

storm sewers are ever built. To-date, stormwater regulations have not been applied to Towns of Skowhegan's size unless they are adjacent to a larger urban area or located on an impaired stream. When stormwater programs have been mandated, they typically consist of public education, best management practices to reduce the potential of pollutant loss, and the periodic monitoring of specific major outfalls. These requirements have not been burdensome to the extent that they should preclude conducting future sewer separation projects to reduce CSO discharges.

In the most urban areas of Skowhegan, there is a greater tendency for pollutants such as oil, grease, and metals to enter the stormdrains from vehicular traffic. Treating stormwater is more critical in downtown, developed urban areas. Now that Skowhegan has constructed excess flow storage in the downtown area and also expanded its treatment plant capacity, it may wish to consider sewer separation work outside of the downtown area as a possible cost-effective method of CSO abatement. A significant amount of the stormwater flowing out the downtown CSO storage tank originates upstream away from the downtown area. Some of these flows cause the storage volume to be filled and, eventually, the tank spills over as a CSO discharge. If some of the less urban flows were removed from the system, the storage reactor may be less prone to overflowing and would be able to contain and hold more of the true urban runoff.

The removal of excess flows from the Skowhegan sewer system by sewer separation or replacement projects is a valuable CSO abatement alternative that should be given consideration, at least in some areas of the sewer system. Now that the Town has been able to achieve excellent CSO reduction progress using storage and treatment methods along with some minor sewer work, consideration of further excess flow removal may make sense.

### 6.2.3 IN-LINE STORAGE

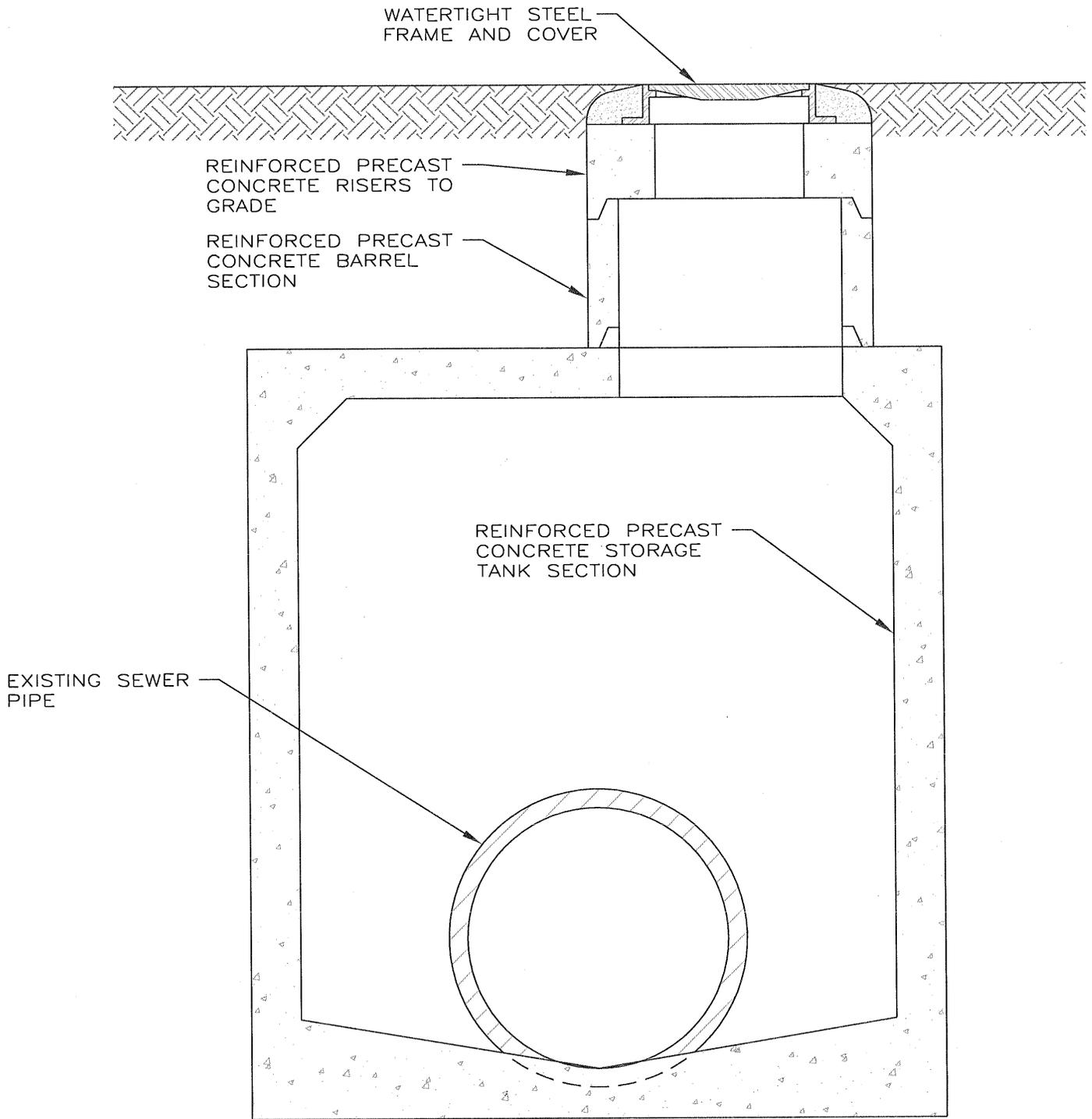
EPA's nine minimum controls for CSO abatement suggest that the in-line capacity of existing sewers and pump stations should be maximized to reduce CSO activity. This approach is attractive given its low cost compared to other options; however, it is limited in effectiveness because it is not always possible to obtain sufficient storage volume within existing piping systems to reduce the CSO discharges caused by large flow surges.

Skowhegan has previously taken advantage of in-line storage to the extent possible. Several pump stations have been upgraded including the Heselton Street, Dinsmore Street and Elm Street stations and larger wet wells were provided at two of these stations at that time. Weir adjustments have also been made at CSO locations to backup water and use the interceptor sewer volume to store peak flows before they are lost out the CSO structures.

For the most part, Skowhegan has already developed in-line storage to its maximum level of acceptance.

- The Island Avenue pump station is an old ejector station that is in need of replacement. Despite the low flow that enters the station, it is associated with an active CSO (No. 009) that has averaged 12 discharge events per year with an average CSO volume loss of 4000 GPD/inch of rainfall. This station should be upgraded in the future with real pumps to eliminate the obsolete ejector station technology. At the same time, it may be possible to add in-line storage using a bigger wet well or offline tank.
- The Town could consider adding in-line storage via precast concrete chambers to store peak flows from the Madison Avenue area. As shown in Figure 19, these structures have a typical sewer invert cast into their base with rectangular storage space provided above the invert. During normal flows, wastewater remains in the invert channel. During peak flows, the channel capacity is exceeded and wastewater backs up into the storage space above the channel. Later, as peak flows subside, the flow elevation slowly dissipates back down to the channel elevation. This type of system could help slow down the rate at which peak flows reach CSO No. 003 at the North footbridge. The usefulness of in-line storage is limited to areas that have sufficient elevation available such that the stored water will not flood adjacent properties. A detailed hydraulic analysis is needed before selecting this option at any location. If sufficient elevation is not available, offline storage below the sewer channel may be needed along with pumps to bring the water back when wet weather conditions subside.

In-line storage might be considered in these two areas as part of future CSO abatement efforts. It will not be considered elsewhere in the sewer system because it appears that this option has been successfully implemented already in most places where it would be beneficial.



TOWN OF SKOWHEGAN  
 TYPICAL PRECAST IN-LINE STORAGE TANK

FIGURE 19

#### 6.2.4 OFFLINE STORAGE

Offline storage can be an effective method for CSO abatement. Storage tanks are built next to the sewer system at key locations and remain empty at normal flows. During wet weather events, peak flows will begin to surcharge the sewer system and overflow into the storage tank. As wet weather events subside, the stored flows can slowly be pumped back to the sewer system and processed at the downstream wastewater treatment plant. The Town's most recent CSO Master Plan recommended the addition of offline storage at several pump stations during their upgrade. A 1.0 MG storage tank was also built on Water Street at CSO No. 010 near the North Avenue intersection.

Offline storage reactors have the advantage of allowing all peak flows to receive treatment. If sufficient storage is provided, all of the stored water will eventually be sent to the downstream wastewater treatment plant. However, this approach has the disadvantage of needing to be precisely sized in order to stop all CSO discharges. Once the constructed storage volume is filled, CSO activity will continue to occur. When this happens, the CSO discharge may be occurring at low storm frequencies because all of the peak flows still remain in the sewer system. The 1.0 MG storage tank has been active an average of eight times per year. When this has occurred, 94% of the events were less than a one-year storm and 61% were less than a three month storm. CSO losses averaged 650,000 GPD/inch of rainfall. This suggests that the present storage volume, while having reduced CSO discharges, will not be able to meet the one-year threshold storm criteria without additional measures being taken. The solution may be to add more storage or to remove excess flows upstream.

As discussed, it is difficult to accurately model or predict the exact amount of runoff that will occur from every rainfall event in Skowhegan. Many factors are at play to determine the volume of water that needs to be stored. In our opinion, adding more offline storage at key locations in Skowhegan is an option that should be considered; however, it should be done with the recognition that this method may not capture all of the storm events that will occur unless the tank is grossly oversized based on very conservative assumptions. Before building additional offline storage, it may prove to be more cost-effective to consider removing some of the excess flows upstream at their source. This would allow the existing storage tank to store water generated in the urban downtown area instead of having its capacity consumed by non-urban upstream flows.

The offline storage option also has the disadvantage of leaving old clay sewers in place upstream. As discussed, the Town will eventually have to address the aging condition of some of its old clay sewer lines apart from the present CSO focus. In making decisions to consider additional offline storage instead of upstream excess flow removal, the fact that sixty percent of Skowhegan's sewer system is

constructed of clay and asbestos cement pipe may be a mitigating factor to remove excess flows rather than building more storage tanks. The capital cost of upstream sewer projects will result in new sewer infrastructure with a 100 year useful life. The money invested to build storage tanks only provides benefits on a few wet weather days per year and will not eliminate the long term need to address the Town's old sewer system. Nonetheless, offline storage remains a viable alternative for CSO abatement that should be given consideration for future implementation.

#### 6.2.5 EXCESS FLOW TREATMENT

Excess flow treatment is often considered as an attractive CSO abatement option because it allows all flows to receive some benefit of pollutant removal. This can be done at a central treatment facility or at satellite plants located upstream in the sewer system. Skowhegan is already utilizing this approach with the Phase I expansion of the wastewater treatment plant to a higher capacity of 7.5 MGD. This expansion was done consistent with EPA and DEP policies that recommend treatment plants in CSO communities to be able to process at least the hydraulic capacity of the interceptor sewers. The South side interceptor has a reported hydraulic capacity of 6.5 MGD. When combined with the adjacent Joyce Street sewer subsystem, a peak flow of 7.5 MGD is reasonable for wet weather flow processing.

In early CSO Master Plan studies, expanding the wastewater treatment plant to a capacity of 15 MGD was suggested. While this amount of excess flow may be present in the sewer system during wet weather events at a five-year storm frequency of 3.50 inches/day, the interceptor sewer system would not be able to carry such a large flow to the plant. With a siphon capacity of only 3.50 MGD and the South side interceptor capacity of only 6.50 MGD, significant sewer work would be needed to get the flow to the plant site. It would make more sense to perform sewer work on some of the old upstream sewer lines instead of building new lines to reach the sewer plant. In our opinion, any further expansion of the treatment plant for CSO purposes is not warranted. This option will not be considered.

