5.0 EVALUATING AND SELECTING ALTERNATIVES

Element 4 of USEPA's IPF requires a process to evaluate and select project alternatives. The process should use sustainable infrastructure planning approaches for prioritizing investments.

Element 04 | Evaluating & Selecting Alternatives

Akron's Integrated Plan uses an iterative, asset management-based approach geared towards the City's goal of equal or better environmental protection at a less unaffordable cost. The flow diagram presented in Figure 5-1 illustrates Akron's overall integrated planning process.

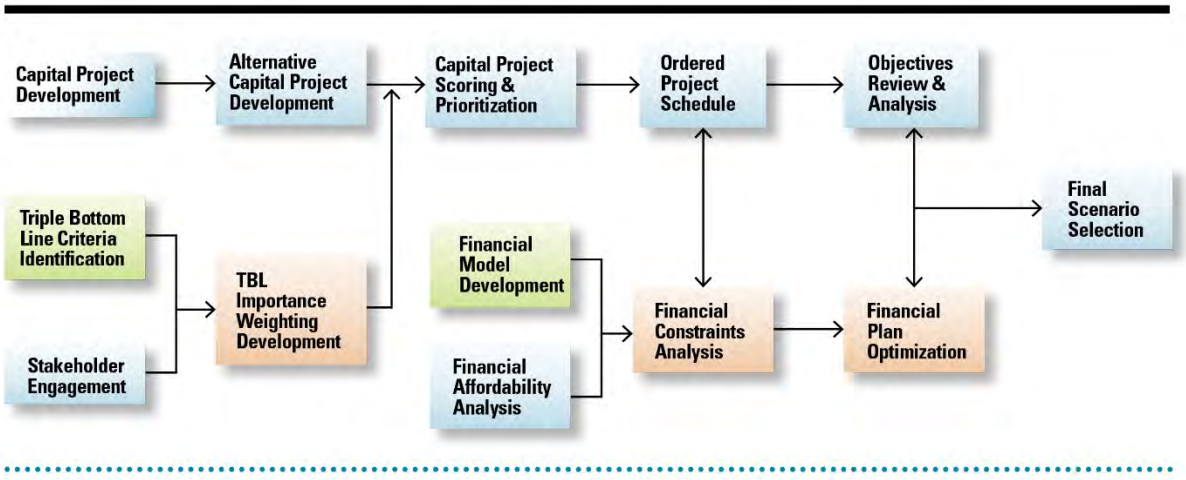

Figure 5-1. Akron Integrated Planning Process Schematic

The strategy illustrated in Figure 5-1 represents a logical progression for building a prioritized Integrated Plan. However, the progression is an iterative rather than a linear progression that suggests an initial prioritized project schedule that is then adjusted and refined based on financial constraints over the projected planning period. Working with stakeholders, City staff, and consultants, the City developed an integrated planning solution that builds and maintains infrastructure for the next century in a manner that protects public health and improves water quality at a less unaffordable cost while adding local jobs.

5.1 Capital and Alternative Project Development

The first step in the integrated planning process was the identification of the City's Capital Improvement Program (CIP) portfolio of projects. The CIP project identification included existing LTCP projects, non-LTCP projects, and other projects required to meet the regulatory level of service performance, improve receiving water quality and the environment, maintain the useful life of wastewater and stormwater assets, and provide high quality customer service.

The initial "baseline" capital project portfolio includes:

- **Existing LTCP Projects**. The existing LTCP projects are those projects required to meet design and performance criteria as stipulated in the CD. The list of projects is included in the negotiated 2009 City of Akron CD and the LTCP Update 2011.

- **Non-LTCP Projects**. These are projects included in the City's Capital Improvement Plan that are needed to meet CWA-related obligations, but are not included within the LTCP projects. Examples of these projects are restoration of eroded streambanks, Water Pollution Control Station (WPCS) headworks improvements, specific pump station rehabilitation and replacements, and sanitary sewer rehabilitation and reconstruction projects. Another important potential non-LTCP project is the contemplated removal of the Gorge Dam.

    - Removal of Gorge Dam along Cuyahoga River. As a part of the City's overall goal of providing an equal or better environmental solution, the City determined that significant improvements in water quality and aquatic protection will be achieved from the removal of the Gorge Dam on the Cuyahoga River. The Gorge Dam is 68 foot high by 429 foot wide, and creates a 34 acre pool. As noted in Section 2, Water Quality, Public Health and Regulatory Issues, removal of dams restores the streams to a free-flowing condition that has been shown to improve aquatic habitat and provide a more balanced DO profile.

- **Annual Projects**. These projects are included to emphasize the need for on-going asset rehabilitation or replacement, particularly for those "out-of-sight, out-of-mind" underground assets. Rehabilitation and repair (R&R) projects, collectively termed "renewal," are needed to maximize the effective life of infrastructure assets. Annual renewal "targets" have been estimated based on asset replacement cost valuation calculations (in capital dollars required to replace each asset). It is important for utilities to continually renew assets to maximize their useful life. Neglecting to fund annual renewal can result in premature or catastrophic asset failures.

    In reality, the annual renewal costs for each type of asset category will vary from year-to-year depending on which assets are renewed. If a particular asset renewal is more expensive than the average asset in that category, such as when a large storage tank is repainted, a specific Capital Improvement Program (CIP) project is generally defined for that year rather than expending the entire annual renewal budget on one project. Further, the annual renewal targets represent expenditures that should be made to fund either replacement assets or the rehabilitation of existing assets to extend their useful life. Expenditures for assets that are required for growth or to expand or extend the system are not considered renewal expenditures. Similarly, expenditures for assets that are required to meet new regulatory compliance initiatives are not considered renewal expenditures.

    The City undertook an extensive effort to identify and assign annual project costs, and a final project cost/data validation step was undertaken prior to entering the cost data into the financial optimization model.

    - Annual Plant and Pump Station Renewal. The City determined that the annual replacement target should be $5,000,000 per year, which equates to approximately a 2% annual replacement of the WPCS and the City's pump stations. While this amount may be considered low for a treatment plant of this capacity, this amount is considered to be adequate for the planning period because of the large investments in treatment plant improvement projects already underway and included in the project lists.

    - Annual Sewer Renewal. The purpose of this project is to proactively replace deteriorating combined, sanitary, and storm sewers at a rate of approximately 1% of the system per year. An estimated unit cost (dollars per foot) for the rehabilitation/ replacement for each equivalent size of pipe was developed based on industry standards and local historic costs. These unit costs were multiplied by pipe lengths to

calculate an overall projected replacement cost for the sanitary, combined, and storm sewer systems.

Due to the significant expenditure of funds on CD and LTCP projects in the early years of the planning period and because of the funding limitations, the Annual Sewer Renewal project ramps up over the planning period. The Annual Sewer Renewal project is initially funded at $5,000,000 and incrementally increases annually to $15,000,000.

- Annual Stormwater Projects. This set of projects includes the Stormwater Maintenance Ditches project ($500,000 per year), the Erosion-Streambank-Restoration Stormwater project ($500,000 per year) and the Local Flooding Pipe project ($1,000,000 per year), for a total of $2,000,000 per year. The costs of these projects were based on historic local costs and are expected to be refined as specific projects are identified in the future. Similar to the Annual Sewer Renewal project, this set of projects also includes incremental increases to the annual costs shown above. In addition, the City has included $3,000,000 per year for O&M costs for the stormwater system, as discussed further in Section 5.4, below.

- Annual Sustainability Initiatives. These initiatives include, but may not be limited to, the City's planned backwater valve installation program to prevent basement backups during large rainfall events and the rain barrel distribution program for $1,000,000 per year.

- Annual Flow Monitoring and Rain Gauge. This project represents the City's ongoing investment in the permanent flow monitoring and rain gauge network for approximately $50,000 per year.

As stated previously, annual projects are required to maintain the useful life of wastewater and stormwater assets and to reduce unplanned service disruptions that may lead to sewer overflows or building backups. However, the projected costs associated with the annual projects, especially for the wastewater R&R projects that are based on a percentage of the estimated asset replacement value, should be viewed as an annual target based on reasonable estimates at this time. In any given year, the City may spend more or less than the target amount depending on specific project needs. The City would re-assess these targets based on actual experience and improved planning on a regular 5-year basis. This will ensure that adequate funding is directed to the appropriate priorities as they change over time.

After determining the baseline list of CIP projects, the City developed alternative projects consistent with USEPA's IPF guidelines. Alternative project development was guided by the following goals:

- **Improved Financial Affordability.** Through lower project costs, new projects should attempt to make the overall plan less unaffordable for the residents of Akron.

- **Enhanced "Triple Bottom Line" Benefits.** Where feasible, value engineering principles should be used to ensure a greater TBL score that measures the predicted overall project benefits and reflects the priorities of the stakeholders involved. The City's TBL benefits criteria are further explained in Section 5.2, Benefit Measurements for Project Prioritization.

- **Equal or Better Environmental Benefits.** While emphasizing affordability, the plan should result in projects that meet or exceed the CD performance requirements, resulting in equal or better environmental benefits than the baseline LTCP.

- **Use of Green Infrastructure.** Wherever practical, feasible, and cost-effective, new projects should incorporate green infrastructure elements.

Following these principles helped the City ensure that it meets the environmental and social priorities at a less unaffordable cost. Improved engineering data and other pertinent information became available subsequent to the development of the original LTCP projects, and that information provided the opportunity to develop these alternative projects. The new data inputs included:

- Improved hydraulic modeling with the inclusion of new flow monitoring gauges.
- Upgraded software, hydraulic model recalibration, and instream water quality information.
- Adopted City guidance on the implementation of various types of innovative green infrastructure technology applicable to City conditions (i.e., the Green Infrastructure Toolbox).
- Refined knowledge of implemented projects and their impact on the City's infrastructure and the environment.
- Improved cost estimates from additional Advanced Facilities Planning (AFP) documents.
- Increased stakeholder involvement and input.
- Lessons learned from communities across the country for the appropriate levels of control, costs, and schedules.

The City developed alternative projects based on the above goals and new data inputs for a number of LTCP projects, as shown in Figure 5-2 and 5-3. Table 5-1 shows the LTCP projects in the left column of the table and the LTCP Alternative projects in the right column of the table. Several of the LTCP projects were already in progress, either in the design phase or the construction phase, and did not have alternative projects identified, as shown in Table 5-1. Complete project descriptions are included in Appendix C, Integrated Plan Project Descriptions. Summary project descriptions are included following Table 5-1.

The project data fields shown in Appendix C are primarily for use in the Expert Choice Comparion software that the City is using to prioritize and sequence projects. Because of this, some of the pertinent project information is constrained, for example, the project start and end dates reflect funding requirements rather than physical activity. Similarly, project costs reflect total costs in 2015 dollars.

