been infiltrated by tree roots.

**Location:** N Knights Bridge Rd from N Cedar Ct. to N Aspen Ct.

**Existing System:** The existing system consists of 8" concrete and corrugated storm drain pipe.

**Proposed System:** The proposed system includes removing the existing 8" diameter pipe and replacing the alignment with 12" diameter HDPE pipe, tying into the existing Knights Bride Rd alignment at N Aspen Ct. The project consists of approximately 750 LF of 8" diameter HDPE pipe.

**Cost:** \$130,000

**Priority:** Medium

**Schedule:** 6 to 10 years.

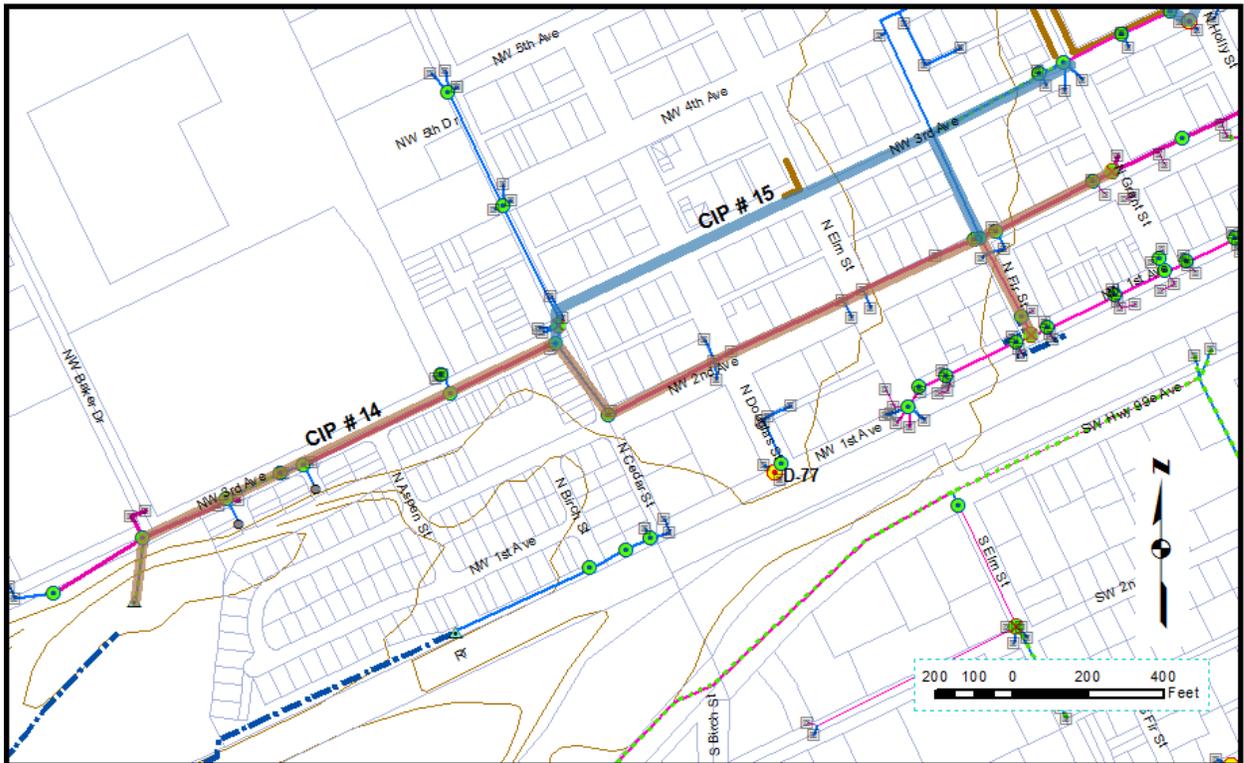
#### 6.5.14 NW 2nd Ave from N Grant St. to NW Baker Dr. CIP #14

Stormwater runoff and conveyance modeling for this area of downtown Canby has shown that the existing infrastructure is undersized, which can lead to surcharging in the pipes and manholes as well as flooding in the area. Furthermore, the existing pipe is old, is in bad condition, has roots, has been observed to be flowing full and needs replacement.

#### **Recommended Improvements**

Prior to initiating any capital improvements to the downtown system (CIP #15 and CIP #16) the city should conduct flow monitoring to verify and calibrate model results. Hydrologic and hydraulic models are particularly sensitive in areas with relatively flat slopes such as found in the downtown areas. Flow monitoring should be conducted at the outfall to the detention pond on NW 3<sup>rd</sup> Ave, at the intersection of NW 2<sup>nd</sup> Ave and N Cedar St. and at the intersection of NW 3<sup>rd</sup> Ave and N Fir St. If model results calibrated through flow monitoring show the existing pipe size is adequate, then cleaning and lining of the existing pipe may be an alternative lower cost option. To be conservative, the estimated cost for pipe replacement with a larger size is presented in this CIP.

The recommended improvements consist of increasing the capacity of the existing conveyance system alignment by replacing the existing pipe with larger diameter pipe. The total approximate length of pipe to be installed is 400 LF of 30" diameter HDPE pipe and 1,350 LF of 36" HDPE. The estimated cost of the project is \$690,000.



CIP #14: NW 2nd Ave from N Grant St. to NW Baker Dr.

**Description:** This area is an integral part of the downtown stormwater conveyance system, and currently consists of multiple pipe segments of different diameters and slopes. Stormwater runoff modeling for this portion of the downtown system demonstrated a lack of conveyance capacity in the existing system, causing surcharging in the pipes and manholes, with the potential for flooding.

**Location:** NW 2<sup>nd</sup> Ave from N Cedar St. to N Grant St., and NW 3<sup>rd</sup> Ave from N Grant St. to NW Baker Dr.

**Existing System:** The existing system consists of piped storm drain systems of various sizes and slopes.

**Proposed System:** The proposed system is to increase the capacity of the existing system. The CIP includes upsizing the existing pipe from N Grant St to N Fir St. from 21" with approximately 400 LF of 30" HDPE, as well as replacing the existing 30" pipe from N Fir St. to NW 3<sup>rd</sup> and NW Baker Dr. at the outfall to the pond with approximately 1,350 LF of 36" HDPE.