The construction of satellite treatment systems using a vortex swirl concentrator at various upstream locations has been considered in the past. Suggested locations have included both sides of the system at the North footbridge (CSO No. 003) and the South footbridge (CSO No. 008). Such a system has the advantage of solving the CSO problem by treating all flows that would otherwise discharge out these CSO structures. However, there are several disadvantages to a satellite treatment approach as follows:

- A satellite treatment plant requires the expenditure of large amounts of money that provide a benefit only a few days of the year. The 100 year old sewer lines that are generating some of the peak flows would provide a 100 year useful life if replaced.
- There is very little land area available near CSO no. 003 and 008 to construct a treatment facility. Siting of this system will be a challenge.
- Satellite treatment plants will have added testing, monitoring, and operational requirements for the treatment plant staff. This will lead to increased operational costs for the Town.
- In the 1995 CSO Master Plan update, satellite treatment was recommended, but later changed by the Town to the option to build the 1.0 MGD storage water tank Water Street instead. The conditions upon which this decision was based have not changed.
- In our opinion, satellite treatment systems for CSO abatement work best when no other variable option for CSO abatement remains. We believe that this approach best suited to address the last remaining CSO abatement needs of the community when no other cost-effective solutions can be implemented. In Skowhegan, we believe the Town should first determine if it can solve CSO problem by considering peak flow removal in selected areas as well as adding additional storage before building satellite treatment systems. For the purposes of this Master Plan update and at this point in 2012, it is our opinion that better CSO abatement options exist than satellite treatment. For this reason, this approach will not be given further consideration at the present time.

### 6.3 SELECTED PRINCIPAL ALTERNATIVES FOR EACH CSO

Having reviewed the CSO abatement alternatives that are available to the Town of Skowhegan, it is now appropriate to evaluate the approaches that would be best suited for implementation at each CSO. A discussion of recommended CSO abatement measures in the nine subsystems served by each CSO location follows:

#### 6.3.1 HESELTON STREET PUMP STATION CSO NO. 002

The Town's recent Phase II work to upgrade the Heselton Street Pump Station and to reroute upstream sewers away from the sewer subsystem have effectively eliminated CSO activity at this location. No CSO events have occurred at Heselton Street since 2006. However; since this pump station is located at the end of the Town's sewer area, the flows that it pumps will impact up to five additional downstream CSO locations. Therefore, any excess flows removed from this subsystem will benefit other CSO points.

The sewer on Heselton Street was found to be the major source of excess flow on this subsystem. Groundwater infiltration was measured at 10,000 GPD during Spring high conditions, and stormwater inflow rates were measured at 35,000 GPD/inch of rain. This suggests that this sewer is contributing an average excess flow of 57,000 GPD during a three month storm, 94,000 GPD during a one year storm, and 175,000 GPD during a twenty-five year storm. There are other areas in the sewer system with greater excess flow generation rates, but the 12" Ø clay sewer on the street is in extremely poor condition. The Town is planning to upgrade the sewer on Heselton Street in the near future. If this project is successful in removing fifty percent of the infiltration and seventy-five percent of the inflow, as is typical, about 40,000 GPD of peak flow is removable during a three month storm, about 68,000 GPD during a one year storm, and 128,000 GPD during a twenty-five year storm. The Town's plans to address the deficiencies on Heselton Street will have a positive impact on downstream CSO activity.

### 6.3.2 NORTH FOOTBRIDGE SIPHON INLET CSO. NO. 003

The North footbridge CSO at the siphon inlet (No. 003) has been active an average of five times per year since the Phase II projects were completed, with annual activity ranging from one event in 2008, to seven events in 2011. The CSO is active 77% of the time at less than a three month storm, and 100% of the time in a 6 month storm. CSO volume losses have averaged 53,000 GPD/inch of rainfall. Madison Avenue and Winter Street are adding a total 111,000 GPD of groundwater infiltration into the sewer system. These same streets are adding an average inflow contribution rate of 480,000 GPD/inch of rainfall. During wet weather events, flows from these upstream areas can average 760,000 GPD during a 3 month storm, 1.26 MGD during a one year storm, and 2.4 MGD during a twenty-five year storm.

In addition to excess flows that are generated in the immediate vicinity of CSO No. 003, all excess flow sources on the North side of the Town must pass by this location to reach the siphon. Total groundwater infiltration from the North side is measured at about 420,000 GPD with total stormwater inflow estimated at a rate of 2.10 MGD/inch of rainfall. This suggests that an average of 3.25 MGD is present during a three month storm, 5.44 MGD during a one year storm, and 10.30 MGD during a twenty-five year storm. These peak rates have been mitigated by the addition of 1.0 MG of storage along the interceptor as well as inline storage ahead of several of the pump station wet wells, so all this peak flow does not reach CSO No. 003 at these high rates. Still, the abatement of CSO No. 003 to meet a one-year or higher storm threshold remains a major challenge.

All North side CSO abatement projects in the Elm Street, North Avenue, Court Street, Water Street and Heselton Street sewer subsystems will have a beneficial impact on CSO No. 003. As will be discussed, some of these projects should be

constructed first because they also have the dual benefit addressing CSO discharges elsewhere in the system. It may make sense for the Town to address some of these upstream sewer areas first, to eliminate them as problems before making a final decision on how to best address CSO abatement needs at the CSO No. 003 location.

Potential CSO abatement alternatives at this location include the following:

- Remove excess flows from the old clay and combined sewer lines on Madison Avenue and Winter Street. If fifty percent of the groundwater infiltration and seventy-five percent of the stormwater inflow can be removed, these projects would decrease peak flow rates into this area by about 625,000 GPD during a three month storm, 1.00 MGD during a one year storm, and 1.85 MGD during a twenty-five year storm.
- Add additional storage to this area. In order to capture the peak CSO losses from this subsystem alone, we estimate that an additional 150,000 gallons of storage will be needed retain a one year storm, and that 300,000 gallons of offline storage will be needed to retain a twenty-five year storm. This assumes that peak flows from upstream areas would be addressed at those areas. More detailed modeling and data analysis would be needed before developing a final design basis to size the storage tank. If upstream CSO abatement projects are to be scheduled, it may make sense to delay the decision to construct a storage tank until a later point in the program. The storage option will likely not be cost-effective or viable due to site constraints in this area.

The most appropriate CSO abatement options for CSO No. 003 at this time will likely be sewer system separation projects on both Madison Avenue and Winter Street.

### 6.3.3 JOYCE STREET CSO NO. 004

The Joyce Street CSO has been active an average of twenty times per year since the construction of the Phase I and II work. The average CSO volume loss has been 22,000 GPD/inch of rainfall. Over 93 % of these events have occurred at less than a one year storm event, while two thirds of the CSO overflows have been at less than a three month event.

The major source of excess flow in the Joyce Street subsystem appears to be from old clay sewer lines on Joyce Street, the Joyce Valley between Mount Pleasant Street and Milburn Street, the cross-country sewer to the Waterville Road, Mount Pleasant Street and from the adjacent Dickey Street Subdivision area. Peak groundwater infiltration from these sewers was measured at 180,000 GPD and peak stormwater inflow rates at 510,000 GPD/inch of rainfall. This suggests that

peak excess flow from these sewers could reach 870,000 GPD during a three month storm, 1.40 MGD during a one year storm, and 2.60 MGD during a twenty-five year storm.

Peak flows from all upstream areas of the sewer system up to the interceptor's hydraulic capacity, must pass by CSO No. 004 due to its location near the treatment plant. The total peak flow in the sewer system has been estimated at 6.50 MGD (infiltration plus inflow) during a three month storm, 11.0 MGD during a one year storm, and 20.7 during a twenty-five year storm event. These flows will not reach the Joyce Street CSO because they are limited by the reported 3.5 MGD capacity of the siphon and the 6.5 MGD capacity of the interceptor sewer. Since the treatment plant has already been expanded to match the interceptor's capacity, it appears that reducing excess flows from the Joyce Street subsystem makes more sense than providing storage at this location. It appears that significant volumes of excess flow are entering the Joyce Street area from old clay lines that are in extremely poor condition and located in wet areas. We recommend that the sewers be improved to reduce peak flow levels. If fifty percent of the groundwater infiltration and seventy-five percent of the stormwater inflow is removed, about 600,000 GPD of the peak flow rate will be reduced during a three month storm, 1.15 MGD during a one-year storm, and 2.00 MGD during a twenty-five year storm. The reduction of these peak flows will have a positive effect on reducing CSO losses through No. 004 and possibly eliminating the Joyce Street CSO altogether.

#### 6.3.4 ELM STREET PUMP STATION CSO NO. 005

The Elm Street Pump Station was upgraded in 2007 as part of the Phase II CSO abatement program. Since then, it has averaged nine CSO events per year with an average CSO volume loss of 43,000 GPD/inch of rainfall. The CSO is now active during 80% of all storms that are less than a one month frequency. Nearly 60% of all CSO events occur during a three month or less storm event.

The majority of the excess flows that enter this station appear to originate on Mary Street, Summer Street and Bennett Street. Total groundwater infiltration is estimated at 50,000 GPD and stormwater inflow is estimated at 180,000 GPD/inch of rainfall. This corresponds to excess flow rates of 300,000 GPD during a three month storm, 480,000 GPD during a one year storm, and 900,000 GPD during a twenty-five-year storm. The previous upgrade of this station was not sufficient to eliminate CSO activity given these high peak flow rates. In our opinion, the Town should address the Elm Street pump station CSO by removing peak flows at their source. Mary Street has a relatively new sewer that leaks profusely. During rain events, the runtime meter at the Norridgewock Avenue pump station shows that pump operating time has increased by 500%. The source of these excess flows could be roof drains, yard drains, foundation drains, or sump pumps. They could

also be from poorly installed sewer pipes. It may be possible to re-line some of these sewers to reduce their leakage rate. The Town recently repaired a broken sewer in this area which may have been a major cause of the excess flows. Further monitoring should be conducted to determine if any additional work is needed.

Summer Street and Bennett Street contain areas of old clay pipe that are likely in poor condition with numerous combined catchbasins. If these sewers were separated and fifty percent of the infiltration and seventy-five percent of the inflow were removed, it may be possible to reduce flows to the pump station by 200,000 GPD during a three month storm, 350,000 GPD during a one year storm, and 650,000 GPD during a twenty-five year storm. This should effectively eliminate CSO activity at the Elm Street pump station.

The previous Master Plan suggested that a 2,500 gallon storage tank could be installed to address CSO discharges at this location. This tank does not appear to be large enough since CSO overflows exceed that volume at far less than a one year storm event. We estimate that at least 130,000 gallons of storage will be required to retain a one year storm and that about 250,000 gallons would be needed to retain a twenty-five year storm. In our opinion, it does not make sense to invest in the construction of this size tank while leaving old, leaking clay sewers in the ground that the Town will eventually have to repair. We do not believe that offline storage is the best solution for CSO No. 005.

#### 6.3.5 DINSMORE STREET PUMP STATION CSO NO. 006

The Dinsmore Street pump station CSO has been inactive since the completion of the Phase II improvements. No CSO activity has been recorded since 2006 and the CSO outlet was permanently blocked off in August 2008. The Town upgraded the capacity of this pump station and redirected upstream flows away from this area. As a result, no additional work is needed at this time at this location.