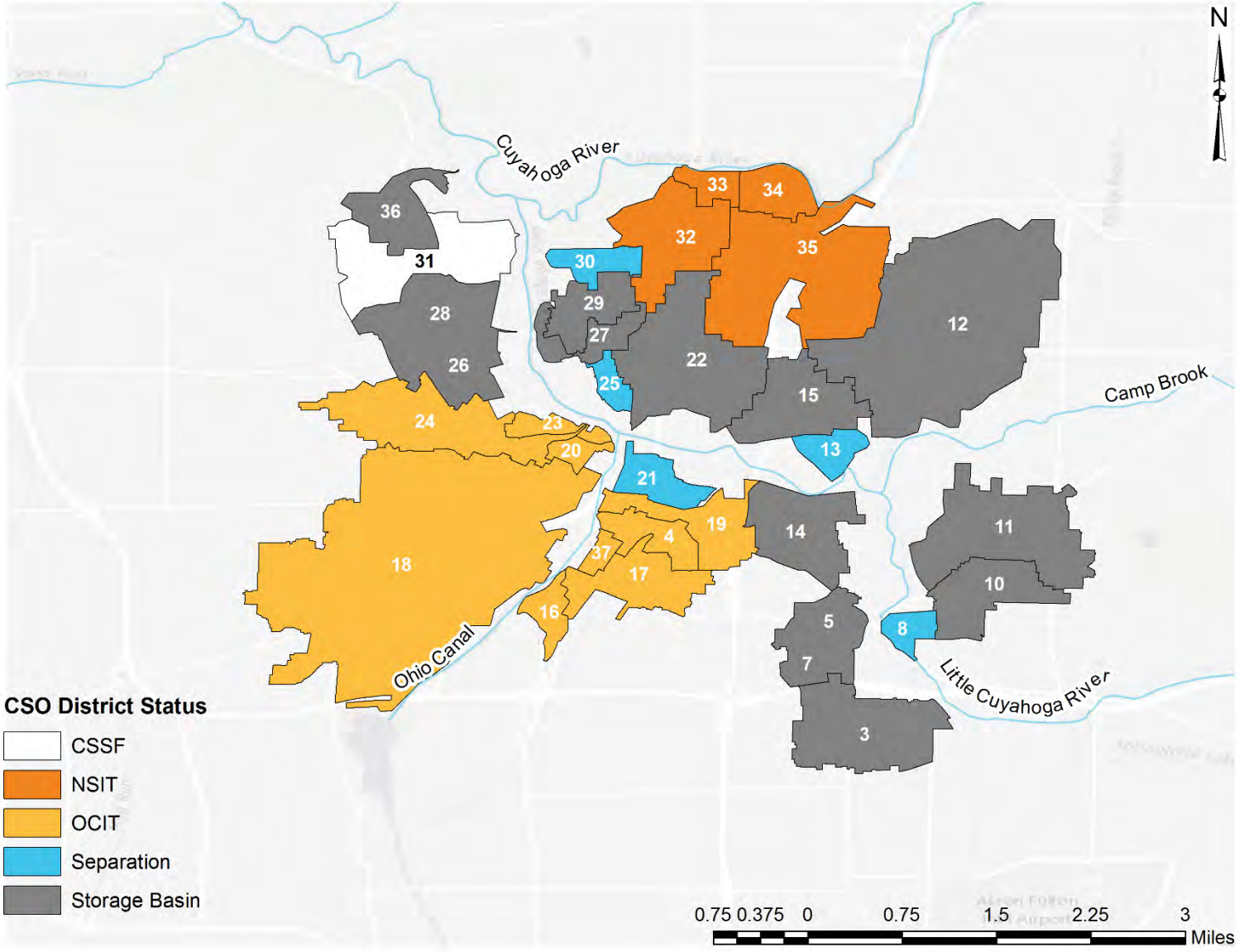

Figure 5-2. Project Types for the LTCP Update 2011

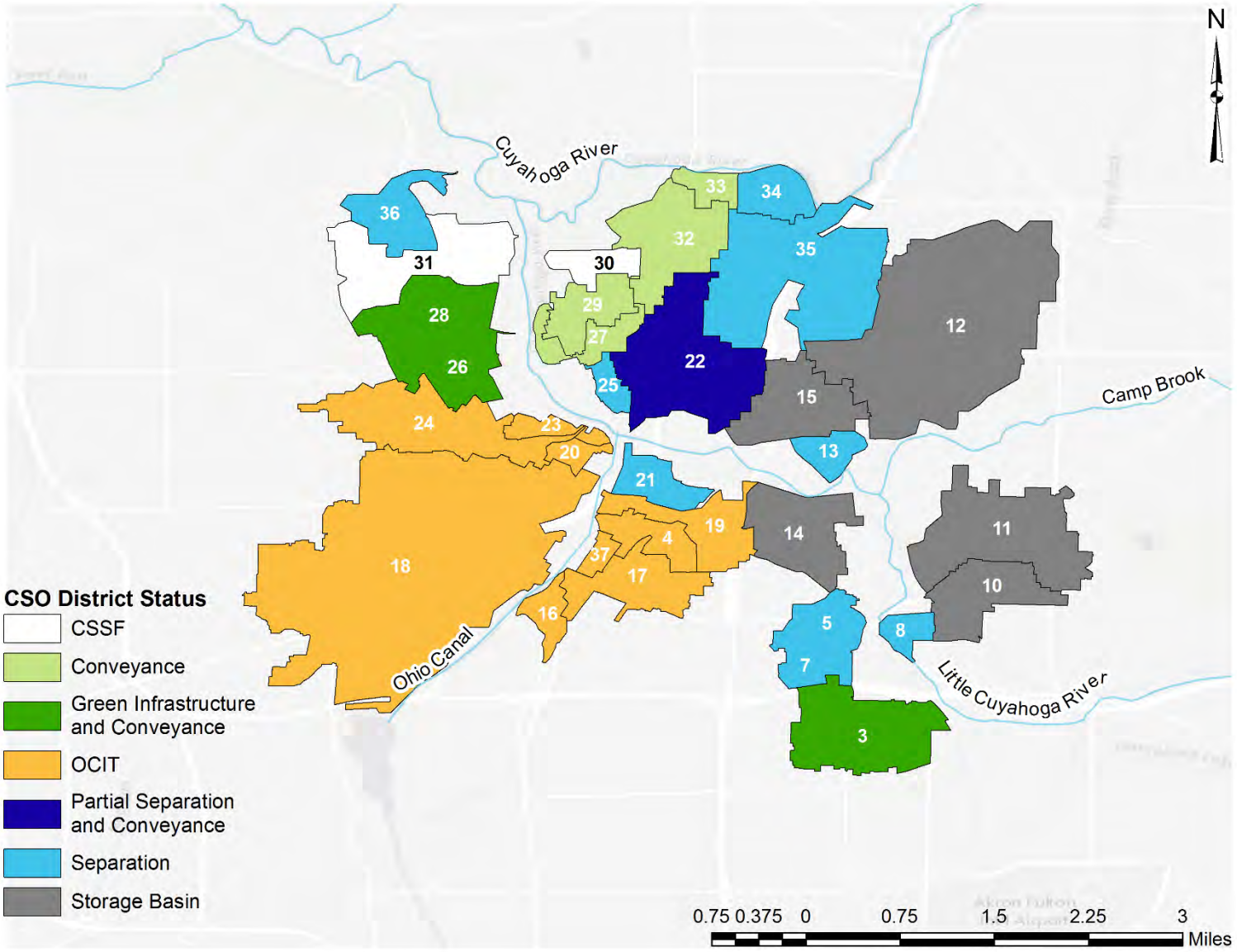

Figure 5-3. Project Types for the Integrated Plan 2040

Table 5-1. LTCP Project and LTCP Alternative Project Listing

LTCP Projects	Alternative Projects	Remarks
Kelly Storage Basin (CSO Rack 3)	Kelly Optimized Alternative (CSO Rack 3)	Proposed as part of Integrated Plan
Middlebury Storage Basin (CSO Rack 5 & 7)	Middlebury Separation Optimized Alternative (CSO Rack 5 & 7): Full sewer separation and a constructed stormwater wetland eliminate the need for a storage basin.	Negotiating with USEPA and Ohio EPA under Exhibit 3
Rack 8 Sewer Separation (CSO Rack 8)	No change	Completed
Hazel Storage Basin (CSO Rack 10 & 11)	Due to 2015 recalibration and system optimization, a 4.5 MG tank is proposed	Proposed as part of Integrated Plan
Camp Brook Storage Basin (CSO Rack 12)	No change	Under construction
Dan Sewer Separation (CSO Rack 13)	No change	Currently bidding
Forge Field Storage Basin (CSO Rack 14)	No change	Under construction
Cascade Village Storage Basin (CSO Rack 15)	No change	Under construction
Old Main Sewer Separation (CSO Rack 21)	No change	In design
Howard Storage Basin (CSO Rack 22)	North Hill Separation Optimized Alternative (CSO Rack 22): Partial sewer separation and a constructed stormwater wetland, along with optimized conveyance eliminates the need for a storage basin.	Negotiating with USEPA and Ohio EPA under Exhibit 3
Rack 25 Sewer Separation (CSO Rack 25)	No change	Completed
Memorial Storage Basin (CSO Rack 26 & 28)	Memorial Optimized Alternative (CSO Rack 26 & 28): Green infrastructure and optimized conveyance eliminates the need for a storage basin.	Proposed as part of Integrated Plan
Uhler Storage Basin (CSO Rack 27 & 29)	Uhler Conveyance Optimized Alternative (CSO Rack 27 & 29): Optimized conveyance and existing storage eliminates the need for a storage basin.	Proposed as part of Integrated Plan
Carpenter Sewer Separation (CSO Rack 30)	Carpenter Conveyance – Alternative (CSO Rack 30): This project was completed when flow was previously routed to the CSSF eliminating the need to separate the sewershed.	Proposed as part of Integrated Plan
Northside Interceptor Tunnel	Northside Interceptor Tunnel Early Action Conveyance Phase 1: Replaces and upsizes a segment of the existing interceptor to convey more flow and address aging infrastructure. Phase 1 also includes in-line storage in two locations.	Proposed as part of Integrated Plan
	Northside Interceptor Tunnel Enhanced Alternative Phase 2: Replaces and upsizes the remainder of the interceptor, as well as sewer separation in Rack 34 and Rack 35.	Proposed as part of Integrated Plan
Merriman Storage Basin (CSO Rack 36)	Merriman Separation Optimized Alternative (CSO Rack 36): Full sewer separation and green streets eliminates the need for a storage basin.	Negotiating with USEPA and Ohio EPA under Exhibit 3

LTCP Projects	Alternative Projects	Remarks
Ohio Canal Interceptor Tunnel System	No change	Under construction
Ohio Canal Interceptor Tunnel Otto Street Pump Station	No change	Construction contract awarded
Ohio Canal Interceptor Tunnel – EHRT	CSSF Control Gate Optimized Alternative: Controls flows from MOI into the CSSF to maximize conveyance downstream to WPCS, while also protecting against surcharge in the interceptor, resulting in greater conveyance from OCIT discharge and reduced overflows at OCIT.	Proposed as part of Integrated Plan
	Ohio Canal Interceptor Tunnel – EHRT Enhanced Alternative: Controls upstream of the OCIT including in-line storage and green infrastructure eliminates the need for the Enhanced High Rate Treatment (EHRT).	Proposed as part of Integrated Plan
CMOM 5-Year Cycle	CMOM 10-Year Cycle: Based on the results of the City's first 5-year cleaning and inspection cycle, the City proposes a modified 10-year cleaning and inspection cycle. The modified 10-year cycle would provide condition-based cleaning and inspection which includes the aggregate cleaning and inspection of the entire gravity sewer system every 10 years. The modification request will be submitted to USEPA in the future.	Proposed as part of Integrated Plan
WPCS Phase 2, Part 1	WPCS Phase 2, Part 1 Alternative: Expanding secondary treatment at the WPCS beyond the requirement, to 220 MGD capacity.	Proposed as part of Integrated Plan – in design
WPCS Phase 2, Part 2	WPCS Phase 2, Part 2 Alternative: Eliminating the need for BioACTIFLO™ with implementation of chemically enhanced primary treatment (CEPT) on bypasses.	Proposed as part of Integrated Plan
Main Outfall Relief Sewer	Main Outfall Relief Sewer Optimized Alternative: Constructing a pneumatically placed mortar cap on the brick-arch section of the MOI eliminates the need for a parallel relief sewer and pump station.	Negotiating with U.S EPA and Ohio EPA as a major modification
Mud Run Pump Station & Storage Basin Construction	No change	Under construction
Mud Run District Capacity Improvements	Per remedial report	Under construction
Mud Run District I/I Repairs	Per remedial report	In design
Mud Run District I/I Rehabilitation	Per remedial report	In design

Brief descriptions of the alternative projects with changes from the LTCP are provided below. Project description sheets for all projects considered under the Integrated Plan are located in Appendix C, Integrated Plan Project Descriptions.