**Cost:** \$690,000

**Priority:** Medium

**Schedule:** 6 to 10 years.

### 6.5.15 NW 3rd Ave from N Cedar St. to N Holly St. CIP #15

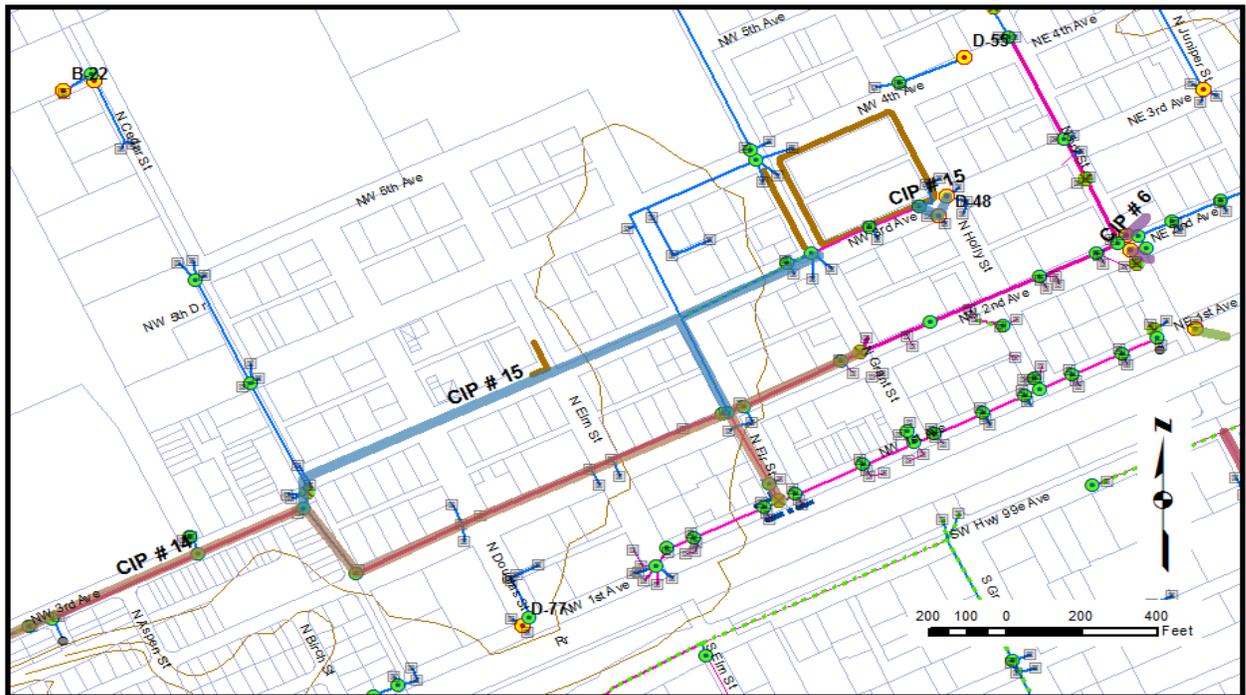
Stormwater runoff and conveyance modeling for this area of downtown Canby has shown that the existing infrastructure is undersized, which can lead to surcharging in the pipes and manholes as well as flooding in the area. To help mitigate surcharging and flooding in the existing conveyance system, CIP #16 involves the installation of a new stormwater conveyance pipeline along NW 3<sup>rd</sup> Ave from N Holly St. to N Cedar St.

#### **Recommended Improvements**

Prior to initiating any capital improvements to the downtown system (CIP #15 and CIP #16) the city should conduct flow monitoring to verify and calibrate model results. Hydrologic and hydraulic models are particularly sensitive in areas with relatively flat slopes such as found in the downtown areas. Flow monitoring should be conducted at the outfall to the detention pond on NW 3<sup>rd</sup> Ave, at the intersection of NW 2<sup>nd</sup> Ave and N Cedar St. and at the intersection of NW 3<sup>rd</sup> Ave and N Fir St. Model results calibrated through flow monitoring will provide more accurate estimates of required pipe sizes.

Decommissioning of the two UICs that is described below should be completed only after the pipe improvements have been completed so that significant flooding problems are not created in the downtown area. In addition, this project should not be completed until CIP #15 has been completed, increasing the capacity of NW 3<sup>rd</sup> St between N Cedar St. and N Baker Dr.

The recommended improvements consist of mitigating the flow from existing stormwater conveyance structures by installing a new stormwater pipeline along NW 3<sup>rd</sup> Ave between N Holly St and N Cedar St. The CIP also involves the decommission of two UICs identified for removal by GSI, as well as the capping of an existing 21" stormwater pipe at NW 3<sup>rd</sup> Ave and N Fir St. The total approximate length of pipe to be installed is 150 LF of 18" diameter HDPE pipe, 400 LF of 20" diameter HDPE, 1,200 LF of 30" diameter HDPE pipe and 2 new manholes and eight new catch basins. The estimated cost of the project is \$670,000.



CIP #15: NW 3<sup>rd</sup> Ave from N Cedar St. to N Holly St.

**Description:** Stormwater runoff and conveyance modeling for the existing downtown Canby basin shows a lack of adequate capacity, which can lead to pipe and manhole surcharging as well as flooding.

**Location:** NW 3<sup>rd</sup> Ave from N Cedar to N Holly St.

**Existing System:** The current system on NW 3<sup>rd</sup> St. includes two UICs located near Wait Park at the corner of NW 3<sup>rd</sup> Ave and N Holly St, a relatively new pipe system connecting catch basins and manholes near NW 3<sup>rd</sup> and N Grant St to the UICs at N Holly St. and an older pipe under NW 3<sup>rd</sup> between N Grant St. and N Fir St. The majority of the stormwater runoff in the downtown Canby is currently handled by the conveyance infrastructure of various sizes along NW 2<sup>nd</sup> Ave.

**Proposed System:** The proposed system is a new stormwater conveyance pipeline along NW 3<sup>rd</sup> Ave from N Grant St. to N Cedar St., connecting to the existing system located at NW 3<sup>rd</sup> and Cedar St. The CIP also includes decommissioning the two existing UICs located near Wait Park at the corner of NW 3<sup>rd</sup> Ave and N Holly St. The system will consist of approximately 150 LF of 18" diameter HDPE pipe in the area of N Holly to N Grant St, approximately 400 LF of 24" diameter HDPE pipe from N Grant St. to N Fir St. as well as 1,200 LF of 30" diameter HDPE from N Fir St. to N Cedar St. The project also includes the installation of 2 new manholes and 8 new catch basins.