#### 6.3.6 BUSH STREET/BUSH VALLEY CROSS-COUNTRY CSO NO. 007

The Bush Street/Bush Valley cross-country CSO has also been inactive since the completion of the Phase II projects with no additional activity having been recorded since 2007. While CSO discharges have ceased, recent flow gauging showed several sewer system areas that had high amounts of excess flow. These flows are now consolidated at downstream CSO No. 010 where they contribute to CSO activity. The removal of these flows from the Bush Street sewer subsystem will have a beneficial impact on downstream CSO losses.

High flows in this area were found to originate from old sewer lines on Bush Street and the Bush Valley cross-country sewer from the East Leavitt Street area. The Bush Street sewer is in extremely poor condition and has been slated for

replacement by the Town. The Bush Valley cross-country line from East Leavitt Street has had much of its sanitary flows redirected by upstream projects on East Street and East Leavitt Street. It may be possible to eventually abandon portions of this line.

With regard to the Bush Street and Bush Valley cross-country sewer, the total estimated groundwater infiltration from this area is 50,000 GPD and the estimated stormwater inflow is 360,000 GPD/inch of rainfall. This suggests that the total excess flow from these two sewers is 0.55 MGD during a three month storm, 0.90 MGD during a one year storm, and 1.75 MGD during a twenty-five- year storm. If the Town proceeds with its proposed sewer work on Bush Street and if the old Bush Valley cross-country line from East Leavitt Street can eventually be abandoned by redirecting the sanitary flows into adjacent sewers, the Town would reduce excess flows by 390,000 GPD during a three month storm, 675,000 GPD during a one year storm and 1,300,000 GPD during a twenty-five year storm. These projects should proceed as scheduled.

### 6.3.7 SOUTH FOOTBRIDGE CSO NO. 008

CSO No. 008 is located at the South end of the footbridge near the intersection of Island Avenue and Main Street. Initial plans were to eliminate it during Phase I of the CSO program at all storms below a one year frequency. Since the completion of the Phase I work, the CSO has been active an average of eleven times per year. About 87% of these CSO events occur at storms below a one year frequency storm and about 67% occur at a storm of three months or less frequency. Average losses during CSO events have been 43,000 GPD/inch of rainfall since the completion of the Phase I work.

CSO No. 008 serves a large area of the Town's South side including the Norridgewock Road area, the Main Street area, the Currier Brook area and the Waterville Road area. The total excess flows measured from these areas include 195,000 GPD of peak groundwater infiltration and a stormwater inflow rate of 1.40 MGD/inch of rainfall. Of these flows, the majority of the peak infiltration, or about 165,000 GPD appears to originate on Norridgewock Road, Alder Street, Main Street, Willow Street, Bailey Street and Bloomfield Street. These same streets are responsible for about 1.15 MGD/inch of the peak stormwater inflow. If the Town were to pursue an excess flow removal approach, it should focus on these five streets at least one of which (Main Street) has been recommended for a selective separation in previous CSO Master Plans.

The Norridgewock Road sewer is essentially separated with sections of clay pipe that may be prone to inflow induced infiltration. Significant levels of inflow were measured at various points along the sewer all the way to the Skowhegan High School campus. Further investigation should be conducted to determine if roof

drains, catchbasins, or athletic field drains at the High School are connected to the sewer system. In addition, it appears that a portion of the sewer line that leaves the High School is located below a swamp. For the purposes of the present Master Plan update, we recommend that work on Norridgewock Road be limited to an assessment of peak flow sources, if any, from the school property.

Alder Street has several catchbasins that are tied into the sewer system, while several others have direct discharges to the adjacent river. In our opinion, all of these catchbasins should be redirected to the river from this residential street.

Main Street has been recommended for separation in Master Plan reports dating back over a decade. This sewer has the highest rate of excess flow upstream of CSO No. 008. Three side streets, namely Willow Street, Bailey Street and Bloomfield Street all contribute large volumes of peak flow into the Main Street system.

The total excess flow rates that originate from these areas could be reduced by 1.25 MGD for a three month storm, 2.15 MGD for a one year storm and 4.15 MGD for a twenty-five year storm if sewer separation and remediation were conducted. This would have a beneficial impact on CSO No. 008.

The Town could also construct a storage tank at this location even though it would be difficult to find a suitable site on which to build the tank. In order to capture a one year storm event, at least 200,000 gallons would be needed to store a one year storm, and 350,000 gallons would be needed to store a twenty-five year storm. This option should be considered to determine its cost; however, the Town should also consider that some of the upstream sewer lines like Main Street have been under discussion for repair for over a decade. If storage facilities are constructed, these old sewer lines will eventually still need to be repaired.

The South side interceptor has a full pipe capacity of about 4.5 MGD without being surcharged. In previous CSO Master Plans, it was reported that the surcharge capacity of the interceptor is about 6.5 MGD from the footbridge to Joyce Street. It was also noted that there is a bottleneck between CSO No. 008 and the siphon outlet which is caused by a 16" Ø and a 20" Ø pipe section over a distance of about 400 linear feet. In the previous CSO Master Plan it was noted that DEP may require the Town to eliminate this bottleneck if it is shown that previous Phase I work has not eliminated CSO activity below a one year storm. The proposal to eliminate the bottleneck is to construct a relief sewer around this point to augment the interceptor's capacity. Since the one year storm event threshold has not been met, the contingency plan to build this relief sewer appears to be in effect. We would recommend against this approach at the present time.

The construction of the proposed relief sewer will be relatively expensive given the difficult location at which the pipe is located. The interceptor was constructed along a ledge base of the river bank and around several bridge abutments. Instead of spending money to install this very difficult section of sewer, it may make more sense to invest in less expensive sewer improvements such as Main Street where more gallons of CSO water can be removed per dollar spent.

Previous CSO reports have noted that CSO No. 008 is often on the same days that CSO No. 004 at Joyce Street is active. A review of recent CSO discharge data shows this to still be the case. If the purpose of building a relief interceptor sewer is to reduce overflows at CSO No. 008, it does not appear that removing the bottleneck will accomplish this. The treatment plant's capacity has already been upgraded to match the capacity of the South side interceptor sewer and the Joyce Street sewer. If CSO No. 004 at Joyce Street is active, it means that there is no more downstream capacity at the treatment plant to accept any more flows. Since CSO No. 008 is active only on days when CSO No. 004 is active, this suggests that a relief sewer will simply cause more water to overflow downstream at CSO No. 004. While there would be some benefit in having the added storage volume that the relief sewer would provide, there might be less expensive options to contain the same amount of water or to remove the water at its source. We recommend that plans to increase the interceptor sewer size be tabled until much later in the CSO abatement program to determine if it is still needed.

#### 6.3.8 ISLAND AVENUE PUMP STATION CSO NO. 009

The Island Avenue pump station receives sanitary flow from a small number of users on the island. The majority of its peak flow historically resulted from catchbasins located across the bridge on Water Street. The addition of stormwater to this pump station was ill advised since it is a pneumatic ejector with very limited (100 GPM) pumping capacity. Ejector technology is generally considered to be obsolete, but it works best at low flow situations. As a result, this station is not well suited to process any wet weather peak flows, and as a result, this CSO has been fairly active.

Most of the peak flows that once reached this station are now processed through the storage tank at CSO No. 010. This has reduced the annual number of CSO events at Island Avenue from an average of about 60 per year before the Phase II improvements, to only about 12 per year at the present time. Still, 75% of these events occur below a three month storm and 91% occur at less than a one year storm. The average CSO discharge volume is only 4,000 GPD/inch of rain, so this CSO has become more of a nuisance than an effective wet weather relief point for the sewer system.

The hydraulics of the interceptor sewer should be reviewed to determine if it is possible to divert any remaining catchbasin flows to the CSO No. 003 subsystem. Very little benefit is achieved if these flows are sent to the ejector station. If this cannot be done, the ejector station should be upgraded to a larger submersible pump size that can process greater peak flows. Even if the catchbasin flows can be redirected, the Town should give serious consideration to replacing this old and obsolete ejector station with a new submersible station.

Previous Master Plans suggested a 15,000 GPD offline storage tank at this location in conjunction with the upgrade of the ejector to a 200 GPM submersible station. Based upon a review of recent CSO activity, it may be necessary to install a 25,000 gallon tank to retain a one year storm and a 45,000 gallon tank to retain a twenty-five year storm.

A more detailed analysis of hydraulic conditions at this station is needed to determine the best approach to follow. We suggest that the Town consider upgrading this station and at the same time, examine options to remove or store any remaining flows from the Water Street catchbasins.

#### 6.3.9 CSO STORAGE TANK NO. 010

The 1.0 MGD CSO storage tank on Water Street was installed as part of the Phase II work to capture and mitigate peak flows from the downtown area. Its major service area is the North Avenue region as well as flows that reach this location from Water Street, Court Street and upstream locations. In addition, when the interceptor sewer is surcharged, and CSO No. 003 is active, flows from the Madison Avenue area can also reach this location.

The previous Master Plan estimated that CSO activity on the North side would be reduced to zero events during a one year storm with the construction of the 1.0 MG storage tank and the completion of the Phase II projects. Due to the variability in all of the factors that lead to CSO activity, this has not been the case and CSO events continue although at a greatly reduced rate. CSO No. 010 has been active an average of eight times per year over the last three years. On these days, 94% of the activation storms have been less than a one year storm and 72% have been equal or less than a three month event. CSO losses from this location have averaged 650,000 GPD/inch. This makes CSO 010 the largest remaining discharge point in terms of excess flow volume loss. This is to be expected since the construction of the storage tank has consolidated excess flows on the North side from CSO No. 002, 006, 007 and 003 as well as 010. When the interceptor sewer becomes surcharged, excess flows from all upstream areas and adjacent sewer subsystems impact CSO 010. As a result, it is likely that CSO 010 will prove to be the most difficult location to completely abate and eliminate CSO discharges.

All excess flow and CSO abatement measures taken on the North side will have a beneficial impact on CSO 010. In terms of projects that lie directly within the CSO 010 subsystem, the greatest sources of remaining CSO flows appeared to be on North Avenue and Chandler/Dane Streets. These areas are responsible for about 90,000 GPD of peak groundwater infiltration and about 700,000 GPD/inch of the peak stormwater inflow rate. This suggests that excess flows from these areas can reach a rate of about 1.0 MGD during a three month storm, 1.80 MGD during a one year storm and 3.40 MGD during a twenty-five year storm. In order to eliminate CSO activity in this area, the Town could take four approaches as follows:

- Separate and rehabilitate the clay and combined sewer in the North Avenue and Chandler/Dane Street areas. If fifty percent of the groundwater infiltration and seventy-five percent of the stormwater inflow could be removed, peak flow rates would be reduced by 750,000 GPD during a three month storm, 1.30 MGD during a one year storm and 2.50 MGD during a twenty-five years storm. This approach would also have the benefit of addressing some of the old clay sewer lines upstream of CSO 010 which the Town will eventually need to address regardless of the CSO program.
- Add additional storage to augment the 1.0 MG storage tank that already exists. In order to capture the additional flows that are being lost once the present tank is filled, an estimated 1.35 MG of storage is needed for a three-month storm, 2.40 MG for a one-year storm and 4.70 MG for a twenty-five year storm. Additional modeling should be conducted before final storage size is determined.
- Add a satellite treatment system, such as a swirl concentrator, at this location. Such a unit should be sized for at least 5.0 MGD to capture and treat the largest threshold CSO storms that might be regulated in the future to achieve zero CSO discharges.
- Given the fact that the Town has already invested extensively at this CSO location, the fact that other CSO problem areas exist, and the fact that the complete resolution of the CSO problem will be a long-term effort, the Town could choose to delay additional work at CSO No. 010 at this time and focus on other areas. This would allow CSO No. 010 to represent a consolidation of all other CSO locations to be resolved when the Town has completed its programs in these other areas. Given the fact that CSO No. 010 is still losing large amounts of flow even though its activation frequency has decreased, this will prove to be an expensive and difficult CSO to fully abate. However, it is important to note that the 1.0 MG of added storage capacity likely eliminates many of the first flush pollutants before they are discharged to the river.