- **Kelly Storage Basin (CSO Rack 3)**. The LTCP stipulated a 1,865,006 gallon storage basin be constructed for Kelly (CSO Rack 3) to store and attenuate wet weather flows and eliminate CSOs during the Typical Year. However, during the 2015 recalibration of the collection system model, the City determined that the required storage volume would need to be increased to approximately 2.1 MG to meet the performance requirement of eliminating CSOs in the Typical Year. The Integrated Plan optimization effort determined that in lieu of constructing a 2.1 MG storage tank, the most cost effective solution was to construct eight green infrastructure BMPs upstream of the rack to attenuate flows and to upsize the underflow from CSO Rack 3 to the Little Cuyahoga Interceptor (LCI) in order to achieve the performance criteria of zero overflows in the Typical Year.

- **Middlebury Storage Basin (CSO Rack 5 & 7)**. The LTCP stipulated a 1,105,920 gallon storage basin be constructed for Middlebury (CSO Rack 5 and 7) to store and attenuate wet weather flows and eliminate CSOs during the Typical Year. However, during the 2014/2015 recalibration of the collection system model, the City determined that the required storage volume would need to be increased to 1.2 MG to meet the performance requirement of eliminating overflows in the Typical Year. As part of the Integrated Plan optimization, the City determined the most cost effective option would be complete sewer separation on multiple streets with one or two constructed stormwater wetlands. This Integrated Plan Alternative solution has been submitted to USEPA for consideration and approval as a minor CD modification under the Exhibit 3-Green Infrastructure substitution process.

- **Hazel Storage Basin (CSO Rack 10 & 11)**. The LTCP stipulated a 2,518,616 gallon storage basin be constructed for Hazel (CSO Rack 10 & 11) to store and attenuate wet weather flows and eliminate CSOs during the Typical Year. However, during the 2015 recalibration of the collection system model, the City determined that the required storage volume would need to be increased to approximately 4.0 MG to meet the performance requirement of eliminating overflows in the Typical Year. After overall optimization of conveyance across the entire system, the City determined that a 4.5 MG storage tank should be constructed. The basin would be designed similar to other storage tanks such as the CSSF. The proposed storage tank will include mechanical bar screens and a flushing system.

- **Howard Storage Basin (CSO Rack 22)**. The LTCP stipulated a 2,424,446 MG gallon storage basin be constructed for Howard Street (CSO Rack 22) to store and attenuate wet weather flows and eliminate CSOs during the Typical Year. However, during the 2015 recalibration of the collection system model, the City determined that the required storage volume could be decreased to approximately 1.95 MG and still satisfy the performance requirement of eliminating overflows in the Typical Year. As part of the Integrated Plan optimization, the City determined the most cost effective option would be a combination of partial sewer separation with green infrastructure BMPs, along with adjusting the flow to the LCI and increasing the size of the CSO Rack 22 underflow pipe would satisfy the performance requirement of eliminating overflows in the Typical Year. This Integrated Plan Alternative solution has been submitted to USEPA for consideration and approval as a minor CD modification under the Exhibit 3- Green Infrastructure substitution process.

- **Memorial Storage Basin (CSO Rack 26 & 28)**. The LTCP stipulated a 2,296,669 gallon storage basin be constructed for Memorial (CSO Rack 26 & 28) to store and attenuate wet weather flows and eliminate CSOs during the Typical Year. However, during the 2015 recalibration of the collection system model, the City determined that the required storage volume could be decreased to 1.5 MG and still satisfy the performance requirement of eliminating overflows in the Typical Year. The City determined that the most cost effective alternative is to implement two green infrastructure projects to attenuate flows to the racks, and to optimize the conveyance from the rack underflow to the LCI to achieve the performance criteria of zero overflows in the Typical Year.

- **Uhler Storage Basin (CSO Rack 27 & 29)**. The LTCP stipulated a 1,290,276 gallon concrete storage basin be constructed for Uhler (CSO Rack 27 & 29) to store and attenuate wet weather flows and eliminate CSOs during the Typical Year. However, during the 2015 recalibration of the collection system model, the City determined that the required storage volume would need to be increased to 1.5 MG to meet the performance requirement of eliminating overflows in the Typical Year. Through the Integrated Plan alternative assessments, the City subsequently determined that optimizing conveyance alone will achieve the performance criteria of zero overflows in the Typical Year. This will be accomplished by upsizing the Rack 27 underflow pipe based on available modeled capacity in the LCI by means of an aerial crossing over the Little Cuyahoga River. The proposed aerial crossing will allow the City to remove the existing crossing that is currently causing an obstruction in the river. The flow from Rack 29 can be conveyed by upsizing piping between Racks 29 and Rack 30 based upon available modeled capacity at the Rack 30 underflow, and with available storage capacity from there to the CSSF.

- **Carpenter Conveyance (CSO Rack 30)**. The LTCP stipulated sewer separation for Rack 30 to eliminate CSOs during the Typical Year. However, during the 2015 recalibration of the collection system model, the City determined that the CSSF has sufficient capacity to store wet weather flows from Rack 30. This conveyance alternative was already implemented in conjunction with the installation of the CSSF.

- **Northside Interceptor Tunnel**. The LTCP stipulated a 20-foot internal diameter tunnel approximately 10,000 feet in length, or any other combination of diameter and length that achieves a storage volume of 23,000,000 gallons, be constructed to store and attenuate wet weather flows and eliminate CSOs from Racks 32, 33, 34, and 35 during the Typical Year. The 2013 NSIT AFP evaluated alternatives relating to size and alignment and recommended a 6,850 linear foot tunnel, 24-feet in diameter to achieve a required storage volume of 23,000,000 gallons. However, during the 2015 recalibration of the collection system model, the volume required to control overflows was revised to 7.33 MG.

  The Integrated Plan process determined that in lieu of constructing the 7.33 MG storage tunnel (or 14-feet in diameter), the most cost effective and beneficial solution was to provide increased conveyance capacity of the entire Northside Interceptor (NSI) to the Main Outfall Interceptor, and proceed with sewer separation at Racks 34 and 35 to achieve the required performance criteria of zero overflows in the Typical Year. This alternative project would proceed in two phases as described below:

- Northside Interceptor Tunnel Early Action Conveyance Phase 1. The early action conveyance project includes:
  - In-line storage in CSO Racks 32 and 35.
  - Stabilization of the access road to the Upper NSI.
  - Increasing conveyance capacity of the Upper NSI by upsizing the interceptor from 24-inch to 36-inch.
  - Increasing conveyance capacity from CSO Rack 34 and Rack 35 by upsizing the underflow pipes.
- Northside Interceptor Tunnel Enhanced Alternative Phase 2. The sewer separation project includes:
  - Increasing conveyance in the Lower NSI by: (1) upsizing the 36-inch NSI (from CSO Rack 33 to CSO Rack 32) to 48-inch and (2) upsizing the 48-inch NSI (from CSO Rack 32 to MOI) to 54-inch.
  - Upsizing the underflows at Rack 32 and Rack 33 to enhance conveyance.
  - Separation of the collection systems tributary to CSO Rack 34 and to CSO Rack 35, including green infrastructure BMPs on the separate stormwater.

- **Merriman Storage Basin (CSO Rack 36)**. The LTCP stipulated a 1,133,074 gallon storage basin be constructed for Merriman (CSO Rack 36) to store and attenuate wet weather flows and eliminate CSOs during the Typical Year. However, during the 2014 recalibration of the collection system model, the City determined that the required storage volume would need to be increased to 1.15 MG to meet the performance requirement of eliminating overflows in the Typical Year. As part of the Integrated Plan optimization, the City determined the most cost effective option would be complete sewer separation on multiple streets with bioretention between the curb and sidewalk (e.g., “bump-ins”) on some streets. This Integrated Plan Alternative solution has been submitted to USEPA for consideration and approval as a minor CD modification under the Exhibit 3- Green Infrastructure substitution process.

- **Ohio Canal Interceptor Tunnel - EHRT**. The LTCP stipulated an EHRT facility be installed downstream of the OCIT to treat seven CSOs with an estimated volume of 175 MG that would still occur in the Typical Year. The Integrated Plan optimization effort determined that the number and annual volume of overflows from OCIT can be significantly reduced by eliminating the EHRT and with the installation of upstream and downstream flow control and storage elements, *in lieu* of the originally proposed EHRT. These consist of two separate alternative projects. First, the proposed CSSF Control Gate Optimized Alternative provides for downstream controls at the CSSF consisting of a new control gate that maintains full pipe flow in the MOI, while still providing relief for the MOI under high flow and surcharge conditions. This modification allows for the more optimized dewatering of the OCIT, and results in only three overflows with an estimated volume of 75 MG in the Typical Year. This proposed alternative would be completed by the time the OCIT comes on line at the end of 2018. The second alternative project is the proposed OCIT EHRT Enhanced Alternative, and consists of upstream storage and flow controls including the installation of in-line

storage upstream of the OCIT along with installation of green infrastructure attenuation at the State Route 59 Bell Street off ramp. These new alternate control measures will together reduce OCIT overflows to three CSOs with an estimated 57 MG per year in the Typical Year. The water quality model results have shown that these small volume overflows and events will not cause a water quality exceedence in the receiving stream during the Typical Year under the "distilled water" test, as discussed further in Section 6, Integrated Planning Results.

- **System-wide Conveyance Optimization.** The overall integrated planning effort included a system-wide effort to optimize conveyance of wet weather flows to the existing infrastructure, and to identify opportunities to enhance the existing infrastructure to support optimized conveyance. This effort included efforts to balance increased conveyance in some portions of the system against decreases in other portions through the application of storage, green infrastructure, full and/or partial sewer separation and off-loading, as well as analyzing the system on a dynamic basis to take advantage of real-time system responses and in-line storage and attenuation in the system. An example of this type of system-wide optimization was presented in the Exhibit 3 Green Infrastructure alternative for the North Hill Optimized Alternative (CSO Rack 22), pending for review and approval by USEPA and Ohio EPA. The objective of this optimization was to develop a suite of projects that together provided the best and lowest cost solution to meet performance criteria and/or water quality objectives. The results of this system-wide optimization are reflected in the combination of projects identified in the Integrated Plan Scenario. In addition to identifying this optimized mix of projects, the City proposes to deploy the specific elements of the program that increase conveyance to the interceptor on a phased basis to allow gradual increases in the system flows over time. This will allow the City to better develop operational experience and to fine tune control strategies to optimize flows on a real-time basis, without creating the potential for system surcharge. The City has proposed to proceed with the Kelly Optimized Alternative (CSO Rack 3) conveyance as the next enhanced conveyance project, with other projects to follow after an initial two year start-up and optimization period. Other projects that include enhanced conveyance elements are described in the project description sheets.