**Cost:** \$670,000

**Priority:** Medium

**Schedule:** 6 to 10 years.

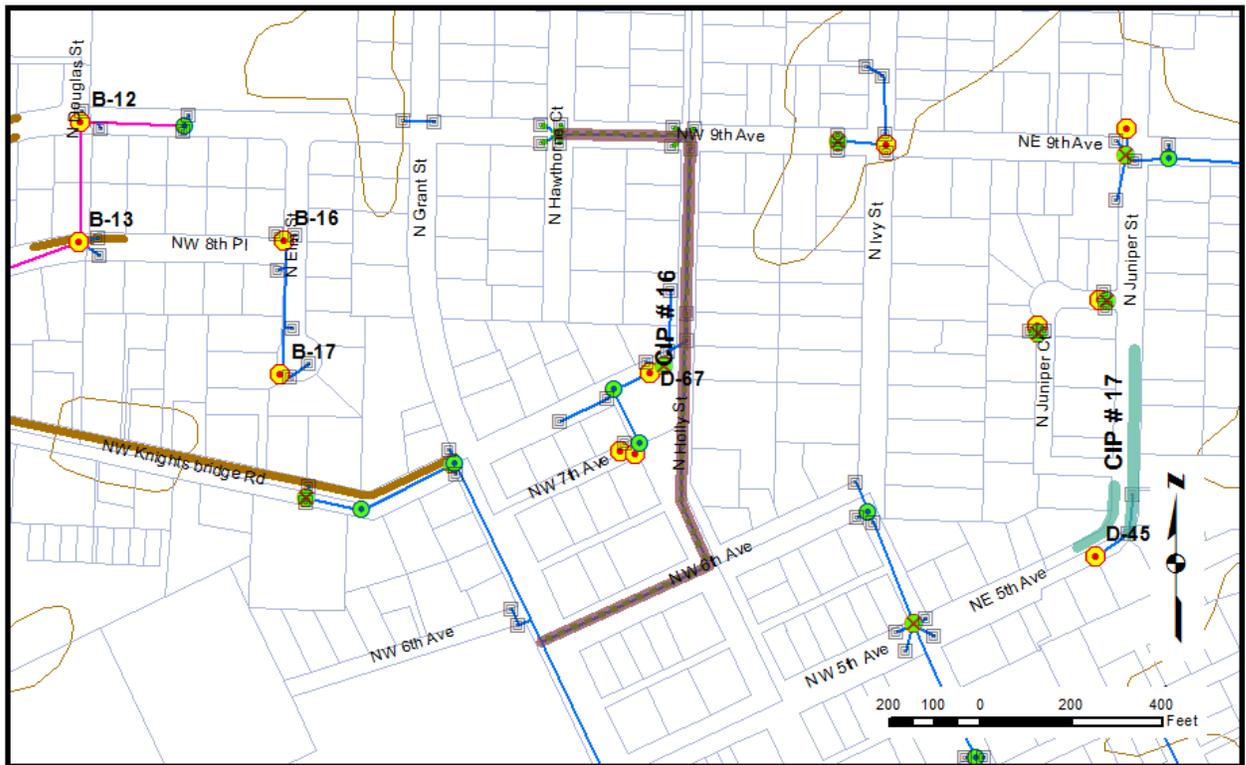
**Requirements:** This project should not be completed until CIP #15 has been completed, increasing the capacity of NW 3<sup>rd</sup> St between N Cedar St. and N Baker Dr.

#### 6.5.16 N Holly St. CIP #16

The N Holly St. drainage basin CIP project extends from NW 9<sup>th</sup> Ave to NW 6<sup>th</sup> Ave along N Holly, and then extends to N Grant St. Stormwater runoff and conveyance modeling for this area has shown that the existing infrastructure is undersized, which can lead to surcharging in the pipes and manholes as well as flooding in the area.

#### **Recommended Improvements**

The recommended improvements consist of increasing the capacity of the existing conveyance system alignment by replacing the existing pipe with larger diameter pipe. The total approximate length of pipe to be installed is 1,650 LF of 12" diameter HDPE pipe as well as the installation of three manholes. The estimated cost of the project is \$310,000.



CIP #167: N Holly St.

**Description:** The N Holly St. drainage basin CIP project extends from NW 9<sup>th</sup> Ave to NW 6<sup>th</sup> Ave along N Holly St., and then extends to N Grant St. Stormwater runoff modeling for this portion of the downtown system demonstrated a lack of conveyance capacity in the existing system, causing surcharging in the pipes and manholes, and a potential for flooding.

**Location:** N Holly St from NW 9<sup>th</sup> Ave to NW 6<sup>th</sup> Ave and from N Holly St to N Grant St along NW 6<sup>th</sup> Ave.

**Existing System:** The existing system consists of an 8" diameter piped storm drain system.

**Proposed System:** The proposed system is to increase the capacity of the existing system. The CIP includes upsizing the existing pipe from N Holly St from NW 9<sup>th</sup> Ave to NW 6<sup>th</sup> Ave and from N Holly St. to N Grant St. along NW 6<sup>th</sup> Ave with approximately 1,650 LF of 12" HDPE.

**Cost:** \$310,000

**Priority:** Medium

**Schedule:** 6 to 10 years.

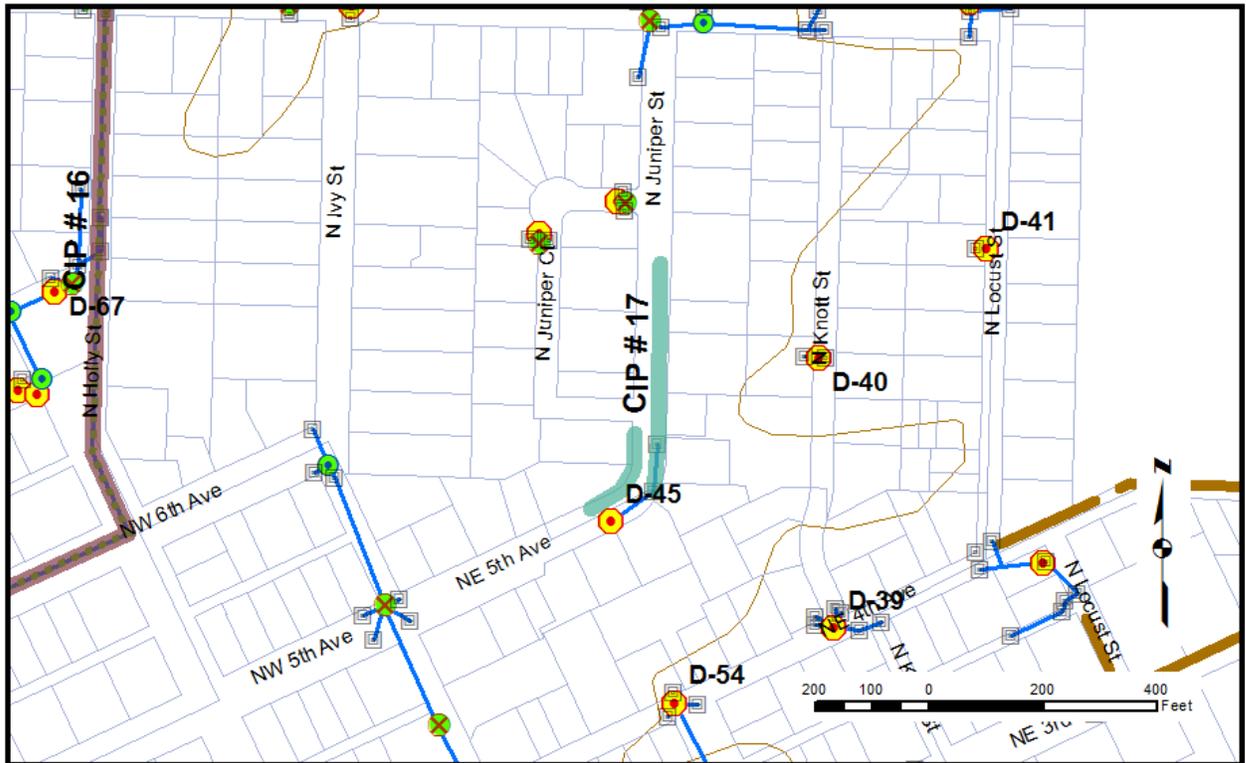
**Requirements:** This project should not be completed until CIP #15 and CIP #16 have been completed, increasing the capacity on NW 3<sup>rd</sup> St.