## 6.4 ESTIMATED COSTS OF POTENTIAL CSO ABATEMENT ALTERNATIVES

In order to assess the implementation costs of each potential CSO abatement alternative, preliminary order-of-magnitude planning estimates for each have been developed. Detailed cost estimates are presented in Appendix A and summarized below. These estimates include budgetary costs for construction, design, contract administration, inspection and contingency on the basis of typical cost estimating approaches, assumptions and allowances for planning level studies. Costs are presented in 2012 dollars for comparison purposes and should be indexed in the future to the actual construction year to allow for inflation and to reflect the construction economy at that time. In order to develop these preliminary cost estimates, a conceptual scope for each project was determined. It is important to note that no final design has been completed and the project scopes may change after design has occurred. More detailed cost estimates should be developed in the future, based upon takeoffs from the plans for each project, once design work has been completed. The final costs for each project will need to be established after the work is placed out to bid with general contractors. These cost estimates assume that all work will be constructed by a general contractor under a traditional bidding approach.

In areas where sewer rehabilitation or separation work is recommended, old lines were left in place on some streets for continued use as a storm drain if leakage rates were relatively low, indicating that the line may still be in fair condition. In areas where the existing line has a high leakage rate indicating poor structural condition, new sanitary sewers and new storm drains were recommended. It would be advantageous to inspect existing pipes with a video camera during the final design stage to confirm the conditions of each pipe. The television inspection data can be used to assess whether it may be possible to reline versus replace specific sewers as a lower cost option. On very narrow streets where construction around existing pipes will be difficult, new storm drains may be recommended in addition to new sanitary sewers.

Cost estimates include the repaving of sewer trenches on some streets. In other areas, pavement overlays are recommended over the entire road width to restore the appearance of the street. In still other areas, the extent of the proposed pipe work is so extensive, given the narrow width of the street, that it will not be possible to simply patch the trench. In these cases, it is assumed that the street pavement will be ground and reclaimed and that the entire road will then be repaved. Based upon the conceptual scope of work defined for each CSO subsystem in Section 6.3 of this report, the following sections summarize the cost estimates presented in Appendix A for each area:

#### 6.4.1 HESELTON STREET PUMP STATION CSO NO. 002 ABATEMENT COSTS

The only work recommended in the Heselton Street pump station CSO No. 002 subsystem is the upgrade of old leaking clay sewer lines on Heselton Street. The estimated cost for this project is \$280,000 which is being conducted in conjunction with sewer work on Bush Street.

#### 6.4.2 NORTH FOOTBRIDGE/SIPHON INLET CSO NO. 003 ABATEMENT COSTS

In order to abate CSO discharges at CSO No. 003, the Town could remove excess flows on Madison Avenue at an estimated cost of \$1,280,000 and on Winter Street at a cost of \$480,000 for total sewer improvement costs of \$1,760,000. Conversely, the Town could build a storage tank under the municipal parking lot off Commercial Street, or at a nearby location, for about \$2,180,000. Because the excess flows in this area are of an urban nature, because of the high traffic volume on Madison Avenue which will make a sewer project difficult, and because of the Town's preference to store stormwater inflow downtown versus discharging it to the river, the higher cost option of building a storage tank could be considered. It should be noted that flows from other areas may reach CSO No. 003 when the Water Street interceptor sewer is surcharged. The complete abatement of CSO No. 003 will likely require the completion of work in other adjacent and upstream sewer subsystems. Decisions on separating or storing flows from Madison Avenue should be delayed until later in the schedule in order to determine the impact of less complex projects.

#### 6.4.3 JOYCE STREET AREA CSO NO. 004 ABATEMENT COSTS

Excess flows that trigger CSO activity at CSO No. 004 originate in old, leaking, clay sewer lines, some of which are located under swampy areas. Given the poor shape of the sewer system in this subsystem, the best long-term option for the Town is to upgrade these lines and to remove the excess water. Several remediation projects have been recommended in this area as follows:

- Conduct television inspection of the Dickey Street subdivision area to determine why high inflow exists in this region of separated sewers. The cost of the TV work is estimated at \$10,000 including line flushing, cleaning and television inspection.
- Upgrade the sewer on Joyce Street at a cost of \$360,000.
- Upgrade the cross-country sewer between Joyce Street and Waterville Road at a cost of \$295,000.

- Replace the Joyce Valley cross-country sewer that runs parallel to Mount Pleasant Street and Milburn Street at a cost of \$345,000.
- Upgrade the Mount Pleasant Street sewer at a cost of \$480,000.

The total estimated sewer rehabilitation work in the Joyce Street subsystem area is estimated to cost \$1,490,000 in 2012 dollars. If this work was done in two separate projects, the average cost of each project would be \$745,000, also in 2012 dollars. The removal of the excess flows from this area will help to reduce influent loading into the treatment plant. As previously discussed, over half of the flow that enters the plant each year represents groundwater infiltration, inflow induced infiltration and stormwater inflow, most of which does not require treatment. The removal of these flows will also alleviate CSO discharges at No. 004.

#### 6.4.4 ELM STREET PUMP STATION CSO NO. 005 ABATEMENT COSTS

CSO activity at the recently upgraded Elm Street pump station appears to be caused primarily by excess flows that originate in the leaking sewer lines on Mary Street, Summer Street and Bennett Street. These flows contribute to the over fifty percent of annual treatment plant influent flow that is not sanitary wastewater. The sewers on Summer and Bennett Streets are old clay lines in poor condition that have been suggested for selective remediation in the past. The sewer on Mary Street is new, but may have been poorly installed or is receiving excess inflow that should not be in the line. The following remediation projects are recommended:

- Upgrade the Summer Street sewer at a cost of \$400,000.
- Upgrade the Bennett Street sewer at a cost of \$415,000.
- The Town recently made a minor repair to the Mary Street sewer which may have removed significant excess flow volumes. If further monitoring shows the excess flows still exist, television inspection and smoke testing of the Mary Street sewer should be conducted to identify the source of additional excess flow into these new PVC pipes. A replacement cost budget of \$330,000 is provided in Appendix A in the event that the line cannot be fully repaired.

The total estimated cost of CSO abatement projects in the Elm Street CSO No. 005 area is \$1,145,000 in 2012 dollars.

#### 6.4.5 DINSMORE STREET PUMP STATION CSO NO. 006 ABATEMENT COSTS

No work is recommended in the Dinsmore Street pump station subsystem at the present time.

#### 6.4.6 BUSH STREET AREA CSO NO. 007 ABATEMENT COSTS

The Town is planning to replace the leaking, old sewer system on Bush Street. The estimated cost of this project is \$280,000 in conjunction with concurrent sewer work on Heselton Street. The Bush Valley sewer needs to be abandoned once all remaining active services are removed.

#### 6.4.7 SOUTH FOOTBRIDGE AREA CSO NO. 008 ABATEMENT COSTS

The majority of excess flows upstream of the South end of the footbridge area that cause CSO No. 008 to become active appear to originate on several streets with old, clay, combined sewers as discussed in Section 6.3. These excess flows could be removed by selective sewer remediation projects as follows:

- Complete the separation work on Alder Street, which is already partially separated, for \$365,000. This project will include sewer work on adjacent Turner and Bridge Streets.
- Separate the old clay sewer on Main Street as has been recommended in previous Master Plans at a cost of \$945,000.
- Address the old, leaking clay sewer on Willow Street at a cost of \$430,000.
- Upgrade the old leaking sewers on Bailey Street at a cost of \$235,000.
- Address the excess flow on Bloomfield Street at cost of \$495,000. This should include a review of possible private excess flow sources from a trailer park as well as from sources on the public sewers.
- Conduct television inspection work and smoke testing at Skowhegan High School to identify possible entry points of excess flow into the sewer at a cost of \$10,000.

The total cost of the above sewer improvement projects is \$2,480,000 in 2012 dollars. This would address some of the worst sewers in Skowhegan and provide the Town with infrastructure improvements that would serve the public for the next 100 years. It would also help to reduce influent flows to the treatment plant where over half of the annual flow at the plant is now water that does not need to

be in the sewer system. These projects could be spread over a three-year period at an average cost of \$830,000 each year.

The Town could also choose to leave the excess flow in the sewer system and build a storage tank near CSO No. 008. In order to capture peak flows in this area, the estimated cost of the tank is \$2,650,000 in 2012 dollars. If this option is selected, the Town will still be left with leaking sewers upstream of the storage tank that will need to be upgraded in the near future. In our opinion, sewer separation projects in these areas, as has been recommended in previous Master Plans, is the best approach to take.

#### 6.4.8 ISLAND AVENUE PUMP STATION CSO NO. 009 ABATEMENT COSTS

The Island Avenue pump station is an obsolete and undersized pneumatic ejector that has surpassed its intended useful life. Its lack of adequate capacity is one reason for the many small volume discharges that occur at CSO No. 009. The pump station should be upgraded at an estimated cost of \$600,000. During the design of this pump station, a detailed hydraulic analysis should be conducted to determine the best approach to address the few Water Street catchbasins that tie into this pump station. Any inflow into the small ejector station is a major cause of CSO activity at this location. If any connected inflow catchbasins cannot be diverted from the pump station, the estimated cost of a peak flow storage tank would be \$1,350,000. It would make sense to address the pump station upgrade first and then reassess the need and size of a storage tank at a later date. A better solution would be to remove the inflow from this system.

#### 6.4.9 WATER STREET STORAGE TANK CSO NO. 010 ABATEMENT COSTS

CSO No. 010 on Water Street will be the most expensive remaining CSO location to abate. The construction of the 1.0 MG storage tank at a total cost of over \$3,000,000 in 2006 dollars has greatly reduced CSO activity, but has not met the one-year storm threshold required by DEP. Once the tank is full, CSO No. 010 is still responsible for untreated overflow volumes of almost 1.0 MG/inch of rainfall during CSO events. In order to capture a one-year storm, the Town will need to either construct additional storage capacity or remove some of the excess flows upstream in the sewer system as follows:

- The majority of the excess flow appears to originate on North Avenue in an old clay combined sewer. This sewer could be separated at a cost of \$1,465,000.
- An additional source of excess flow is the sewer on Chandler/Dane Streets. These sewers could be separated at a cost of \$795,000.

The total estimated cost to separate the above sewers upstream of CSO No. 010 is \$2,260,000. This is much lower than the cost of adding a larger storage tank to capture a one-year storm which is estimated at \$4,100,000 in 2012 dollars. In the likely event that DEP may require that a higher storm threshold than one year be used, the cost of the storage tank will be even greater. Since CSO No. 010 is impacted by other upstream excess flow areas, we suggest that it be reassessed after the construction of recommended improvements in other areas to determine the best approach to implement at this location.