- **CMOM 10-Year Cycle**. The CD requires implementation of various CMOM activities, including a program to clean and inspect the gravity sanitary and combined sewers and inspect manholes on a 5-year cycle. Other elements of the overall CMOM Program, such as acute defect repairs, SSO and CSO response, SSO and CSO data evaluation, SSO and CSO corrective actions to prevent SSOs and CSOs, addressing trouble spots, and sanitary sewer reconstruction are also required to be implemented on an ongoing basis. Based on the results of the mostly completed 5-year cleaning and inspection cycle and an analysis of associated findings, the City will be requesting a modified 10-year cycle for cleaning and inspection. Extending the cycle for the majority of the system to a 10-year duration will enable the City to allocate more resources towards addressing trouble spot areas and system R&R. Given the City's top quartile performance in terms of blockage-related SSO events, addressing root causes and system R&R is a more effective way to improve the system and reduce overflows in the long term. Full details of the proposed cleaning and inspection strategy will be submitted to USEPA as part of a separate modification request.

- **WPCS Phase 2, Part 1 & Part 2 Projects**. The CD requires expansion of the secondary treatment process to 170 MGD peak capacity, along with installation of 110 MGD peak capacity of BioACTIFLO to treat secondary bypasses. The Integrated Plan Alternatives for these projects include expanding the secondary capacity to 220 MGD, and utilizing CEPT for the few, and much smaller, secondary bypasses that would occur during the Typical

Year. The City is currently conducting a pilot project to gauge the effectiveness of CEPT as an alternative to BioACTIFLO, and has observed outstanding results that meet or exceed the performance criteria contained in the CD for bypass treatment. The LTCP project would result in 20 bypasses/ year and 265 MG/ year to be treated with BioACTIFLO. The proposed alternative project would result in 5 bypasses/ year and 41 MG/ year to be treated with CEPT. The secondary expansion project could also be completed 3 years sooner than required in the LTCP.

- **Main Outfall Relief Sewer**. The original CD required parallel relief sewer and pump station to be constructed along the entire length of the lower brick-arched section of the MOI, in order to eliminate potential surcharge conditions in this section of the MOI. It has been shown that the pump station is not required to meet the LTCP criteria. Additional analysis has shown that the MOI is not subject to surcharge conditions along its entire length, and that an alternate capping procedure can be constructed that can withstand any anticipated surcharge, where indicated. The City is in the process of obtaining a CD Modification for this alternative solution.

5.2 Development of Integrated Plan Scenarios

To evaluate the various CIP projects and compare the existing LTCP and alternative CIP projects, the integrated planning process grouped projects into scenarios. A scenario is a grouping of projects that, taken together, represent an alternative solution to meeting CWA obligations.

Based on the capital availability funding constraints described in more detail in Section 5.4, Financial Constraints, a software package (Expert Choice Comparion) was utilized to develop a schedule of various project scenarios using the 2027 compliance schedule for LTCP projects which results in an RI of 2.46%. The schedule was analyzed in a financial model that indicated the projects could not be funded in this timeframe without significant additional rate increases (48%) over a relatively short period.

The cost for the total wastewater and stormwater systems, with a 2027 deadline for the LTCP projects, is clearly unaffordable. Since the total costs are unaffordable, an extension to the 2027 deadline for the LTCP projects, in addition to the reprioritization and optimization of projects, is necessary.

As a result of the need for a longer schedule, the City evaluated the costs based upon a 13 year extension to the deadline for the LTCP Projects. Expert Choice Comparion model runs were conducted for this extended 2040 planning period. However, the results of these additional model runs demonstrate that the Original LTCP projects with a new deadline of 2040, along with the Non-LTCP projects and Annual projects, still could not be funded without significant rate increases (80%) over this extended period.

There are two scenarios presented in this *City of Akron Integrated Plan*:

- **Baseline Scenario 2040:** The Baseline Scenario 2040 includes the original set of LTCP projects that are not constrained to current CD milestone dates, along with current City CIP projects termed either non-LTCP projects or annual projects for wastewater and stormwater infrastructure needs. The objective of this scenario was to determine if simply allowing additional time would be sufficient for the City to satisfy the CD performance requirements and still have the ability to finance the program. The Baseline Scenario 2040 combination of projects are projected to meet a performance level of zero overflows per year from the

CSOs under a Typical Year's rainfall patterns. Even if the LTCP project deadline is extended by an additional 13 years to 2040, the total wastewater and stormwater costs are still unaffordable. This scenario results in an RI of 2.64%.

- **Integrated Plan Scenario 2040**: An alternative set of projects that met the same performance measures of zero overflows per year from the CSOs under a Typical Year's rainfall patterns, except at the OCIT, with an optional performance measure of three overflows per year, and including an additional alternative project to provide some of the funding towards the removal the Gorge Dam on the Cuyahoga River. The Integrated Plan Scenario 2040, with the additional receiving water quality benefits associated with removal of the Gorge Dam and with the earlier removal of CSO overflow and secondary bypass discharge volumes, provides a better level of water quality enhancement while maintaining a less unaffordable cost. This scenario results in an RI of 2.34%.

  The Integrated Plan Scenario 2040 includes selected existing LTCP projects that have already been initiated, alternative LTCP projects, and current CIP projects (either non-LTCP or annual projects) for wastewater and stormwater infrastructure needs. Due to the number of projects already under design or construction, the Integrated Plan Scenario 2040 is highly constrained due to construction schedules and ongoing modification negotiations with USEPA. If timely approvals of modification requests are not received, several of these projects will be required to be unconstrained in the model resulting in a revised schedule.

Table 5-2 summaries the RIs for each scenario.

Table 5-2. Summary of FCA Residential Indicators

	Baseline 2027	Baseline 2040	Integrated Plan 2040
Residential Indicator - Service Area	2.46%	2.64%	2.34%

Figure 5-4 on the following page shows a schematic of the final Integrated Plan Scenario 2040. As depicted in the legend, the CSO Rack project recommendations are illustrated with a less than full pipe for sewer separation, a partially full pipe for in-line storage, a tank for storage, a plant and Great Blue Heron for wetlands, a leaf for stormwater Best Management Practices (BMPs), a smart gate and pump are shown at the CSSF, and projects where optimized conveyance from the existing rack to the interceptor is identified with "Optimized Conveyance" and a red arrow. The full pipe capacity of the interceptor is noted, from 80 MGD upstream to 280 MGD in the downstream segments flowing to the WPCS. The performance criteria of each rack is shown in terms of overflows in the typical year.

Akron's Integrated Plan Scenario 2040 eliminates overflows where sewer separation is proposed, achieves zero overflows at each proposed rack project, and proposes a level of control of three overflows at OCIT to eliminate the need for an enhanced high rate treatment (EHRT) facility. With the addition of controls at the Cuyahoga Street Storage Facility (CSSF), the remaining flows are reduced from the current LTCP. Even with this change in level of control, Akron's study of water quality indicated there would be no negative impact.

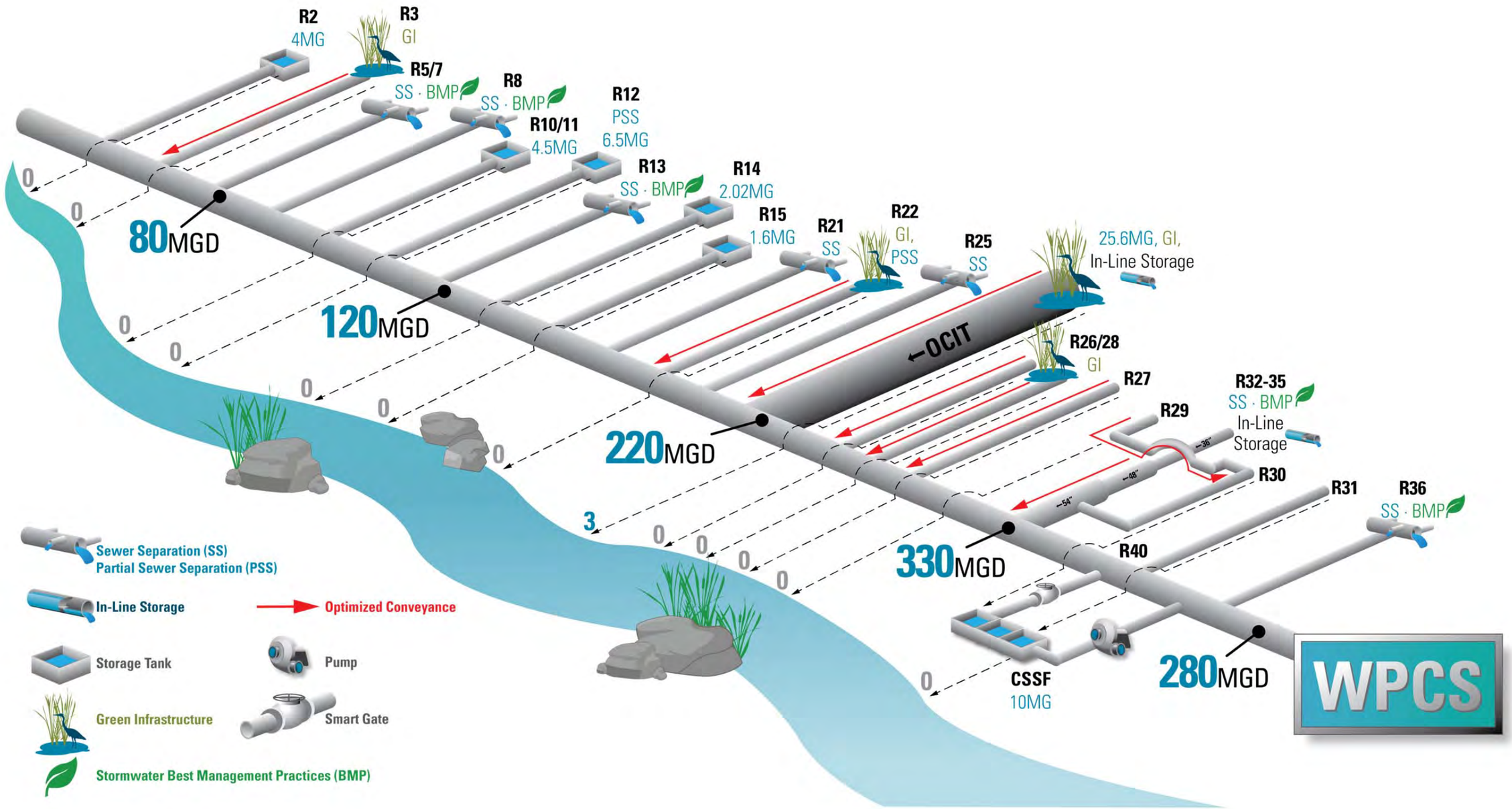

Figure 5-4. Final Integrated Plan Scenario 2040 Schematic

5.3 Benefit Measurements for Project Prioritization

Once the Integrated Plan project portfolio was defined, the individual projects needed to be prioritized to determine which projects should be implemented first. As noted in Figure 5-1, the City's Integrated Plan process used TBL criteria to measure benefits and to assign project priorities based on those benefit measurements. As further described below, each project was assessed and assigned a score against each TBL criterion, generating an overall project score. Projects with the highest importance weighted TBL scores were deemed the most beneficial, and prioritized highest based on providing the maximum environmental, economic, and social benefit for the City.