### 6.5.17 N Juniper and NE 5th Ave #17

The area near N Juniper and NE 5<sup>th</sup> Ave is currently underserved by stormwater infrastructure, with only one UIC in the area. The roadway can become overloaded with stormwater runoff. Furthermore, according to the City Public Works Department, the pedestrian and transportation infrastructure in the area is in need of a redesign and rehabilitation, including the installation of new roadway shoulders and sidewalks.

#### **Recommended Improvements**

The recommended improvement to N Juniper and NE 5th Ave is the installation of approximately 4,800 ft<sup>2</sup> of pervious pavement within the roadway shoulder and parking lane. To save costs, the CIP should be coupled with future roadway improvement projects. The estimated cost of the project is \$30,000.



**CIP #17: N Juniper and NE 5<sup>th</sup> Ave**

**Description:** The existing area is underserved by stormwater infrastructure, and currently is susceptible to flooding. The roadway is in need of improvements according to City Public Works staff, including the repaving and sidewalks.

**Location:** N Juniper and NE 5<sup>th</sup> Ave

**Existing System:** The existing system consists of one UIC in the vicinity of the flooding.

**Proposed System:** The proposed system includes coupling the stormwater improvement project with transportation infrastructure improvements, and installing approximately 4,800 ft<sup>2</sup> of pervious pavement to infiltrate stormwater.

**Cost:** \$30,000

**Priority:** Medium

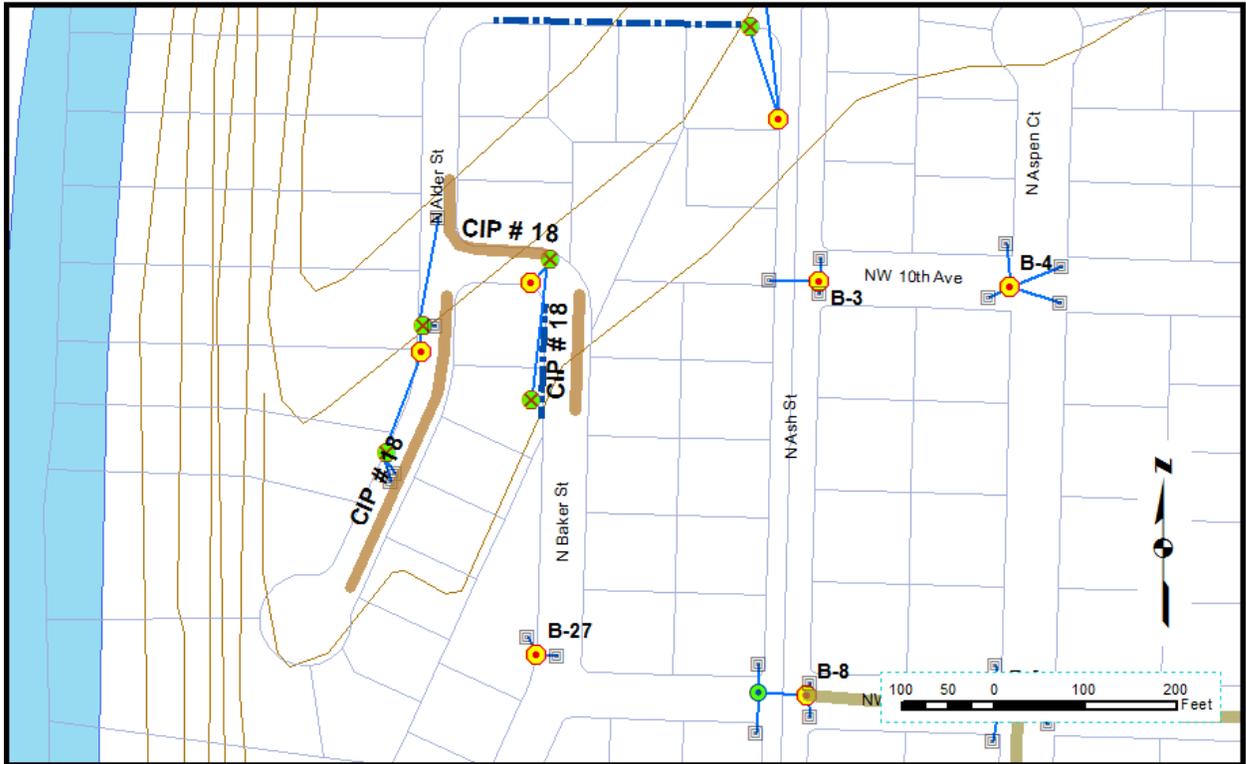
**Schedule:** 6 to 10 years.

#### 6.5.18 N Baker St. and N Alder St.#18

The intersection of N Alder and N Baker St is currently underserved by stormwater infrastructure, with two slow draining UICs in the area. The roadway can become overloaded with stormwater runoff.

#### **Recommended Improvements**

The recommended improvement to N Alder and N Baker St is the installation of approximately 4,800 ft<sup>2</sup> of pervious pavement within the roadway shoulder and parking lane. The estimated cost of the project is \$30,000.