## 7. SKOWHEGAN'S UPDATED SEWER SYSTEM MASTER PLAN FOR CSO ABATEMENT

### 7.1 CSO MASTER PLAN OBJECTIVES

Based upon the analysis and discussion presented in this report, Skowhegan's CSO Master Plan for CSO abatement can now be updated to reflect current conditions. The Phase I and II projects that the Town has previously implemented have greatly reduced both CSO activity and CSO volumes. However, they have not yet reached the goal of zero CSO discharges during a one-year storm event that has been cited in previous Master Plans. Additional efforts will be needed to achieve that goal. In the future, the one-year frequency storm threshold may prove to be insufficient to abate CSO discharges to the extent needed to meet evolving and more stringent CSO regulations. If excess flows are removed by sewer separation in replacement projects, there is very little difference between meeting a one-year storm event and a significantly higher threshold since the excess flows no longer exist in the system. However, if storage and treatment are selected, the design storm becomes more critical because CSO discharges will continue to occur after the storage or treatment capacity is exceeded. This is the case in Skowhegan.

The Town has many miles of old clay sewers that have been in the ground for over 100 years. These lines are likely in poor condition and well beyond their intended useful life. Many of these sewer lines are also combined and allow peak stormwater inflow to mix with sanitary sewage. At some point in time, the Town will be faced with significant expenditures to address the age and condition of its old sewer system. If some of these lines are addressed as part of the CSO abatement program, the Town will meet two objectives with the same capital expenditure.

About 38% of the annual influent flow received at the wastewater treatment plant consists of clean groundwater that does not require treatment. Over half of the annual flow is water other than sanitary sewage that enters the sewers from inflow induced infiltration and stormwater inflow. Storage and treatment options retain this water in the sewer system and increase plant operating costs for pump runtime, electricity and chemical addition. If selected sewer improvement projects in the worst areas of the sewer system are conducted, the removal of some of these flows will recover capacity at the treatment plant and also allow lower operating costs.

Storage and treatment may make the most sense in urban areas of the community given the potential for contaminants that are present from vehicular traffic and downtown catchbasins. It may be best to capture these flows and to allow them to pass through the treatment plant. Nonetheless, Skowhegan already has over 50 stormwater discharge outfalls throughout its sewer system. In areas where separation of peak flows makes sense to reduce CSO activity, the addition of a few more stormwater outfalls will likely not have any adverse impact on the Kennebec River.

Skowhegan is not large enough to fall under EPA stormwater regulations at this time. Should that change in the future, the permitting requirements related to stormwater will need to be addressed for the existing stormwater outfall pipes as well.

As future CSO abatement projects are scheduled, the Town should consider the most cost-effective approaches to move its CSO abatement program forward. While the previous focus has been primarily on storage and treatment of peak flows, we recommend that the Town focus on excess flow removal in the future. The Phase I and Phase II projects have allowed the Town to reduce its CSO discharge locations from nine original CSO points down to six at present. The Town should continue its efforts to further consolidate its CSO discharges and further reduce their numbers.

We suggest that the following strategy be used to prioritize future CSO abatement projects:

PRIORITY ONE: Complete the sewer projects that have already been planned for implementation. The Town has scheduled sewer work on Bush Street and Heselton Street for 2012. Both of these streets have high excess flow levels and these projects will have a beneficial impact on downstream CSO reduction. It may also make sense to perform television inspection work in 2013 in the three problem areas noted in this report, mainly in the subdivision by Dickey Street, in the Skowhegan High School sewer lines and the Mary Street sewers. The findings from these inspections may result in slight modifications to future Master Plan schedules.

PRIORITY TWO: Remove excess flows from the East Maple Street area by conducting sewer separation or rehabilitation work. This will address a problem area of the sewer system and remove excess flows from CSO No. 010.

PRIORITY THREE: Remove peak flows from Winter Street. This will help to mitigate activity at CSO No. 003 and No. 010 downtown.

PRIORITY FOUR: Replace the Island Avenue ejector station with a submersible pump station and larger wet well that has the capacity to convey greater peak flow volumes. At the same time, evaluate the hydraulics of the storm sewer system on Water Street to determine if surcharged catchbasin flows from this area can be diverted away from the pump station. The project should focus on the elimination of activity at CSO No. 009.

PRIORITY FIVE: Remove excess flows upstream of the Elm Street pump station on Mary Street, Summer Street and Bennett Street. This project should eliminate activity at CSO No. 005 and will reduce flow downstream at CSO No. 003.

PRIORITY SIX: Address the old, leaking clay sewers on Main Street, Bailey Street, Willow Street, Bloomfield Street, and Alder Street that cause activity at CSO No.

008. These sewers should be separated as recommended in past Master Plans. Alternatively, storage could be provided near CSO #008 for about the same cost if siting issues could be resolved. However, this will still leave 100 year old clay sewer lines in the ground that appear to be in very poor condition and they will need to be upgraded in the future. This project should focus on the elimination of CSO No. 008 and will help to reduce flows to CSO No. 004.

PRIORITY SEVEN: Address the old clay sewer lines in the Joyce Street subsystem including Joyce Street, Joyce Valley, cross country sewer to Waterville Road, Mount Pleasant Street and the Dickey Street subdivision. The upgrade of these old clay pipes will reduce excess flows to CSO No. 004.

PRIORITY EIGHT: Address the remaining peak inflow on Madison Avenue by either removing it or adding storage to mitigate the peak flow. Given the heavy traffic on Madison Avenue, it may be possible to reduce peak flow by relining the sewer if inflow induced infiltration is found to be significant. This project will help to reduce CSO events at CSO No. 003.

PRIORITY NINE: With the completion of the above projects, it is believed that the majority of remaining CSO activity will be consolidated at CSO No. 010. This CSO is presently active about eight times a year at storms less than a one-year threshold. The completion of upstream projects as recommended on the North side of Skowhegan will have a beneficial impact on CSO No. 010. Once these projects are completed, the Town will be in a better position to determine the best approach for this location. At present, it appears that it would be far less expensive to separate the sewers on North Avenue and Chandler/Dane Streets than to try to build additional storage on Water Street. The cost of building additional storage to capture even a one-year storm will be about twice as much as to remove the excess flows from the system. Should DEP ever require that a threshold storm other than a one-year event be used to demonstrate CSO compliance, the cost of storage will be even greater. If excess flows from North Avenue and Chandler/Dane Streets are reduced, the capacity of the 1.0 MG storage tank that now exists can be more effectively used to retain peak flows from the urban area of Water Street.

Figure 20 shows the proposed CSO abatement priority projects.

## 7.2 IMPACTS OF PROPOSED ABATEMENT PROJECTS ON CSO ACTIVITY

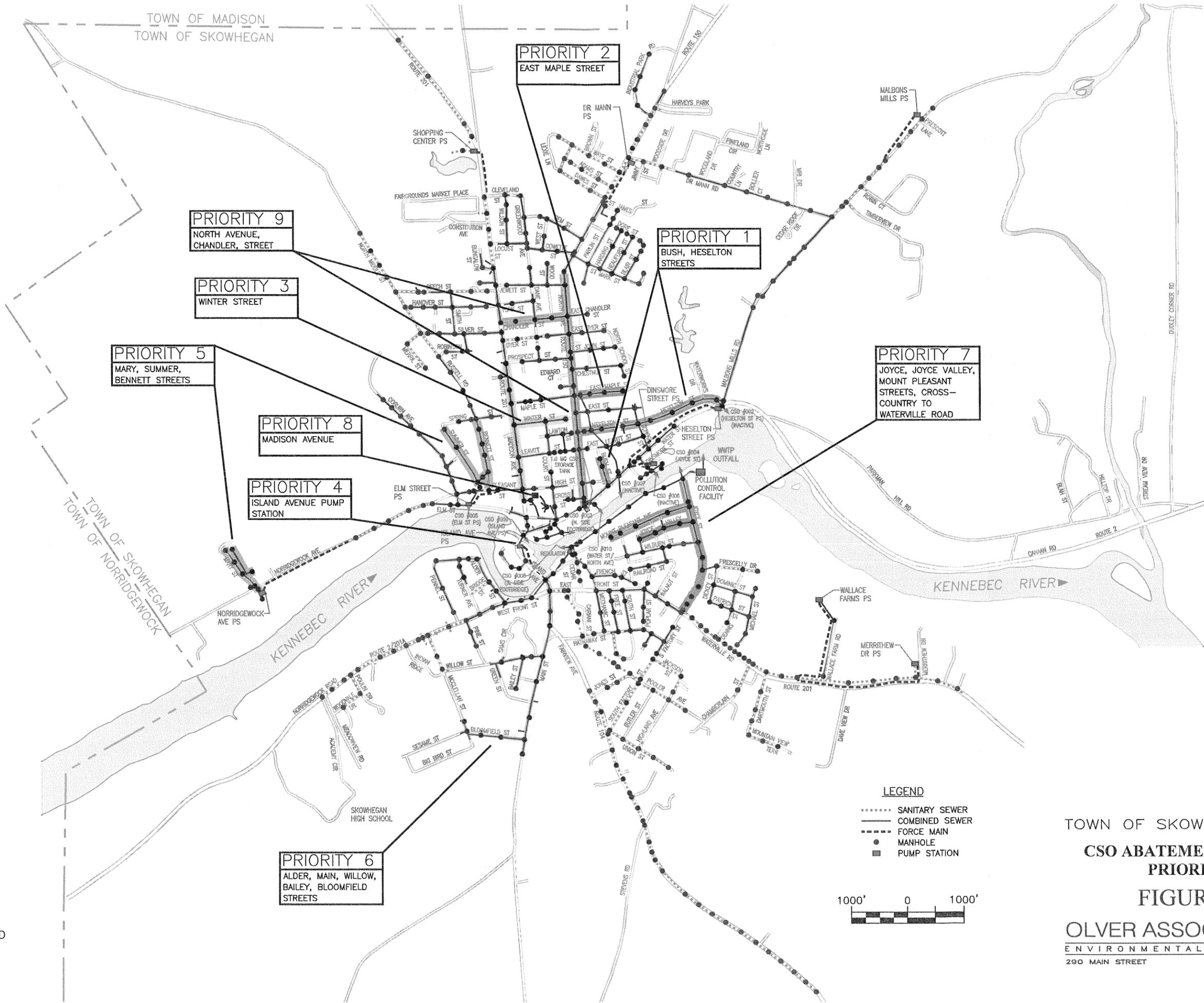
The activity of Skowhegan's nine CSO points, of which six are still active, is dependent entirely on the rate of excess inflow and inflow induced infiltration that is present in the Town's sewer system. The planned removal of these excess flows will result in the eventual elimination of CSO activity below a threshold storm event. This will occur when sufficient excess flow has been reduced to bring the sewer systems peak flow rates below the hydraulic capacity of the siphon, interceptor sewers, and

treatment plant. Table 24 summarizes the excess flow reductions that are estimated to occur as a result of the proposed CSO abatement program:

**TABLE 24: ESTIMATED SEWER SYSTEM PEAK FLOW RATE REDUCTION FROM PROPOSED CSO ABATEMENT PROJECTS**

AFTER PRIORITY	SEWER SUBSYSTEM (CSO NO.)	<u>SEWER SYSTEM PEAK HOURLY FLOW RATES (MGD)</u>		
		3-MONTH STORM	ONE-YEAR STORM	25-YEAR STORM
0	Present Status	5.71	10.16	19.91
1	Bush/Heselton area (002/007)	5.28	9.42	18.48
2	East Maple Street area (010)	5.27	9.40	18.45
3	Winter Street (003)	5.17	9.20	18.12
4	Island Ave (009)	5.17	9.20	18.12
5	Elm Street PS area (005)	4.97	8.85	17.47
6	South Footbridge area (008)	3.72	6.70	13.32
7	Joyce Street area (004)	3.12	5.70	11.42
8	Madison Avenue area (003)	2.65	4.90	9.90
9	Water Street area (010)	1.90	3.60	7.40