The City's TBL included environmental, economic, and social categories with criteria customized to the City's needs based on stakeholder input. Potential benefit criteria were identified based on different types of evaluation benchmarks the City has used for past projects including master planning and LTCP studies. The initial criteria were reviewed with the Integrated Plan Stakeholders Group. The stakeholders modified, or eliminated, the City's initial criteria as needed and suggested additional criteria for consideration.

The TBL criteria were selected based on the following principles:

- **Customizable:** TBL criteria should be customized to the Akron community's specific needs and values.
- **Measurable:** Data to measure each benefit should be available so that the projects can be quantitatively compared and scored.
- **Applicable:** Each criterion should not be so specific that only a few projects will be able to score in that particular criterion.
- **Definable:** To limit subjective scoring, scoring definitions should be clear and well defined to ensure consistency across projects.

After City staff, the Mayor's Cabinet, and the Integrated Plan Stakeholder Group evaluated the criteria, 12 criteria were selected as the most appropriate for the City. These criteria are listed in Appendix B, Akron Integrated Plan Triple Bottom Line Scoring Definitions. Appendix B provides a table with the 12 scoring criteria, definitions, and applicable scores for each project. Each criterion contains a unique scoring definition, and each project can receive up to 10 points per TBL criterion, reflecting their individual perspectives. These detailed scoring definitions promote consistency in the project scoring process.

Once a consensus agreement was obtained on the 12 TBL criteria, the various stakeholders evaluated the importance of individual TBL criterion. Individual communities and groups may weigh criteria differently. One group may place extreme importance on regulatory compliance, while another on environmental benefit.

The following stakeholder groups provided input on importance weightings for the Akron Integrated Plan development process:

- **Mayor's Cabinet:** The weightings developed by the Mayor's Cabinet reflect a broad array of the Cabinet staff's responsibilities (planning, law, economic development, education) which allows for a greater diversity in stakeholder considerations.

- **Akron Engineering Bureau (AEB):** AEB representatives developed importance weightings that reflect a deep understanding of the important issues to consider when implementing a large-scale LTCP and the technical ramifications of specific improvements. AEB Stakeholder Group includes representatives outside of the Engineering Bureau.

- **Akron Integrated Plan Stakeholder Group:** The City facilitated a two-part weighting development session open to all Akron Integrated Plan Stakeholders. An optional manual Excel spreadsheet weighting exercise was developed for stakeholders who could not attend the workshops, and the results were incorporated into the Integrated Plan Stakeholder Group's overall importance weightings.

A pairwise comparison was conducted on the importance weightings prepared by the Mayor's Cabinet, AEB, and Integrated Plan Stakeholder Group using Expert Choice Comparion™ software. Pairwise comparison methodology is widely used for multi-criteria decision analysis. The use of this method facilitates good collaboration between multiple stakeholders while providing the ability to make simple judgments and gain better result acceptance.

Following a review of various methods of combining importance weights, the City chose a weighted average approach that weighted the Mayor's Cabinet and the AEB representatives at 25% each and the Integrated Plan Stakeholder Group at 50%. The TBL criterion importance weights are shown in Figure 5-5.

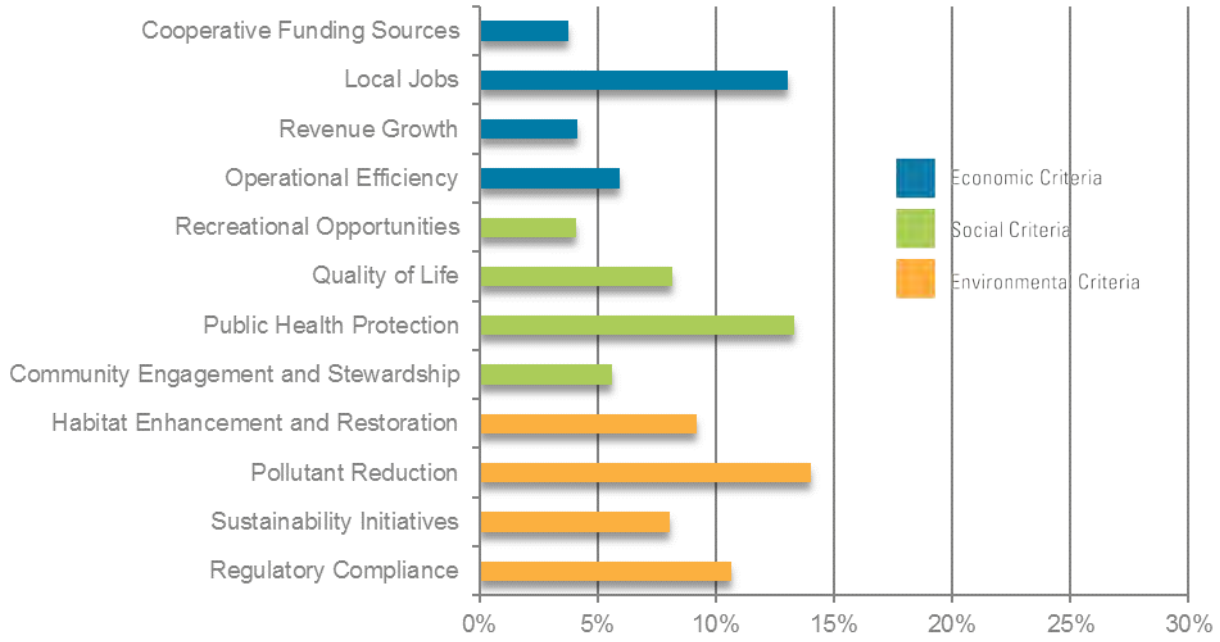

Figure 5-5. Akron TBL Criterion Importance Weights

This weighted average approach reflects the City's desire to highlight the importance of the Stakeholder's involvement in the integrated planning process. It is consistent with USEPA's IPF, which calls for the full consideration of stakeholder views.

Following development of the TBL criteria and importance weights, the City assigned raw scores to all CIP projects for each TBL criterion in accordance with the scoring definitions. Project Description Sheets (included in Appendix C, Integrated Plan Prioritized Project Descriptions) provided a common template for evaluating and scoring projects.

The assigned raw scores were then converted to weighted scores using the importance weightings. The analysis calculates the weighted scores by multiplying raw scores by the appropriate weighting for the TBL criteria considered. Appendix A, Integrated Plan Project List, shows all considered projects with raw and weighted scores.

The weighted scores for the 12 TBL criteria were added together to achieve a total weighted score. The total weighted score was then used to compare projects from highest score to lowest score in a prioritized project list. Akron's Integrated Planning process checked this prioritized list against known project assumptions as a "reality check" to ensure the mathematical project scores created realistic project prioritizations.

5.4 Financial Constraints

With unlimited funding, the City would be able to fund every project in the Integrated Plan project portfolio in the priority order indicated by the project prioritization list. The City has taken aggressive steps to fund the LTCP projects and other costs of the City's wastewater and stormwater systems. In just the past ten years alone, the City has raised sewer rates over 269%. However, even with such aggressive rate increases, the City will still not be able to pay for the cost of the current LTCP Projects and the additional costs associated with the City's wastewater and stormwater systems. The expenditure of funds required to implement the CIP requires a financial strategy and capability assessment to optimize a schedule for implementing priority projects.

The City has been discussing financial issues with the regulatory agencies since informing the agencies that the LTCP was unaffordable and several versions of the City's FCAs have been submitted to USEPA. The USEPA has requested additional MM customer financial information be included in the FCA, which will be included in a separate FCA submittal to USEPA. The following summarizes key elements of the FCA report related to the integrated planning process.

The City's financial model determined the funding availability, rate requirements, and affordability for each Integrated Plan scenario considered. The financial model is a cash-flow study that analyzed the sources of funds (rate revenues, other revenues, bond and loan proceeds, and reserve fund balances) with the uses of funds (O&M, debt service, and capital improvements). Inputs and outputs to the model are shown in Table 5-2.

Table 5-3. Financial Model Inputs and Outputs

Model Inputs			Model Outputs
General Assumptions	**2014 Year-End Actuals**	**2015 Budget**	
Inflation Growth Borrowing Terms Debt Service Coverage Requirements Minimum Fund Balance Requirements	O&M Debt Service Capital Improvements Revenues Fund Balances	O&M Debt Service Capital Improvement Plan Revenues	Annual Revenue Required Ending Fund Balances Projected Debt Issues Necessary Rate Revenue Increases [1] Maximum Annual Net Revenues Available

[1] Necessary rate revenue increases may not relate to an affordable solution. The affordability analysis is detailed in the *Financial Capability Assessment*, which will be submitted to USEPA separately.

The financial analysis considered prior capital investments and future cost requirements. The O&M costs include $3 million per year projected to be needed to fund the stormwater system recurring annual O&M costs, which are separate from the specific capital projects identified for the three stormwater annual projects described in Section 5.1. These O&M costs were developed by the City as part of an evaluation of the requirements for a sustainable stormwater utility for a system of this size.

Table 5-3 summarizes the City's capital investments in the collection system and wastewater treatment facilities from 2008 to 2014.

Table 5-4. Capital Improvement Collection and Treatment Expenditures, 2008 to 2014

Year	Sewer Reconstruction	CSOs	Treatment Plant	Totals
2008	6,687,155	93,972	328,143	7,109,270
2009	3,346,808	458,193	62,738	3,867,739
2010	1,539,300	5,769,694	964,756	8,273,750
2011	3,827,909	7,570,996	2,020,667	13,419,572
2012	5,510,722	18,126,131	5,989,072	29,625,925
2013	3,741,138	29,862,312	4,479,802	38,083,252
2014	7,464,000	24,317,000	2,618,000	34,399,000
Totals	**$32,117,032**	**$86,198,298**	**$16,463,178**	**$134,778,508**

The historical spending amounts helped inform future cost requirements. The increase in CSO expenditures from 2010 through 2014 was a direct result of the LTCP. Additionally, as the City's wastewater and stormwater assets age, additional emphasis will be placed on moving towards an asset management-focused mode of operation. This provides capital reinvestment to rehabilitate and replace existing assets.

The financial model was used to project rate increases necessary to fund the two scenarios. Figure 5-6 presents the cumulative rate increases for the two scenarios using a 2% and 3% annual rate increase beginning in 2021.