CIP #18: N Alder and N Baker St.

**Description:** The existing area is underserved by stormwater infrastructure, and currently is susceptible to flooding.

**Location:** N Alder and N Baker St.

**Existing System:** The existing system consists of two slow draining UICs.

**Proposed System:** The proposed system includes the installation of approximately 4,800 ft<sup>2</sup> of pervious pavement to infiltrate stormwater.

**Cost:** \$30,000

**Priority:** Medium

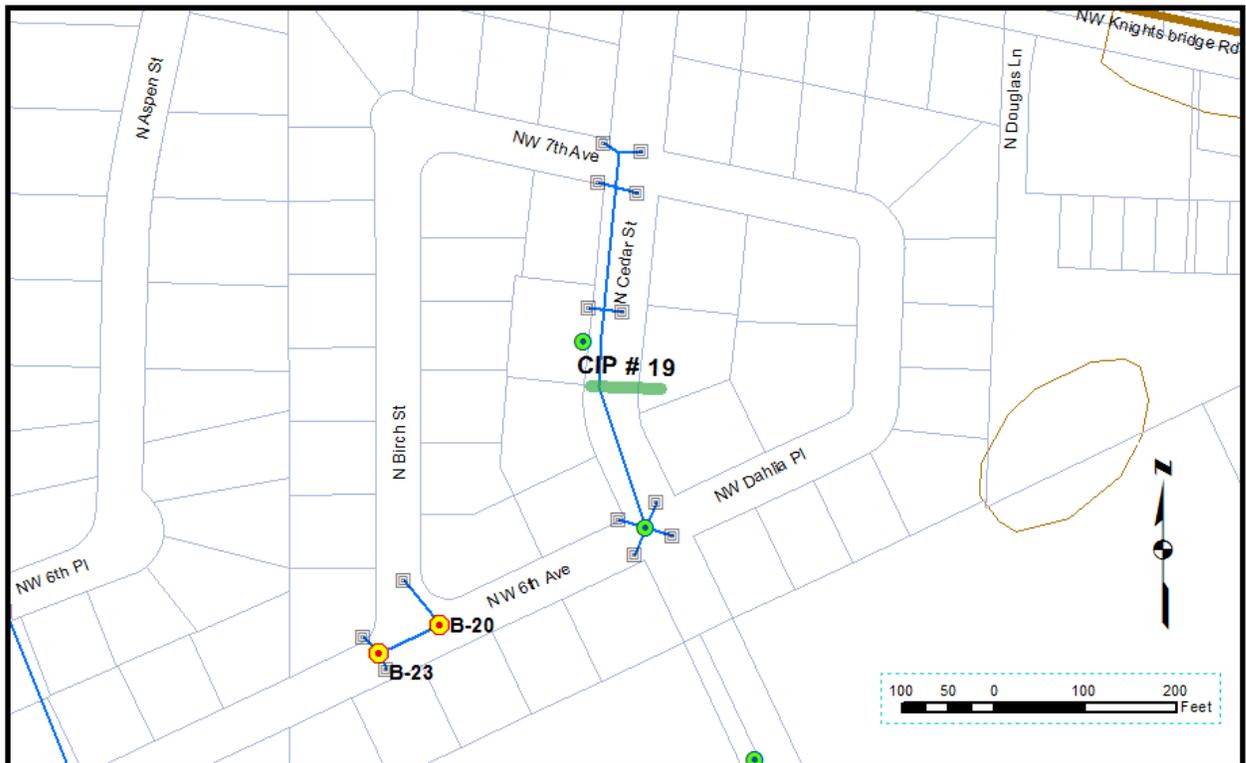
**Schedule:** 6 to 10 years.

### 6.5.19 N Cedar CIP #19

An existing storm drain line along N Cedar St from NW 7<sup>th</sup> Ave to NW Dahlia Pl drains to a UIC at the intersection of NW Dahlia Pl. The current line consists of catch basins and a UIC, but does not have any existing manholes along the line, which creates difficult conditions for cleaning the pipe.

#### **Recommended Improvements**

The recommended improvement to the N Cedar line is to install a new manhole within the alignment, mid-block, between NW 7<sup>th</sup> Ave and NW Dahlia Pl at the location of existing catch basins to allow for cleaning of the storm drain line. The existing catch basins should connect to the new man holes. The estimated cost of the project is \$10,000.



CIP #19: N Cedar St.

**Description:** The existing area consists of a storm drain line draining to a UIC; the alignment has no manholes along the long stretch of pipe, creating maintenance difficulties.

**Location:** N Cedar St between NW 7<sup>th</sup> Ave and NW Dahlia Pl.

**Existing System:** The existing system consists of two slow draining UICs

**Proposed System:** The proposed system includes installing a new manhole within the alignment, mid-block between NW 7<sup>th</sup> Ave and NW Dahlia Pl, at the location of existing catch basin connection.

**Cost:** \$10,000

**Priority:** Low

**Schedule:** 10 to 20 years.

#### 6.5.20 S Pine St. and SE 2nd Ave and SE 3<sup>rd</sup> Ave CIP #20

Currently, significant flooding occurs at the intersections of S Pine St. and SE 2<sup>nd</sup> Ave and S Pine St. and SE 3<sup>rd</sup> Ave. The roadway often becomes overloaded with stormwater runoff. The current stormwater infrastructure consists of unmaintained and poorly functioning privately owned UICs.

#### **Recommended Improvements**

A phased approach is recommended to address this issue. Because the problem is suspected to be unmaintained private UICs, the City should first clean and maintain these private UICs one time and monitor the performance of the stormwater system. If the flooding is resolved for the short term, then the private UICs will have been confirmed to be the likely cause of the problem. The City can then work with the owners of the private system to correctly maintain their system, or proceed with the CIP and secure funding as appropriate.

Assuming the system is not resolved through maintenance, the recommended improvements consist of installing pervious pavements within the bike lane, shoulder and parking lanes of the roadways. The total approximate area of pervious pavement to be installed is 4,800 ft<sup>2</sup>. The estimated cost of the project is \$30,000.