The reported hydraulic capacity of the siphon below the river is 3.50 MGD, of the South Side interceptor sewer is 6.50 MGD, and of the wastewater treatment is 7.50 MGD. Data in Table 24 shows that the peak sewer system flows will be easily conveyed through the plant during all storm events up to a twenty-five-year storm at the completion of the proposed projects. At the present time, sewer system overflows are occurring at less than a three-month storm. The proposed projects should also eliminate all CSO activity below a one-year storm as required and will likely meet a twenty-five-year storm as well. As these proposed priorities are completed, less CSO points will remain active in the sewer system as shown below in Table 25:



**PRIORITY 9**  
NORTH AVENUE,  
CHANDLER, STREET

**PRIORITY 3**  
WINTER STREET

**PRIORITY 5**  
MARY, SUMMER,  
BENNETT STREETS

**PRIORITY 8**  
MADISON AVENUE

**PRIORITY 4**  
ISLAND AVENUE PUMP  
STATION

**PRIORITY 2**  
EAST MAPLE STREET

**PRIORITY 1**  
BUSH, HESELTON  
STREETS

**PRIORITY 7**  
JOYCE, JOYCE VALLEY,  
MOUNT PLEASANT  
STREETS, CROSS-  
COUNTRY TO  
WATERVILLE ROAD

**PRIORITY 6**  
ALDER, MAIN, WILLOW,  
BAILEY, BLOOMFIELD  
STREETS

**LEGEND**

- ..... SANITARY SEWER
- COMBINED SEWER
- FORCE MAIN
- MANHOLE
- PUMP STATION



SOURCE:  
TOWN OF SKOWHEGAN AND  
MAINE OFFICE OF GIS

TOWN OF SKOWHEGAN, MAINE  
**CSO ABATEMENT PROJECT  
PRIORITIES**

**FIGURE 20**

**OLVER ASSOCIATES INC.**  
ENVIRONMENTAL ENGINEERS  
290 MAIN STREET WINTERPORT, MAINE

TABLE 25: ESTIMATED REDUCTION IN ACTIVE CSO LOCATIONS

AFTER PRIORITY	CSO'S ELIMINATED	CSO'S REMAINING
Original	0	9
Phases I / II	3	6
1	0	6
2	0	6
3	0	6
4	1	5
5	1	4
6	1	3
7	1	2
8	1	1
9	1	0

The proposed CSO abatement program will result in significant reductions in the amount of excess flow in the Skowhegan sewer system. It will also reduce CSO discharge events, CSO discharge locations and CSO discharge volumes.

The data presented in Tables 24 and 25 suggests that the proposed sewer system remediation projects will eventually drop the peak inflow into the system down to below the 7.50 MGD treatment plant capacity. Flows up to a twenty-five year storm would essentially match the 7.50 MGD capacity of the plant's peak flow treatment system.

Since the prediction of sewer system excess flows is not an exact science, actual excess flows removed and remaining with each project will vary over a band of various flow volumes. Flow data from this type of evaluation is not meant to provide exact values, but is useful in estimating flow removal trends. The proposed excess flow removal projects will allow the Town to move towards its goal of fully eliminating all CSO activity in the sewer system up to a threshold storm event. Mid-course corrections can be made to the flow removal estimates in future CSO Master Plan Updates. This will allow the Town to make future decisions on project scopes including adding or deleting additional sewer projects, storage, or treatment capacity until the point that excess flows are reduced to manageable levels. It should be noted that the excess flow removal estimates are conservative and actual flow removal values may exceed modeled estimates.

The above removal estimates should be considered in the context that the actual removal or storage of excess flow that each project will achieve may vary. The amounts were based on the assumption that seventy-five percent of the observed

inflow and fifty percent of the infiltration would be removed. Actual removal rates may vary. It is likely that additional private excess flow sources will be identified in each project area during the design and construction of the proposed projects. During the design of these projects, cellar inspections of every home along each project route should be conducted. If roof drains, cellar drains or sump pumps are found to be connected into the sewer, they should be removed.

### 7.3 ESTIMATED CSO ABATEMENT PROJECT COSTS

The Town of Skowhegan has already invested over \$9.5 million on CSO abatement projects over the last decade. Additional expenditures will be needed to fully resolve the Town's CSO problems as shown below on Table 26:

TABLE 26: SUMMARY OF CSO ABATEMENT CAPITAL COSTS

PRIORITY	DESCRIPTION	PROJECT COST (\$)	TOTAL COST FOR EACH PHASE (\$)
To-date	Phases I & II completion	9,500,000	9,500,000
1	Heselton/Bush CSO No. 002/007 Area		300,000
	Heselton/Bush Streets sewer	280,000	
	Skowhegan High video	10,000	
	Dickey/Mary Street video	10,000	
2	Water Street Storage Tank CSO No. 010		420,000
	East Maple Street sanitary/storm sewers	420,000	
3	North Footbridge CSO No. 003 Area		480,000
	Winter Street sanitary/storm sewers	480,000	
4	Island Avenue Pump Station CSO No. 009		510,000
	Pump Station upgrade	510,000	
5	Elm Street Pump Station CSO No. 005		915,000
	Mary Street sewer relining	100,000	
	Summer Street sanitary sewer	400,000	
	Bennett Street sanitary sewer	415,000	
6	South Footbridge CSO No. 008 Area		2,470,000
	Alder Street storm sewer	365,000	
	Main Street sanitary sewer	945,000	
	Willow Street sanitary/storm sewer	430,000	
	Bailey Street sanitary/storm sewer	235,000	
	Bloomfield Street sanitary/storm sewer	495,000	

7	Joyce Street CSO No. 004 Area		1,480,000
	Joyce Street sanitary sewer	360,000	
	Cross-country to Waterville Road sanitary	295,000	
	Joyce Valley sanitary sewer	345,000	
	Mount Pleasant sanitary/storm sewer	480,000	
8	North Footbridge CSO No. 003 Area		1,280,000
	Madison Avenue sanitary sewer	1,280,000	
9	Water Street Storage Tank CSO No. 010		2,260,000
	North Avenue sanitary sewer	1,465,000	
	Chandler/Dane sanitary/storm sewers	795,000	
Total To-Date			9,500,000
Remaining Projects			10,115,000
TOTAL CSO ABATEMENT COSTS			19,615,000

As shown above, the Town of Skowhegan has expended \$9.5 million to-date to address its CSO abatement issues. An additional \$10.115 million dollars may be needed to fully address the Town's CSO issues; however, some of the proposed projects include the upgrade of 100 year old clay sewers which the Town will need to address apart from CSO considerations. As a result, the CSO program will have the dual benefit of addressing long term infrastructure needs of the Town by replacing sewers that have been in use for a century in some areas. New sewers should be expected to have an additional 100 years of useful life.

It is also important to note that the Town may not need to complete every proposed project to address its CSO abatement goals. As discussed, CSO excess flow modeling is not an exact science and conservative assumptions have been used. CSO Master Plans should be updated every five years to assess the impact of each phase of completed projects on CSO abatement goals. Adequate CSO reduction may be achieved before all of the listed projects are completed at which point the Town will no longer be classified as a CSO community.

#### 7.4 FINANCIAL CAPACITY ANALYSIS

As shown in Table 26, the estimated cost to implement the proposed Master Plan for CSO abatement in Skowhegan is about \$19.615 million in 2012 dollars. Of this amount, the Town has already expended about \$9.5 million for Phase I and II work that is now completed. This leaves a funding gap of \$10.115 million in 2012 dollars to complete the Town's CSO abatement work.

Skowhegan finances its wastewater treatment program through general taxation which has made it difficult to qualify for outside funding; however, it is useful to consider how typical user fees would be impacted by the CSO costs. The Town's current wastewater conveyance and treatment operating budget is \$508,000 per year. In addition, the Town currently has a wastewater treatment and sewer system reserve account budget of \$167,000 and a debt service of \$721,000 per year for a total budget

of \$1,396,000 per year. There are presently 1800 equivalent sewer users in Skowhegan over which to distribute these costs. Therefore, the average “equivalent” sewer user in Skowhegan would have an average sewer user fee of \$775/year at current budget levels if the Town did not use general taxation to fund its sewer collection and treatment system.

The current median household income (MHI) in Skowhegan is \$28,390 per year although it is likely that an income survey of the sewer area could reveal a lower MHI for connected sewer users. DEP and EPA financial capacity guidelines suggest that a sewer user fee is excessive and represents a financial hardship any time that it exceeds two percent of the median household income of the sewer area. In Skowhegan, the 2% MHI level would be \$568 per year. Based on this criterion, if Skowhegan had sewer user fees that fully funded all sewer related expenses for operations, debt service and reserve, there would be a financial hardship caused by the cost of CSO abatement work.

Rural Development (RD), a major funding agency for CSO projects, does not utilize the 2% MHI guideline. Instead, RD estimates reasonable sewer user rates for a community based upon a detailed evaluation of local economic conditions. In past discussions, RD has indicated that a maximum reasonable sewer user fee is be about \$400 to \$500 per year per average user. Skowhegan would essentially be beyond this point at the present time.

The purpose of this discussion is to demonstrate that Skowhegan has already taken on a considerable level of debt for a community of this size to address CSO issues. If the Town had to borrow an additional \$10.115 million at a two percent interest rate over twenty years, the 1800 sewer users would incur an annual payment of \$619,000 in new debt service which would be added to the annual sewer budget of \$1,396,000 to create an increased budget of \$2,015,000, or an increase of 44%. This would also result in an annual total debt service payment of \$1,340,000, or about 67% of the annual sewer budget, as a result of CSO related work. This would represent a tremendous burden on the connected sewer users if they had to pay a sewer user fee.

In Skowhegan, there is no sewer user fee. The cost to operate the sewer system is paid for by general taxation. The Town is also home to a major pulp and paper mill. This has helped to offset the cost of the past sewer system improvements by spreading them over a wider tax base. It would be unfair, however, for this to be the basis to require an accelerated implementation schedule beyond that which would be expected if all the costs had been paid for through user fees. The paper industry in Maine has been unstable over the past decade. The Town should not be forced to undertake an accelerated sewer system debt under the assumption that the industrial tax base can absorb these costs. Other Maine communities that hosted paper mills have found themselves in financial difficulty when the mills’ operation was curtailed or ceased. While there is no indication that this is a concern in Skowhegan, it would not be wise

to assume that the Town has the financial capacity to accept such a large increase in debt service all at once. In reviewing implementation schedules for CSO projects, the Town should take the position that, if it had to fund these projects by user fees alone, it would already have expended a greater amount of money than its equivalent sewer user base could afford if the users alone had to incur costs over the twenty year life of the debt service. Given the \$9.5 million that the Town has already expended and the added cost of up to \$10.115 million that may still be needed, the Town should feel justified in requesting consideration by DEP and EPA for a reasonable schedule to complete its CSO work.

The Town should request an implementation schedule that allows the remaining CSO projects to be completed at a reasonable rate and at a cost increase that can be tolerated by its taxpayers in these difficult economic times. If the \$10.115 million in remaining projects were divided into twenty increments of average project interval, this would be equivalent to an annual debt increase of \$506,000. It may also be possible to raise \$500,000 per year through general taxation to minimize added debt service costs. At two percent interest and a twenty year term, this would be equivalent to an added debt payment of \$31,000 per year each time a new project was scheduled. This represents an added budget cost of about 2.3% per project at current budget levels. If other operations costs increased at 1.5% per year, this would result in an annual sewer budget increase of just under 4% per year. In our opinion, this would be the maximum reasonable budget increase that could be absorbed in the current difficult economy. Therefore, twenty years of project construction time would be a reasonable request. In order to allow future CSO Master Plan updates to assess the benefits of completed projects, it is also necessary to schedule the proposed projects over at least a twenty year time frame.