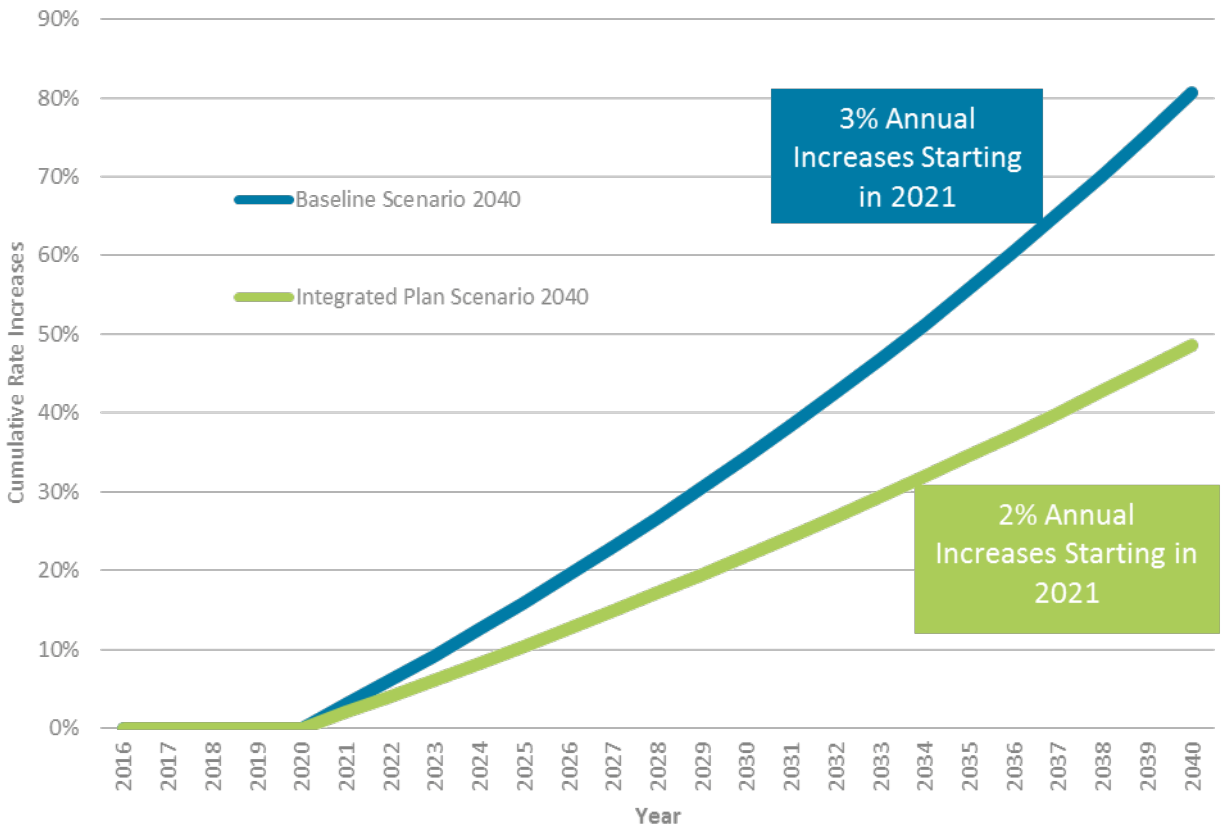

Figure 5-6. Cumulative Rate Increases Required to Fund Scenarios

The graph in Figure 5-6 already assumes the current baseline revenues from the City's implemented sewer rate increases in 2014 and 2015 that increased a typical customer's bill by approximately 69%. The revenue analysis assumed no increases in residential rates from 2015 until 2021, when a 2.0% per year (or 3% per year) increase was required to support existing and future program expenditures. The analysis also assumed MM rate revenues will remain consistent with the current agreements and annual reconciliation model.

In addition, the model assumes an average of 72% of the CIP budget will be funded through State Revolving Fund (SRF) loans and 28% will be funded through cash (i.e., Pay-As-You-Go or "PayGo" expenditures). In the near term, the percentage funded through debt will be much higher, corresponding with the greater LTCP expenditures over the early years of the program. Likewise, the percentage funded through debt is significantly lower in the later years of the program.

Anticipated O&M costs from new LTCP and other projects were estimated at 0.5% of 80% of the scenario capital project portfolio, which was derived from a more detailed review of the specific projects in the portfolio. Adjusted Net Revenues were calculated by subtracting the anticipated O&M cost from Projected Net Revenues.

Finally, specific project constraints were developed by the City to reflect fiscal and project sequencing realities of the various projects. For example, the NSIT project was constrained to start after completion of the OCIT because it would be unrealistic for the City to finance the

construction of two tunnel projects simultaneously. The specific project constraints are listed in Appendix D, Schedule Constraints.

The results from the financial model were used to develop a funding availability curve for capital costs over the life of the planning period. The funding availability curve is the annual amount of capital costs incurred to fund capital projects. This curve was used to determine the timing and amount of projects that could be funded under each scenario.

As stated above, an adequate funding level must be maintained to meet debt service coverage and other bond covenants throughout the period of the analysis. These requirements limited the maximum annual funding available for capital expenditures. Since project costs escalate over time, the analysis must account for increases in nominal capital costs as schedules change. Figure 5-7 shows the funding availability curve for capital costs for the Integrated Plan Scenario 2040. A similar funding availability curve for Baseline Scenario 2040 capital costs was also developed but is not shown.

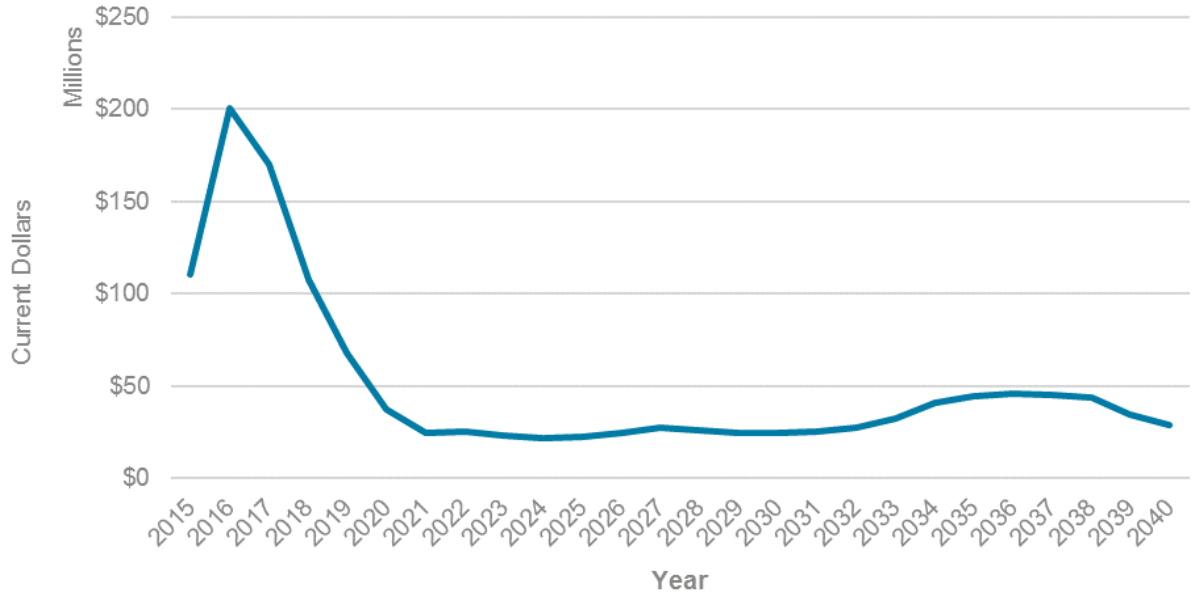

Figure 5-7. Funding Availability for Capital Costs

The higher level of capital spending available in early years is due to the spending requirements of the OCIT project, the WPCS projects, and the individual rack projects already in design or under construction, which are required to be completed in accordance with CD and LTCP milestone dates. These early requirements in capital costs limited capital funding availability in later years. If timely approvals of modification requests are not received, several of these projects will be required to be unconstrained in the model resulting in a revised Integrated Plan schedule.

5.5 Project Prioritization and Scheduling

The next step in the integrated planning process is to integrate the prioritized project list with the funding availability curve financial constraints. To do this integration, both the prioritized project list and the funding availability curve were input into the Expert Choice Comparion decision-making model. This comparison software uses a mathematical model to maximize benefit scores and uses a 3% inflation rate, for the capital projects from the 2015 present worth estimate. Essentially, the model attempts to schedule each of the prioritized projects without exceeding the funding availability curve constraint in any given year, and seeks to maximize benefits each year within the affordability constraints.

In addition to the funding availability curve constraint, the model allows for additional constraints to reflect physical requirements such as required start or end dates, and individual project sequencing limitations (i.e., Project X cannot start until Project Y finishes). Once all project constraints are loaded, the model output provides an optimized TBL solution for each scenario. TBL benefits for each optimized scenario are described in detail in Section 6, Integrated Planning Results.

The sequencing and scheduling of the Integrated Plan projects is reflected in a detailed Gantt chart included in Appendix E. Similarly, the sequencing and scheduling of the Baseline Scenario 2040 projects is shown in a detailed Gantt chart in Appendix F. The project dates shown in the Gantt charts, as well as in Appendix C, Integrated Plan Project Descriptions, indicate when the City initiates or finalizes project spending on a particular project, as opposed to a construction start date, bidding date, or Achieve Full Operation (AFO) date of a project. The project cash flows are based on a generic “S” spend curve (cost forecast is annualized normal “bell curve” distribution) unless an individualized project spend has been forecasted for a particular project. Capital costs are escalated at 3% per year throughout the 2040 planning period (consistent with industry best practices).

5.6 Affordability Analysis

As previously mentioned, the City’s financial affordability analysis is included in the separate FCA report submittal. In summary, the financial affordability was analyzed using USEPA’s FCA guidelines.[65] This guidance dictates a series of calculations using current and projected wastewater and combined stormwater system costs and economic characteristics of the community to determine the financial burden of CSO LTCPs.

Once each LTCP scenario was prioritized, the FCA was calculated to determine the cost per household in the City’s service area and the RI (the cost per household percent of the MHI). Six financial capability indicators intended to measure background or underlying financial capacity of the community were also evaluated for the City. Two financial capability indicators address existing debt, two concern socio-economic conditions, and two concern property tax data. These six parameters are compared with benchmark figures (nationwide data, for example) or against specific criteria provided by USEPA. The RI is intended to represent the prospective financial burden, and the Financial Capability Indicators are intended to represent the existing financial capacity to accommodate additional financial burden. The RI and financial capability

[65] USEPA Office of Water. March 1997. *CSO Guidance for Financial Capability Assessment and Schedule Development*, EPA 832-B-97-004.

indicators score are combined to determine the financial burden of CSO LTCPs. USEPA considers an RI greater than 2.0% to contribute to a “high financial impact”, which when combined with Akron’s mid-range financial capability score, results in a “high burden” to the City’s ratepayers.

USEPA Guidance provides a high-level snapshot of affordability. Communities are encouraged to provide additional information that better characterizes their unique financial burden. The revised financial capability framework used in conjunction with IPF requires the consideration of community impacts and disproportionate burdens resulting from LTCP approaches.

Akron’s Integrated Plan process uses a technique for analyzing financial burdens called WARi. This measure enhances visibility of residential affordability by focusing on three key areas that USEPA’s Guidance calculation does not include: population details by neighborhoods, the full distribution of income at a census-tract level, and real bill data.

The American Community Survey (US Census Bureau) provided data on the distribution of income by household across sixteen income buckets, presented at a census-tract level. Current billing systems provide actual bills for neighborhoods that can be geographically matched to census tracts. With greater attention to income skew, income distribution, neighborhoods, and actual bills an understanding of real burden is improved for better decision-making Finding the weighted average of census tract burden and income distribution in Akron’s Retail Sewer Service Area provides an alternative methodology that gives insight on specific groups within the City that have a high fiscal burden.

A more accurate picture of the entire community is provided with this approach. Using this analysis, it is determined the LTCP program will represent a financial burden of 2.1 to 9.5% of MHI for a significant proportion of the ratepayers, particularly those within the City of Akron proper. Additionally, poverty rates in the City have been relatively high in recent years. The U.S. Census Bureau defined the poverty threshold for a family of four at $23,834 in 2013.[66] In 2013, 27.8% of the population in the City was reported below the poverty level, including 41.3% of children under the age of 18 years old. This is obviously an unacceptable burden under any measure.