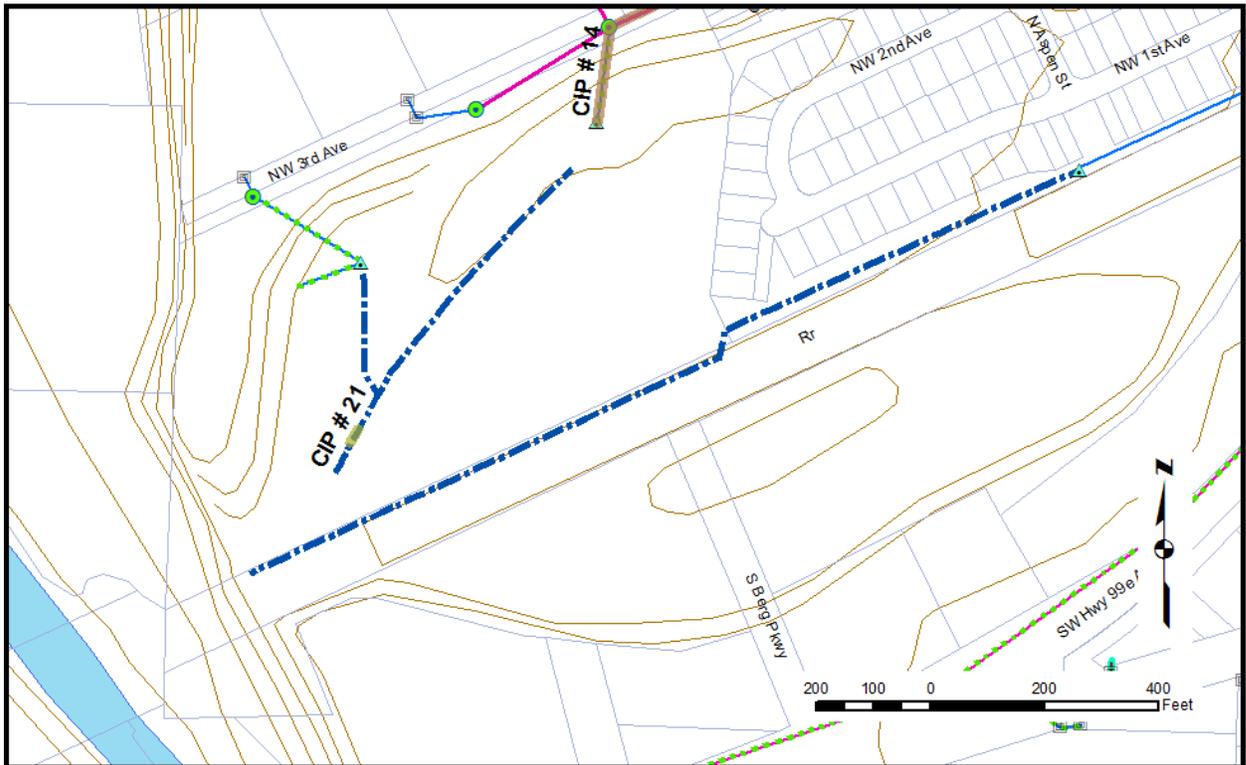


### 6.5.21 Police Station/NW 3rd Ave Pond CIP #21

The City of Canby currently utilizes a constructed stormwater detention pond within an empty field near the Police Station located at NW 3<sup>rd</sup> Ave. The Detention pond flows to a stormwater conveyance swale which outfalls to the Molalla River.

#### **Recommended Improvements**

The recommended improvements to this detention pond is to install a flow monitoring system located just upstream of the existing culverts. This flow monitoring system will allow the City to quantify the discharge occurring from the stormwater pond. The system should consist of constructed concrete channel or flume, a stilling well connected to the concrete channel, and a flow measurement data logger. The estimated cost of the project is \$30,000.



CIP #21: Police Station/NW 3<sup>rd</sup> Ave Pond

**Description:** The existing area consists of a stormwater detention pond and a grassy swale used to convey stormwater to an outfall on the Molalla River.

**Location:** The swale across an undeveloped field near the Police Station on NW 3<sup>rd</sup> Ave.

**Existing System:** The existing system consists of a stormwater detention pond and a grassy swale used for stormwater conveyance and discharge

**Proposed System:** The proposed system includes the installation of a flow monitoring and data collection system located within the grassy swale, just upstream of the existing culverts. The system should consist of a concrete channel and flume, along with a stilling well and a flow measurement data logger.

**Cost:** \$30,000

**Priority:** Low

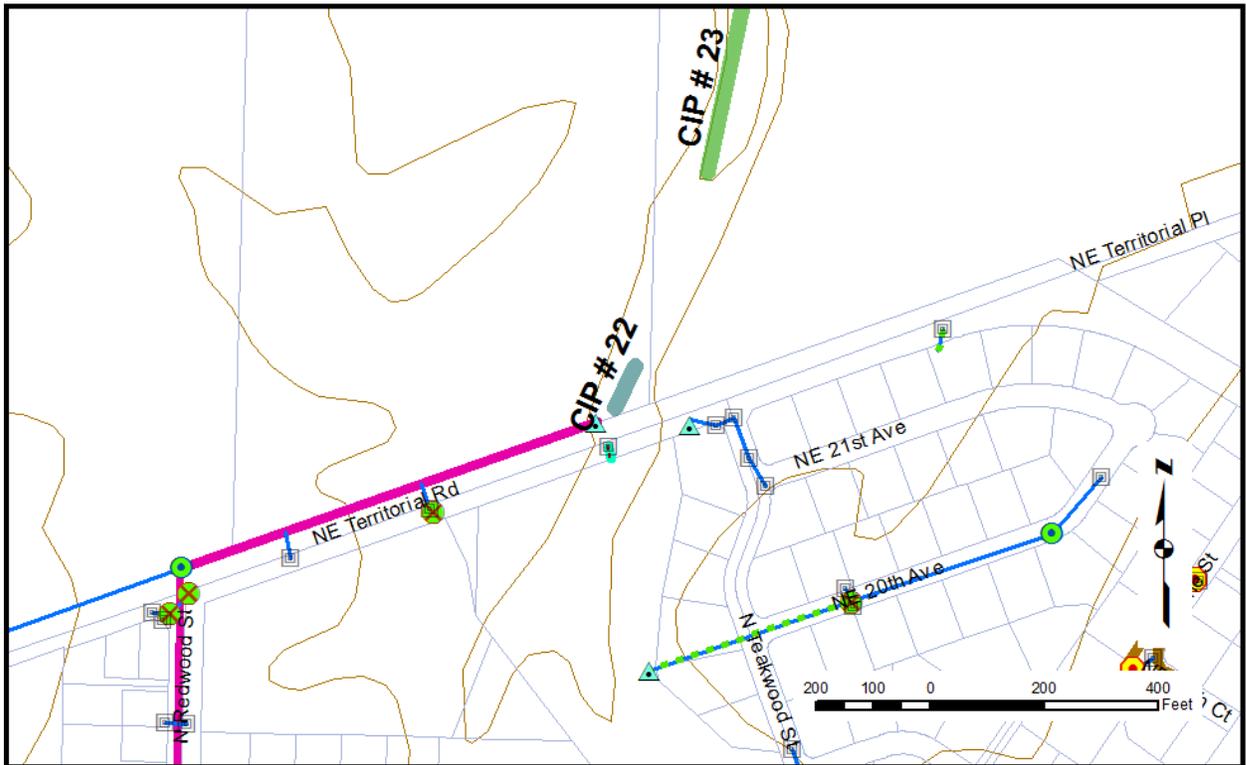
**Schedule:** 10 to 20 years.