#### 7.5 TENTATIVE IMPLEMENTATION SCHEDULE

DEP requires that CSO Master Plan updates contain a revised schedule for implementation of the remaining CSO projects. The proposed schedule is based on the following criteria:

- The Town has already expended \$9.5 million on its program and faces potential expenditures of an additional \$10.115 million. This is a significant amount of money with only 1800 equivalent connected sewer users.
- Even though general taxation is used to fund the Town's wastewater treatment programs, additional debt service cannot be incurred at a rate that a typical sewer user fee could not absorb. Should changes occur in the Town's industrial base over the life of the added debt service, the sewer users would need the ability to pay the remaining debt.

- The Town will not retire the significant amount of sewer related debt service that is has already accumulated for CSO related projects until 2027.
- Dividing the remaining CSO projects into twenty average increments would result in an annual added budget increase of just under 4% with 2.3% for debt service and 1.5% for other sewer operational costs. This would seem to be the maximum level of added cost that the taxpayers could be expected to incur in the current economic climate.
- For planning purposes, the proposed projects have been grouped into individual projects that average about \$500,000. They have also been consolidated into five year blocks to allow either annual small projects or larger groups of projects to be funded.
- Time needs to be built into the schedule to allow periodic updates to the CSO Master Plan. Based upon these criteria, the tentative project implementation schedule shown in Table 27 is suggested for initial discussion:

TABLE 27: TENTATIVE CSO PROJECT IMPLEMENTATION SCHEDULE

YEAR(S)	CSO ABATEMENT ACTIVITY	ESTIMATED PROJECT COST*	ESTIMATED BLOCK COSTS
2012	Submit CSO Master Plan	\$ 24,000	
	Heselton/Bush Street sewers	280,000	\$ 304,000
2013	Clean/video Dickey/Mary/High School area	20,000	
2013-2017	East Maple Street sanitary/storm sewers	420,000	
2013-2017	Winter Street sanitary/storm sewers	480,000	
2013-2017	Upgrade Island Avenue PS	510,000	
2013-2017	Mary Street sewer relining	100,000	
2013-2017	Summer Street sanitary sewer	400,000	
2013-2017	Bennett Street sanitary sewer	415,000	
2018	Update CSO Master Plan	25,000	\$ 2,370,000
2018-2022	Main Street sanitary sewer	945,000	
2018-2022	Alder Street storm sewer	365,000	
2018-2022	Willow Street sanitary/storm sewer	430,000	
2018-2022	Bailey Street sanitary/storm sewer	235,000	
2018-2022	Bloomfield Street sanitary/storm sewer	495,000	
2022	Update CSO Master Plan	30,000	\$ 2,500,000
2023-2027	Joyce Street sanitary sewer	360,000	
2023-2027	Joyce Street cross-country to Waterville Road sanitary sewer	295,000	
2023-2027	Joyce Valley sanitary sewer	345,000	
2023-2027	Mount Pleasant Street sanitary/storm sewer	480,000	
2023-2027	Madison Avenue sanitary sewer	1,280,000	
2027	Update CSO Master Plan	35,000	\$ 2,795,000
2028-2032	North Avenue sanitary sewer	1,465,000	
2028-2032	Chandler/Dane Street sanitary/storm sewer	795,000	
2032	Update CSO Master Plan	40,000	\$ 2,300,000

\*All costs presented in 2012 dollars and should be updated each year.

## 7.6 INTERIM MONITORING PLAN

During the time period over which the proposed Master Plan will be implemented, the Town will continue to conduct interim monitoring to assess the ongoing status of its CSO abatement program. The Town proposes to continue evaluating its CSO flow data regularly after precipitation events to assess CSO activity reductions. The purpose of the CSO flow data will be to:

- Assess the results of the completed CSO abatement work in terms of CSO activity predictions.
- Refine the Master Plan's implementation schedule as needed with DEP approval.

Annual reports will be submitted to DEP presenting revised CSO discharge volume and activity data on the basis of the interim monitoring. System wide dry weather checks will be conducted periodically to assure that dry weather CSO flows are not occurring.

### 7.7 PERIODIC MASTER PLAN REVIEW

As required by EPA and DEP guidelines, the Town will review the progress of its Master Plan every year and will submit an interim report which defines:

- Survey of overall effectiveness of CSO abatement program.
- Work completed since the last report and to-date.
- Benefits of completed work as measured by CSO flow data.
- Results of dry weather CSO surveys.
- Comparison of field results with predicted data.
- Compliance with proposed Master Plan schedule.
- Modifications to original Master Plan based upon ongoing increased knowledge of sewer system and on funding availability.

### 7.8 PUBLIC NOTIFICATION

The Town proposes to maintain public interest and involvement in its CSO abatement program using a three-part approach:

1. The Master Plan will be presented at a public hearing upon incorporation of DEP comments.
2. The Master Plan will be discussed publicly at meetings of the Skowhegan Board of Selectmen.
3. The local news media will be kept apprised of significant CSO related decisions and activities.

**APPENDIX A**

**DETAILED PRELIMINARY COST ESTIMATES FOR SEWER  
SYSTEM CSO ABATEMENT PROJECTS**

APPENDIX A.1 - PRELIMINARY ORDER-OF-MAGNITUDE  
PLANNING COST ESTIMATE FOR ALDER STREET SEWER IMPROVEMENTS

Quantity	Description/Unit Cost	Estimate
LS	Traffic control/mobilization @ \$5,000/LS	\$ 5,000
LS	Temporary erosion control @ \$2,000/LS	2,000
10 EA	Precast structure removal @ \$500/EA	5,000
400 LF	12"Ø SICPE storm drain @ \$60/LF	24,000
1700 LF	18"Ø SICPE storm drain @ \$80/LF	136,000
10 EA	4'Ø precast catchbasin @ \$3,000/EA	30,000
250 TONS	3" trench pavement @ \$130/TON	33,000
450 TONS	1 1/4" roadway pavement @ \$95/TON	43,000
LS	Loam and seed @ \$10,000/LS	10,000
LS	Owner's testing allowance @ \$2,000/LS	2,000
	Subtotal	\$ 290,000
	Ledge probing allowance	2,000
	Design allowance	20,000
	Inspection allowance	23,000
	Ledge removal allowance	2,000
	Contingency allowance	29,000
	Estimate	\$ 366,000
	(Rounded)	\$(365,000)

APPENDIX A.2 - PRELIMINARY ORDER-OF-MAGNITUDE  
PLANNING COST ESTIMATE FOR BAILEY STREET SEWER IMPROVEMENTS

Quantity	Description/Unit Cost	Estimate
LS	Traffic control/mobilization @ \$1,000/LS	\$ 1,000
10 EA	Test pits @ \$300/EA	3,000
LS	Temporary erosion control @ \$1,000/LS	1,000
8 EA	Precast structure removal @ \$500/EA	4,000
550 LF	8"Ø PVC sewer @ \$95/LF	52,000
500 LF	4"Ø PVC building sewer @ \$60/LF	30,000
3 EA	4'Ø precast manholes @ \$4,000/EA	12,000
650 LF	12"Ø SICPE storm drain @ \$60/LF	39,000
6 EA	4'Ø precast catchbasin @ \$3,000/EA	18,000
220 TONS	4" roadway reclaim/pavement @ \$95/TON	21,000
500 SF	Trench insulation @ \$2/SF	1,000
LS	Loam and seed @ \$3,000/LS	3,000
LS	Owner's testing allowance @ \$1,000/LS	1,000
	Subtotal	\$ 186,000
	Ledge probing allowance	2,000
	Design allowance	13,000
	Inspection allowance	15,000
	Ledge removal allowance	2,000
	Contingency allowance	19,000
	Estimate	\$ 237,000
	(Rounded)	\$(235,000)

APPENDIX A.3 - PRELIMINARY ORDER-OF-MAGNITUDE  
PLANNING COST ESTIMATE FOR BENNETT STREET SEWER IMPROVEMENTS

Quantity	Description/Unit Cost	Estimate
LS	Traffic control/mobilization @ \$4,000/LS	\$ 4,000
50 EA	Test pits @ \$300/EA	15,000
LS	Temporary erosion control @ \$2,000/LS	2,000
6 EA	Precast structure removal @ \$500/EA	3,000
1300 LF	8"Ø PVC sewer @ \$95/LF	124,000
1200 LF	4"Ø PVC building sewer @ \$60/LF	72,000
6 EA	4'Ø precast manholes @ \$4,000/EA	24,000
200 LF	15"Ø SICPE storm drain @ \$70/LF	14,000
200 TONS	3" trench pavement @ \$130/TON	26,000
300 TONS	1 1/4" roadway pavement @ \$95/TON	29,000
1500 SF	Trench insulation @ \$2/SF	3,000
LS	Loam and seed @ \$6,000/LS	6,000
LS	Owner's testing allowance @ \$2,000/LS	2,000
	Subtotal	\$ 324,000
	Ledge probing allowance	3,000
	Design allowance	23,000
	Inspection allowance	26,000
	Ledge removal allowance	5,000
	Contingency allowance	32,000
	Estimate	\$ 413,000
	(Rounded)	\$(415,000)

APPENDIX A.4 - PRELIMINARY ORDER-OF-MAGNITUDE  
PLANNING COST ESTIMATE FOR BLOOMFIELD STREET  
SEWER IMPROVEMENTS

Quantity	Description/Unit Cost	Estimate
LS	Traffic control/mobilization @ \$5,000/LS	\$ 5,000
40 EA	Test pits @ \$300/EA	12,000
LS	Temporary erosion control @ \$1,000/LS	1,000
12 EA	Precast structure removal @ \$500/EA	6,000
1000 LF	8"Ø PVC sewer @ \$95/LF	95,000
1000 LF	4"Ø PVC building sewer @ \$60/LF	60,000
4 EA	4'Ø precast manholes @ \$4,000/EA	16,000
200 LF	12"Ø SICPE storm drain @ \$60/LF	12,000
1400 LF	15"Ø SICPE storm drain @ \$70/LF	98,000
8 EA	4'Ø precast catchbasin @ \$3,000/EA	24,000
15 TONS	4" trench pavement @ \$130/TON	2,000
550 TONS	4" roadway reclaim/pavement @ \$95/TON	52,000
1000 SF	Trench insulation @ \$2/SF	2,000
LS	Loam and seed @ \$5,000/LS	5,000
LS	Owner's testing allowance @ \$1,000/LS	1,000
	Subtotal	\$ 391,000
	Ledge probing allowance	3,000
	Design allowance	27,000
	Inspection allowance	31,000
	Ledge removal allowance	5,000
	Contingency allowance	39,000
	Estimate	\$ 496,000
	(Rounded)	\$(495,000)