To fund the Baseline Scenario 2040 projects that include the original LTCP project list, the City would need to increase sewer rates an additional 80% beyond the already implemented 2014 and 2015 rate increases. To fund the Integrated Plan Scenario 2040, additional rate increases are anticipated to start in 2021 and will proceed at 2% per year through 2040, for a cumulative rate increase of 49% excluding the 2014 and 2015 increases.

[66] U.S. Census Bureau. Social Economic and Housing Statistics Division, Poverty Thresholds for 2013.

6.0 INTEGRATED PLANNING RESULTS

Section 6 is a continuation of the alternative evaluation activities. Section 5, Evaluating and Selecting Alternatives, identified individual project alternatives and grouped them into scenarios. Section 6 presents the detailed scenario evaluations in terms of the City's major Integrated Plan goals as follows:

- Reduce the amount of unaffordability.
- Use of an enhanced Triple Bottom Line to measure benefits and evaluate projects.
- Achieve equal or better environmental benefits at a less unaffordable cost.
- To the extent feasible and when cost effective, use green solutions.

The goals are designed to ensure the City meets environmental priorities at a less unaffordable cost. Section 6 analyzes the Integrated Plan results for the scenarios defined in Section 5 based on these goals.

This section will discuss how the benefit of extending the LTCP projects compliance dates allows the City to fund needed projects that achieve a greater environmental benefit, some sooner in the program. Benefits under the proposed Integrated Plan Scenario 2040 are measured in terms of the benefit scores assigned to each CIP project. In addition to the TBL measured benefits, there are several important additional benefits for the Integrated Plan Scenario 2040, including:

- Earlier reduction of CSO volume.
- Reduction in secondary treatment bypass volume at the Akron WPCS sooner as compared to the current LTCP.
- Improved water quality, predicted improvements in habitat and fish index scores, and more uniform dissolved oxygen (DO) concentrations associated with the Gorge Dam removal.
- Improved Total Suspended Solids (TSS) and bacteria removal from stormwater flows that discharge to green infrastructure facilities and downstream BMP installation on new green infrastructure facilities.

Extending the LTCP projects compliance dates allows the City to fund needed projects that achieve a greater environmental benefit, some sooner in the program.

6.1 Improved Financial Affordability

Large capital requirements such as the OCIT necessitate substantial available funding in the short term, resulting in decreased funds available in subsequent years as debt service is repaid. The result is the funding availability curve for the City (previously shown in Figure 5-7) that is higher in the early years of analysis and significantly lower after the funding of major capital projects. The capital constraints imposed by these projects means that the specific constraints of a scenario can lead to a situation where fund requirements for projects cannot be met by fund availability.

A scenario is only feasible if: i) the funding requirements are equal to or less than the available funding in each year, and ii) all projects can be funded in the planning period. The City uses a long-term financial model to analyze sources and uses of funds that determines the capital funding available each year. Minimum required fund balances and debt service coverage requirements are maintained throughout the length of the program. Beginning in 2021, 2% annual rate increases are assumed to be acceptable and incorporated into the available funding.

Sources of funds include rate revenues (including miscellaneous revenues) and debt proceeds. Uses of funds include:

- Existing and projected O&M expenses.
- Existing and projected debt service payments.
- PayGo capital expenses.
- Loan administration costs.

Figure 6-1 and Figure 6-2 show sources and uses of funds for the optimized project expenditures for the Baseline Scenario 2040 and the Integrated Plan Scenario 2040, respectively. The stacked bars in each year represent the project cost requirements. The lines represent sources of funds. Cash balances are not shown in the figures; however, in some years, cash balances are increasing and in other years are decreasing.

The financial model indicates that 3% rate increases beginning in 2021 are required to fund the Baseline Scenario 2040 LTCP projects as shown in Figure 6-1. This represents a cumulative increase of 80%, resulting in an unacceptably high financial burden on ratepayers.

The financial model indicates that 2% rate increases beginning in 2021 are required to fund the Integrated Plan Scenario 2040 LTCP projects as shown in Figure 6-2. This represents a cumulative increase of 49%. While less unaffordable for the ratepayers, this scenario still results in a high financial impact.

Figure 6-3 shows the same capital project expenditures from Figure 6-2 differentiated by project types instead of by expense type.