### 6.5.22 Fish Eddy Wetland Flow Monitoring #22

Willow Creek is an existing creek which collects stormwater, conveys stormwater runoff to the location of the future Fish Eddy wetland.

#### **Recommended Improvements**

The recommended improvements to this stormwater conveyance creek are to install a flow monitoring system located within Willow Creek, just North of NE Territorial Rd. This flow monitoring system will allow the City to quantify the discharge occurring from the stormwater pond, and provide guidance for sizing the future Fish Eddy Wetland. The system should consist of constructed concrete channel or flume, a stilling well connected to the concrete channel, and a flow measurement data logger. The estimated cost of the project is \$30,000.



CIP #22: Fish Eddy Wetland Flow Monitoring

**Description:** The existing area consists of Willow Creek, which collects and conveys stormwater runoff through the future Fish Eddy Wetland site.

**Location:** Willow Creek, North of NE Territorial Rd

**Existing System:** Willow Creek

**Proposed System:** The proposed system includes the installation of a flow monitoring and data collection system located within Willow Creek, North of NE Territorial Rd. The system should consist of a concrete channel and flume, along with a stilling well and a flow measurement data logger.

**Cost:** \$30,000

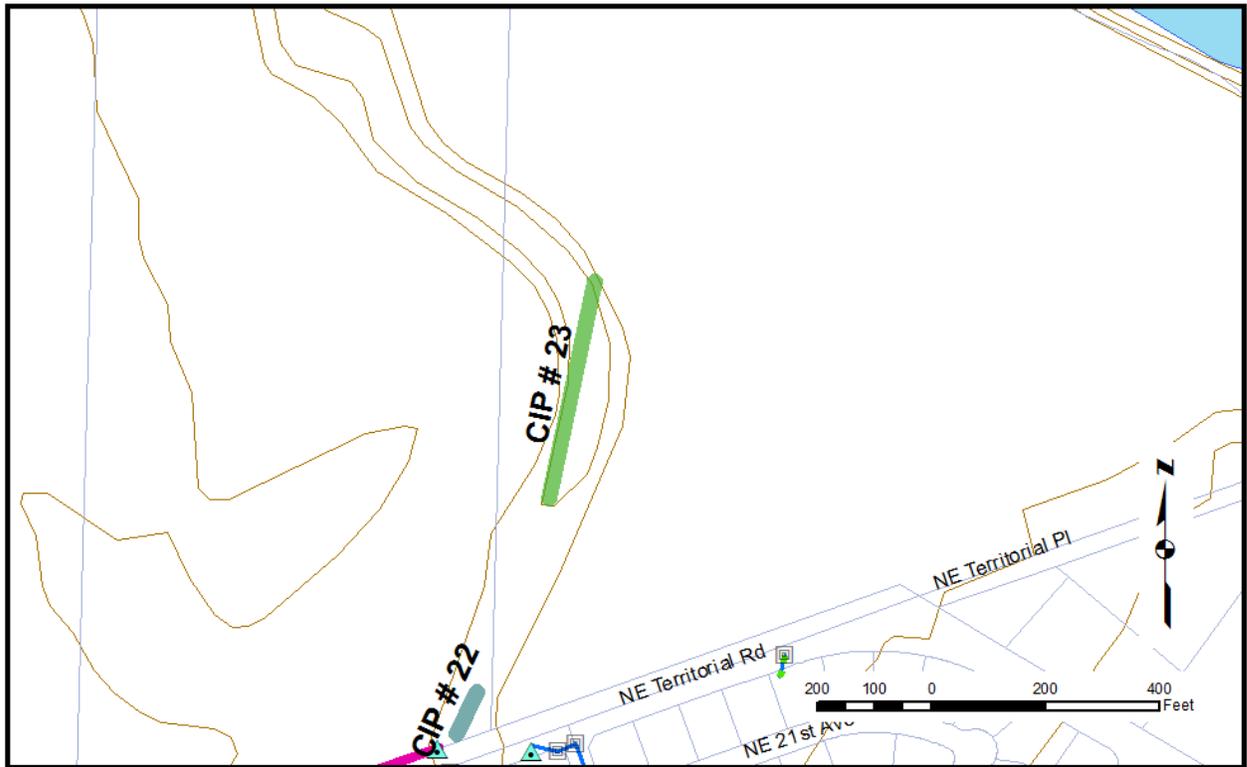
**Priority:** Low

**Schedule:** 10 to 20 years.

### 6.5.23 Fish Eddy Wetland #23

#### **Recommended Improvements**

A stormwater treatment wetland is proposed on the Fish Eddy property north of NE Territorial Rd and adjacent to the existing Willow Creek, as discussed in Section 5.3. This treatment wetland is part of a restoration of the entire Fish Eddy property to native seasonal wetland and wet prairie habitat as part of the Willamette Wayside Properties Master Plan. The estimated cost for the treatment wetland is \$670,000.



CIP #23: Fish Eddy Wetland

**Description:** A stormwater treatment wetland as part of the Willamette Wayside Master Plan

**Location:** Willow Creek, north of NE Territorial Rd

**Existing System:** Willow Creek and agricultural field.

**Proposed System:** A stormwater Treatment Wetland sized to provide water quality treatment, based on the 6-month, 24-hour storm as described in Section 5.3. The cost estimate is for design and construction of the treatment wetland and does not include interpretive features, boardwalks etc., or surrounding landscaping.