APPENDIX A.5 - PRELIMINARY ORDER-OF-MAGNITUDE  
PLANNING COST ESTIMATE FOR CHANDLER / DANE STREET  
SEWER IMPROVEMENTS

Quantity	Description/Unit Cost	Estimate
LS	Traffic control/mobilization @ \$5,000/LS	\$ 5,000
50 EA	Test pits @ \$300/EA	15,000
LS	Temporary erosion control @ \$2,000/LS	2,000
20 EA	Precast structure removal @ \$500/EA	10,000
1800 LF	8"Ø PVC sewer @ \$95/LF	171,000
1200 LF	4"Ø PVC building sewer @ \$60/LF	72,000
6 EA	4'Ø precast manholes @ \$4,000/EA	24,000
400 LF	12"Ø SICPE storm drain @ \$60/LF	24,000
1100 LF	15"Ø SICPE storm drain @ \$70/LF	77,000
600 LF	18"Ø SICPE storm drain @ \$80/LF	48,000
18 EA	4'Ø precast catchbasin @ \$3,000/EA	54,000
1200 TONS	4" roadway reclaim/pavement @ \$95/TON	114,000
2000 SF	Trench insulation @ \$2/SF	4,000
LS	Loam and seed @ \$9,000/LS	9,000
LS	Owner's testing allowance @ \$2,000/LS	2,000
	Subtotal	\$ 631,000
	Ledge probing allowance	3,000
	Design allowance	44,000
	Inspection allowance	50,000
	Ledge removal allowance	5,000
	Contingency allowance	63,000
	Estimate	\$ 796,000
	(Rounded)	\$(795,000)

APPENDIX A.6 - PRELIMINARY ORDER-OF-MAGNITUDE  
PLANNING COST ESTIMATE FOR CSO STORAGE TANK EXPANSION TO  
CAPTURE ONE-YEAR STORM AT CSO NO. 010

Component	Estimate
Concrete tank	\$ 2,000,000
Access hatches	15,000
Sitework	385,000
Piping	300,000
Valves	50,000
General conditions	275,000
Subtotal	\$ 3,025,000
Geotechnical allowance	10,000
Design allowance	200,000
Inspection allowance	240,000
Contingency allowance	300,000
Ledge removal allowance	100,000
Land acquisition allowance	200,000
Estimate	\$ 4,075,000
(Rounded)	\$(4,100,000)

APPENDIX A.7 - PRELIMINARY ORDER-OF-MAGNITUDE PLANNING COST ESTIMATE FOR DICKEY STREET SUBDIVISION SEWER IMPROVEMENTS

<u>Quantity</u>	<u>Description/Unit Cost</u>	<u>Estimate</u>
LS	Television inspection allowance	\$ 10,000
	Estimate	\$ 10,000

APPENDIX A.8 - PRELIMINARY ORDER-OF-MAGNITUDE  
PLANNING COST ESTIMATE FOR EAST MAPLE STREET  
SEWER IMPROVEMENTS

Quantity	Description/Unit Cost	Estimate
LS	Traffic control/mobilization @ \$3,000/LS	\$ 3,000
30 EA	Test pits @ \$300/EA	9,000
LS	Temporary erosion control @ \$2,000/LS	2,000
6 EA	Precast structure removal @ \$500/EA	3,000
900 LF	8"Ø PVC sewer @ \$95/LF	86,000
800 LF	4"Ø PVC building sewer @ \$60/LF	48,000
4 EA	4'Ø precast manholes @ \$4,000/EA	16,000
200 LF	12" Ø SICPE drain @ \$60/LF	12,000
900 LF	15"Ø SICPE storm drain @ \$70/LF	63,000
10 EA	4' Ø precast catchbasins @\$3,000/EA	30,000
550 TONS	4" roadway reclaim/pavement @ \$95/TON	52,000
1000 SF	Trench insulation @ \$2/SF	2,000
LS	Loam and seed @ \$5,000/LS	5,000
LS	Owner's testing allowance @ \$1,000/LS	1,000
	Subtotal	\$ 332,000
	Ledge probing allowance	3,000
	Design allowance	23,000
	Inspection allowance	27,000
	Ledge removal allowance	3,000
	Contingency allowance	33,000
	Estimate	\$ 421,000
	(Rounded)	\$(420,000)

APPENDIX A.9 - PRELIMINARY ORDER-OF-MAGNITUDE PLANNING COST  
ESTIMATE FOR ISLAND AVENUE PUMP STATION REPLACEMENT

<u>Components</u>	<u>Estimate</u>
Deep wet well	\$ 40,000
Duplex submersible pumps	25,000
Rail retrieval system	10,000
Control panel	20,000
Variable frequency drives	5,000
Flow meter	5,000
Alarm telemetry	5,000
Hatch	1,000
Equipment installation	90,000
Demolition	15,000
Sitework	40,000
Piping	35,000
Valves	10,000
Electrical	30,000
General conditions	35,000
<hr/>	
Subtotal	\$ 366,000
Geotechnical allowance	7,000
Design allowance	26,000
Inspection allowance	30,000
Ledge removal allowance	40,000
Contingency allowance	40,000
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Estimate	\$ 509,000
(Rounded)	\$ (510,000)

APPENDIX A.10 - PRELIMINARY ORDER-OF-MAGNITUDE  
PLANNING COST ESTIMATE FOR JOYCE STREET SEWER IMPROVEMENTS

Quantity	Description/Unit Cost	Estimate
LS	Traffic control/mobilization @ \$3,000/LS	\$ 3,000
26 EA	Test pits @ \$300/EA	8,000
LS	Temporary erosion control @ \$1,000/LS	1,000
4 EA	Precast structure removal @ \$500/EA	2,000
1200 LF	15"Ø PVC sewer @ \$140/LF	168,000
400 LF	4"Ø PVC building sewer @ \$60/LF	24,000
5 EA	4'Ø precast manholes @ \$4,000/EA	20,000
500 TONS	4" roadway reclaim/pavement @ \$95/TON	48,000
2000 SF	Trench insulation @ \$2/SF	4,000
LS	Loam and seed @ \$5,000/LS	5,000
LS	Owner's testing allowance @ \$1,000/LS	1,000
	Subtotal	\$ 284,000
	Ledge probing allowance	2,000
	Design allowance	20,000
	Inspection allowance	23,000
	Ledge removal allowance	3,000
	Contingency allowance	28,000
	Estimate	\$ 360,000

APPENDIX A.11 - PRELIMINARY ORDER-OF-MAGNITUDE  
PLANNING COST ESTIMATE FOR JOYCE STREET TO WATERVILLE ROAD  
CROSS-COUNTRY SEWER IMPROVEMENTS

Quantity	Description/Unit Cost	Estimate
LS	Temporary erosion control @ \$2,000/LS	\$ 2,000
6 EA	Precast structure removal @ \$500/EA	3,000
1350 LF	15"Ø PVC sewer @ \$140/LF	189,000
6 EA	4'Ø precast manholes @ \$4,000/EA	24,000
60 TONS	4" trench reclaim/pavement @ \$130/TON	8,000
1000 SF	Trench insulation @ \$2/SF	2,000
LS	Loam and seed @ \$5,000/LS	5,000
LS	Owner's testing allowance @ \$1,000/LS	1,000
	Subtotal	\$ 234,000
	Ledge probing allowance	2,000
	Design allowance	16,000
	Inspection allowance	19,000
	Ledge removal allowance	3,000
	Contingency allowance	23,000
	Estimate	\$ 297,000
	(Rounded)	\$(295,000)

APPENDIX A.12 - PRELIMINARY ORDER-OF-MAGNITUDE  
PLANNING COST ESTIMATE FOR JOYCE VALLEY SEWER IMPROVEMENTS

Quantity	Description/Unit Cost	Estimate
LS	Traffic control/mobilization @ \$3,000/LS*	\$ 3,000
50 EA	Test pits @ \$300/EA	15,000
LS	Temporary erosion control @ \$2,000/LS	2,000
6 EA	Precast structure removal @ \$500/EA	3,000
1400 LF	8"Ø PVC sewer @ \$95/LF	133,000
800 LF	4"Ø PVC building sewer @ \$60/LF	48,000
8 EA	4'Ø precast manholes @ \$4,000/EA	32,000
200 TONS	4" roadway reclaim/pavement @ \$95/TON	19,000
3000 SF	Trench insulation @ \$2/SF	6,000
LS	Loam and seed @ \$5,000/LS	5,000
LS	Owner's testing allowance @ \$2,000/LS	2,000
	Subtotal	\$ 268,000
	Ledge probing allowance	3,000
	Design allowance	19,000
	Inspection allowance	21,000
	Ledge removal allowance	5,000
	Contingency allowance	27,000
	Estimate	\$ 343,000
	(Rounded)	\$(345,000)

\* Traffic control on side street areas

APPENDIX A.13 - PRELIMINARY ORDER-OF-MAGNITUDE  
PLANNING COST ESTIMATE FOR MADISON AVENUE  
SEWER IMPROVEMENTS

Quantity	Description/Unit Cost	Estimate
LS	Traffic control/mobilization @ \$20,000/LS	\$ 20,000
100 EA	Test pits @ \$300/EA	30,000
LS	Temporary erosion control @ \$6,000/LS	6,000
20 EA	Precast structure removal @ \$500/EA	10,000
3400 LF	12"Ø PVC sewer @ \$120/LF	408,000
4000 LF	4"Ø PVC building sewer @ \$60/LF	240,000
20 EA	4'Ø precast manholes @ \$4,000/EA	80,000
500 LF	48"Ø SICPE storm drain @ \$150/LF	75,000
1000 TONS	4" trench pavement @ \$130/TON	130,000
1500 SF	Trench insulation @ \$2/SF	3,000
LS	Loam and seed @ \$15,000/LS	15,000
LS	Owner's testing allowance @ \$3,000/LS	3,000
	Subtotal	\$ 1,020,000
	Ledge probing allowance	5,000
	Design allowance	70,000
	Inspection allowance	80,000
	Ledge removal allowance	5,000
	Contingency allowance	100,000
	Estimate	\$ 1,280,000

APPENDIX A.14 - PRELIMINARY ORDER-OF-MAGNITUDE  
PLANNING COST ESTIMATE FOR MAIN STREET SEWER IMPROVEMENTS

Quantity	Description/Unit Cost	Estimate
LS	Traffic control/mobilization @ \$15,000/LS	\$ 15,000
100 EA	Test pits @ \$300/EA	30,000
LS	Temporary erosion control @ \$3,000/LS	3,000
12 EA	Precast structure removal @ \$500/EA	6,000
3200 LF	12"Ø PVC sewer @ \$120/LF	384,000
2000 LF	4"Ø PVC building sewer @ \$60/LF	120,000
15 EA	4'Ø precast manholes @ \$4,000/EA	60,000
300 LF	24"Ø SICPE storm drain @ \$100/LF	30,000
600 TONS	4" trench pavement @ \$130/TON	78,000
3000 SF	Trench insulation @ \$2/SF	6,000
LS	Loam and seed @ \$15,000/LS	15,000
LS	Owner's testing allowance @ \$3,000/LS	3,000
	Subtotal	\$ 750,000
	Ledge probing allowance	5,000
	Design allowance	50,000
	Inspection allowance	60,000
	Ledge removal allowance	5,000
	Contingency allowance	75,000
	Estimate	\$ 945,000

APPENDIX A.15 - PRELIMINARY ORDER-OF-MAGNITUDE  
PLANNING COST ESTIMATE FOR MARY STREET SEWER IMPROVEMENTS

Quantity	Description/Unit Cost	Estimate
1500 LF	8"Ø PVC sewer lining @ \$40/LF	\$ 60,000
6 EA	4'Ø precast manhole rehab @ \$2,500/EA	15,000
LS	Owner's testing allowance @ \$2,000/LS	2,000
	Subtotal	\$ 77,000
	Additional television inspection allowance	5,000
	Design allowance	5,000
	Inspection allowance	6,000
	Contingency allowance	8,000
	Estimate	\$ 101,000
	(Rounded)	\$(100,000)