**Cost:** \$670,000

**Priority:** Low

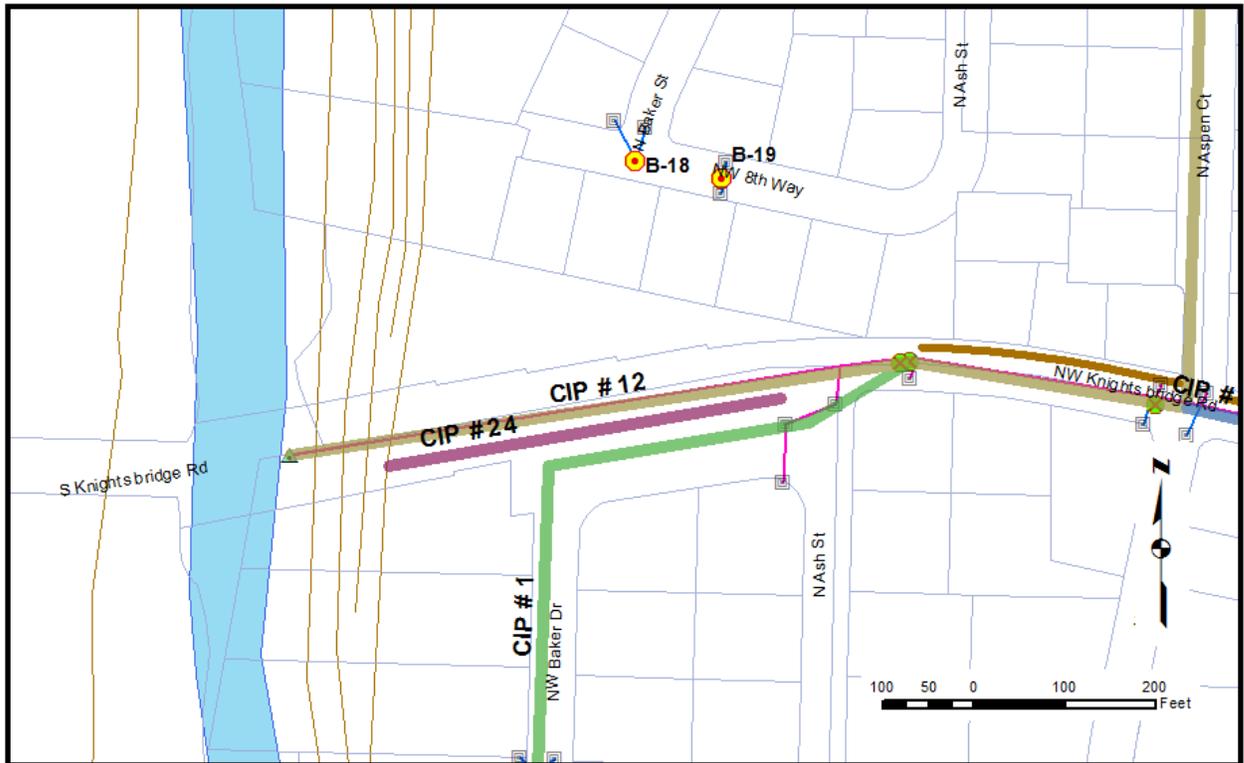
**Schedule:** 10 to 20 years.

#### 6.5.24 Knight's Bridge Runoff Treatment #24

Currently, runoff from the Knight's Bridge basin flows through a Contech Model CDS2015-4 hydrodynamic separator treatment system and then freely discharges to the Molalla River from a pipe attached to the underside of Knight's Bridge.

#### **Recommended Improvements**

A stormwater treatment flow through swale is proposed on the City-owned property on the south side of Knight's Bridge Rd, west of Ash St. This stormwater treatment swale is proposed in anticipation of future DEQ stormwater discharge requirements. The estimated cost for the treatment swale is \$50,000.



**CIP #24: Knight's Bridge Runoff Treatment**

**Description:** A flow through stormwater treatment swale to treat stormwater runoff from the Knight's Bridge basin prior to discharge to the Molalla River.

**Location:** City owned property on the South side of N Knight's Bridge Rd, West of Ash St.

**Existing System:** The basin currently utilizes a Contech Model CDS2015-4 hydrodynamic separator treatment system and then outfalls to the Molalla River via a pipe beneath Knight's Bridge.

**Proposed System:** A flow-through stormwater treatment swale designed to treat for anticipated DEQ stormwater discharge permit requirements.

**Cost:** \$50,000

**Priority:** Low

**Schedule:** 10 to 20 years.

## 6.6 Other Considerations

While compiling data and analyzing the existing stormwater system during the development of this Stormwater Master Plan, other projects, in addition to capital improvement projects, were identified. These other considerations are detailed below.

### 6.6.1 Comprehensive Survey of Existing System

When collecting and analyzing available existing data for this SWMP, it became apparent that there are numerous areas throughout town where the available data is incomplete, or where multiple sources of information do not agree. It is recommended that the City implement a plan to collect a comprehensive survey of the existing stormwater infrastructure system. Comprehensive survey data will allow for updated and accurate mapping and inventorying of the existing stormwater infrastructure, which will help identify future CIPs and aid in locating potential problem areas. It is recommended that the City plan to add the cost of surveying to the annual stormwater budget. A reasonable schedule would be to collect survey data for one basin per year. The anticipated cost for the collection of survey data is \$10,000/year. This cost includes the mobilization of one survey crew for five days, for the purposes of collecting stormwater infrastructure data (Manhole locations, rim elevations, Pipe diameters, pipe invert elevations, catch basins, pipe lengths, UIC locations, UIC RIM elevations, and UIC depth), as well as submitting this data electronically in a format that can be used by the City to update their GIS system mapping.

### 6.6.2 Operation and Maintenance (O&M) Manual

Proper operation and maintenance of infrastructure and devices of a system can prolong its life, improve its performance, and minimize future capital costs. It is recommended that the City create a formal O&M manual for its stormwater infrastructure. The O&M should include an inventory of the existing system, a cleaning schedule for all infrastructures, and a replacement schedule. The anticipated cost for the development of an O&M manual is \$30,000. The O&M manual should be updated and be revised as survey data for the existing system is collected.

### 6.6.3 System Flow Monitoring

During modeling of storm events and stormwater infrastructure conveyance for the SWMP, general assumptions were made. These assumptions, including basin sizes, pipe conditions, and stormwater flow paths, when coupled together, can have a profound effect on the model output. Because little to no historical stormwater flow data was available, it was not possible to calibrate the model and these assumptions, to ensure that the model is providing accurate flow estimates. It is recommended that the City implement a stormwater infrastructure flow monitoring program, which will allow for calibration of the stormwater runoff modeling, and ensure that the CIP projects recommended within this report are accurately sized. The anticipated cost for this ongoing system flow monitoring program is \$10,000/year.

#### 6.6.4 Coordination with Clackamas County and Oregon Department of Transportation

During data collection for the SWMP, it was determined that very little data pertaining to the stormwater infrastructure located beneath the County and ODOT roads was available. Furthermore, these roadways often were problem areas susceptible to flooding. It is recommended that the City make an effort to coordinate data collection as well as roadway and stormwater infrastructure improvements in these areas with the County and ODOT.