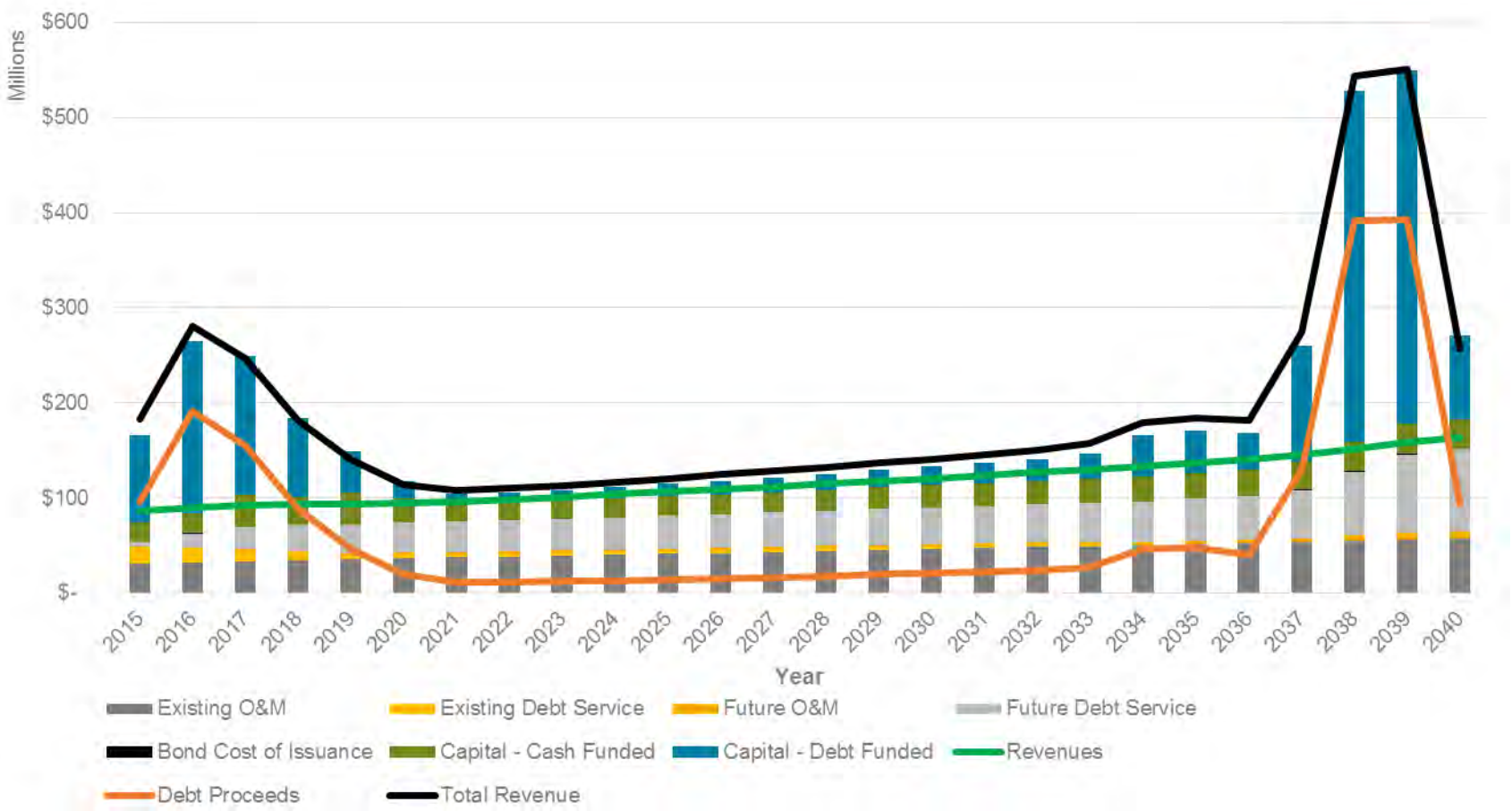

Figure 6-1. Projected Baseline Scenario 2040 Sources and Uses of Funds

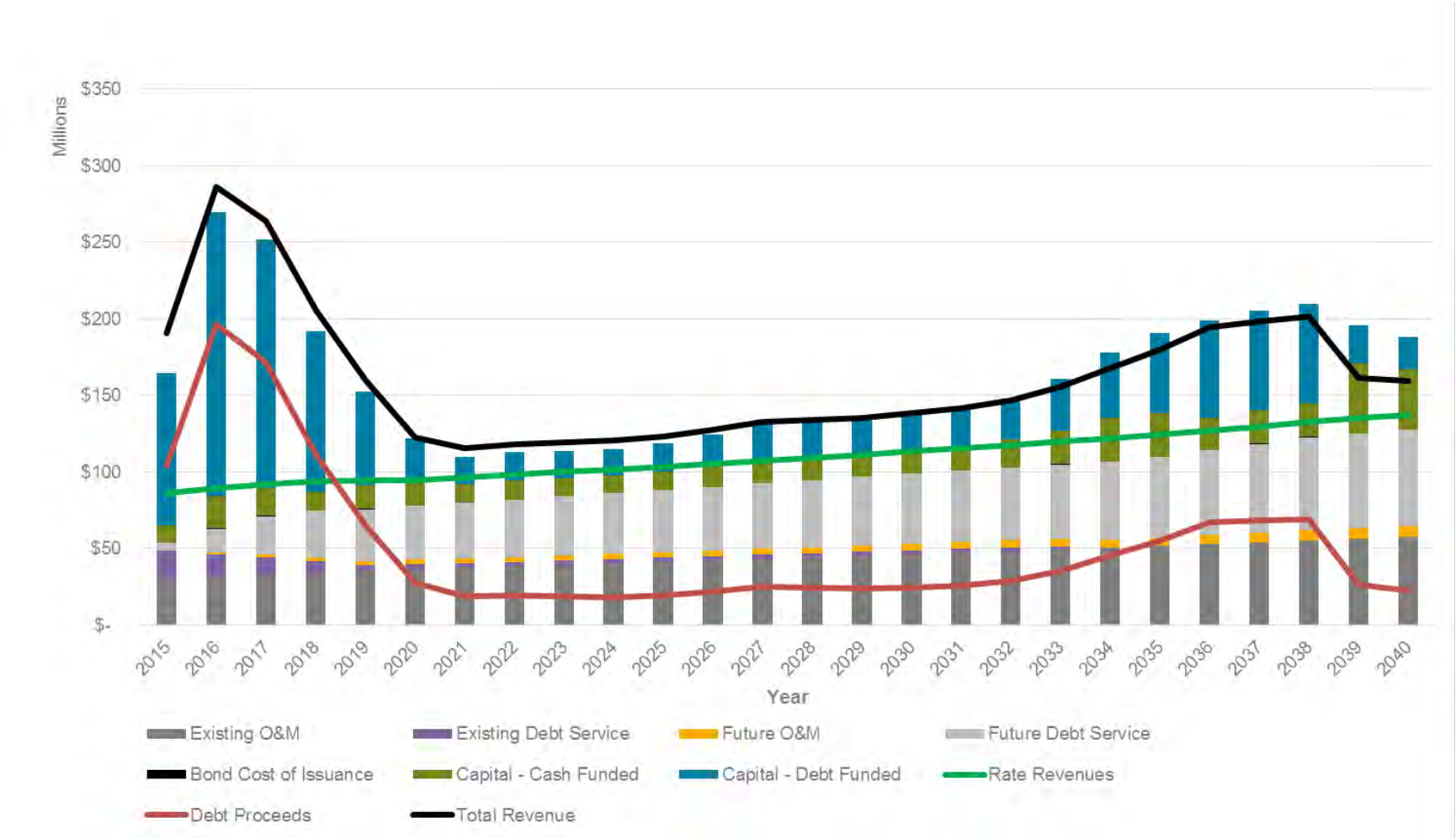

Figure 6-2. Projected Integrated Plan Scenario 2040 Sources and Uses of Funds

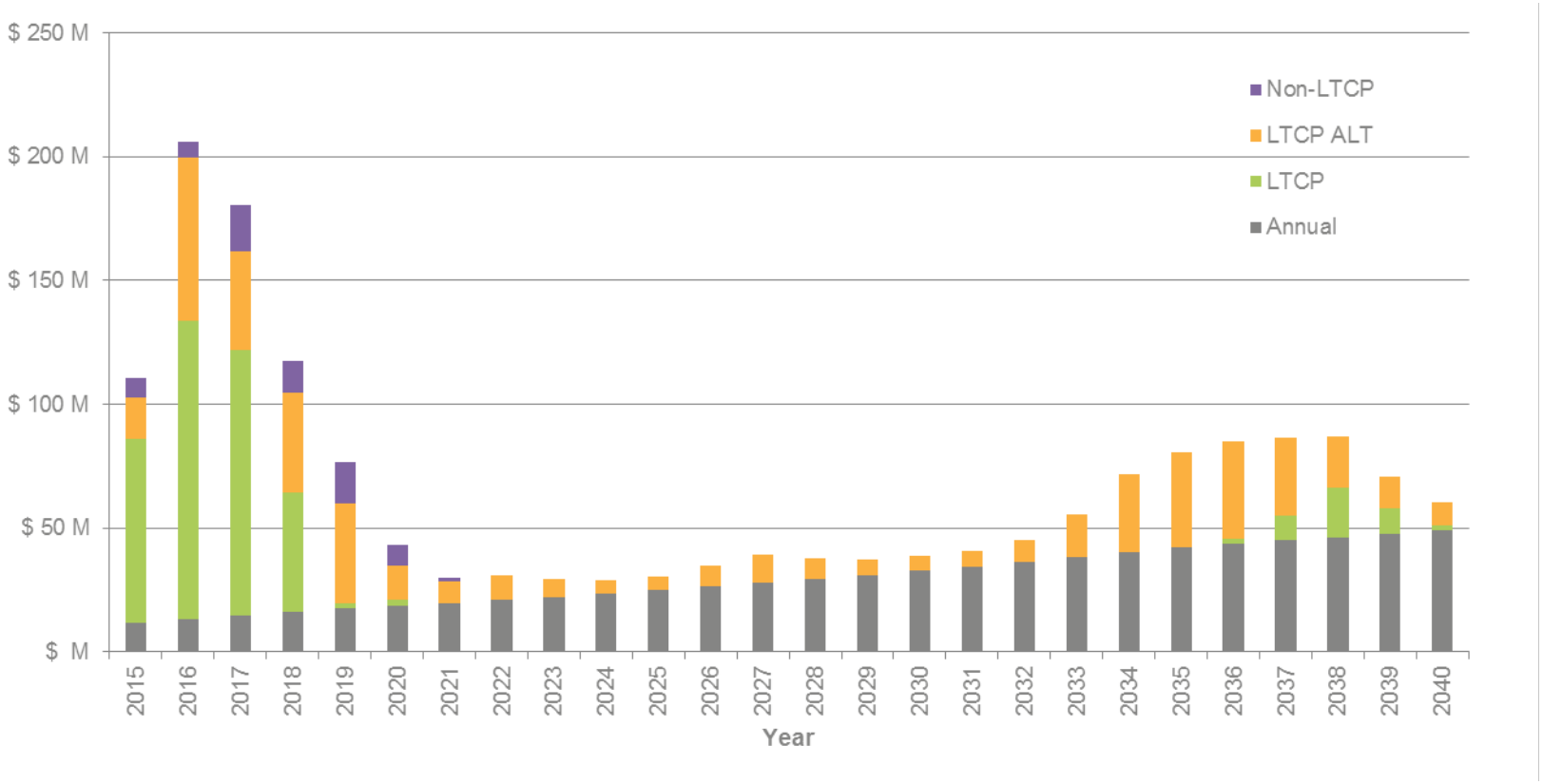

Figure 6-3. Integrated Plan Scenario 2040 Annual Capital Expenditures by Project Type

6.2 Enhanced Triple Bottom Line Measured Benefits

The project benefits are measured by the weighted benefit scores for each project.

The cumulative aggregate TBL benefit total is calculated by adding the weighted TBL benefit core for all completed or on-going projects for each specified year in every scenario and then plotting these aggregated scores on a graph. A project accrues its TBL benefit the year the project is completed. Annual projects accrue TBL benefits each year.

Figure 6-4 shows these scores over time for each scenario. As shown, the total benefits for Integrated Plan Scenario 2040 are greater than the Baseline Scenario 2040. The difference in cumulative benefits gradually increases throughout the planning period.

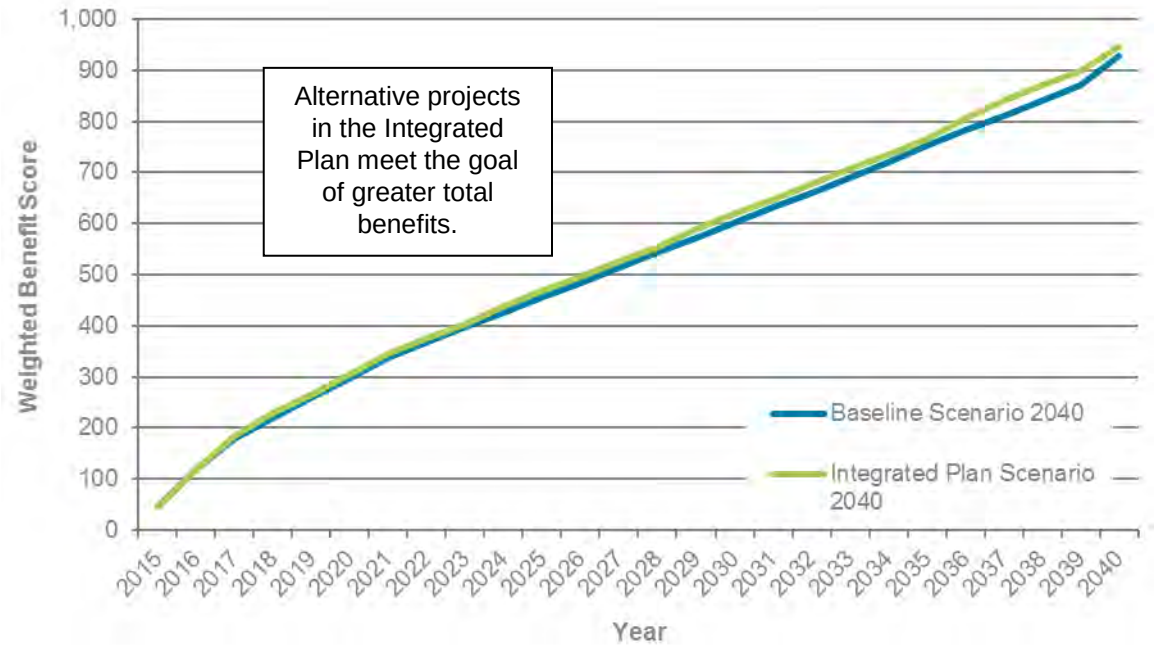

Figure 6-4. Akron Total TBL Benefit Curve Comparison

In the graph above, it is difficult to discern the difference between the two lines, so the following graph was produced that shows ONLY the difference between the two lines above. This clearly shows that the Integrated Plan 2040 scenario results in greater TBL benefits in every year during the planning period. The benefit curve for the Integrated Plan Scenario 2040 starts equal to the Baseline Scenario 2040 benefit curve, but quickly exceeds the Baseline Scenario 2040 benefit curve and results in greater total benefit.

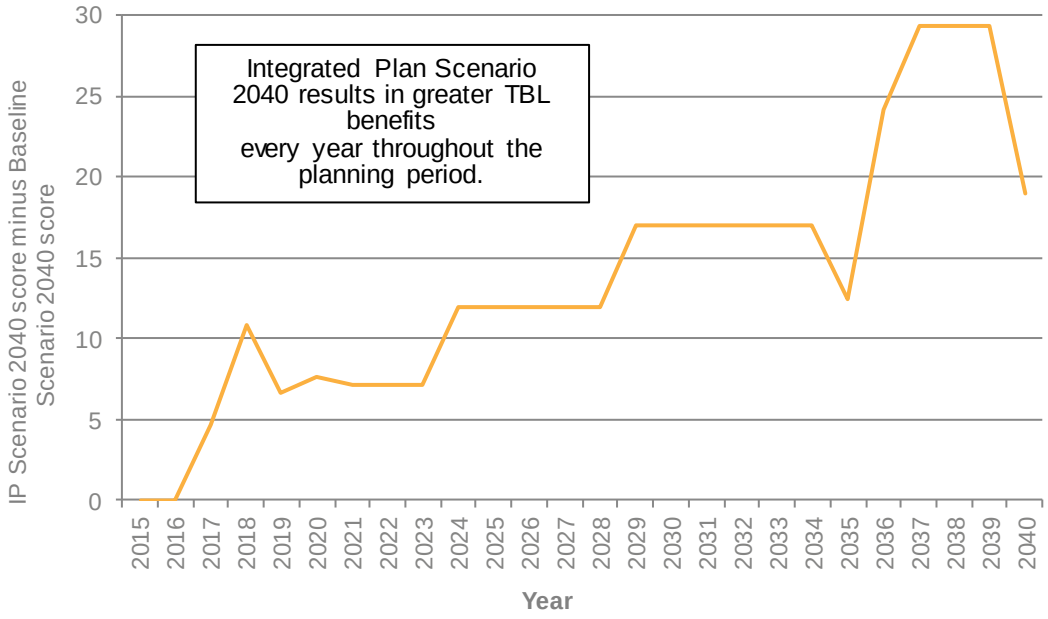

Figure 6-5. Difference in TBL Benefit Scores between Scenarios

6.3 Equal or Greater Environmental Benefit

While the TBL score includes environmental benefits, the USEPA's IPF clearly conveys that the selected alternative should show equal or greater environmental benefit from the original compliance plan baseline. Akron's Integrated Plan shows equal or greater environmental benefits in the following areas:

- Environmental portion of TBL benefit.
- Projected CSO discharge volume during the modeled Typical Year.
- Bypass volume reductions at the Akron WPCS.
- Reduction in CSO loadings, including permanent removal of CSO discharge for separated areas. The stormwater from those areas will also be treated.
- Ability to fund stormwater projects that include such environmental protection components as BMPs and stream restoration, and to address long-term drainage and flooding issues associated with stormwater issues in the City.

It should be noted that neither the LTCP nor the Integrated Plan Scenario 2040 result in any significant increase in compliance with RWQC.

6.3.1 Environmental Triple Bottom Line Benefit

It is possible to use the same analysis that generates Figure 6-4 and evaluate only the environmental portion of the TBL benefit score. The results of this are shown in Figure 6-6. Through this analysis, it is clear that the benefits discerned in the original TBL analysis in Figure 6-5 for total TBL benefits are maintained for the environmental only benefits.

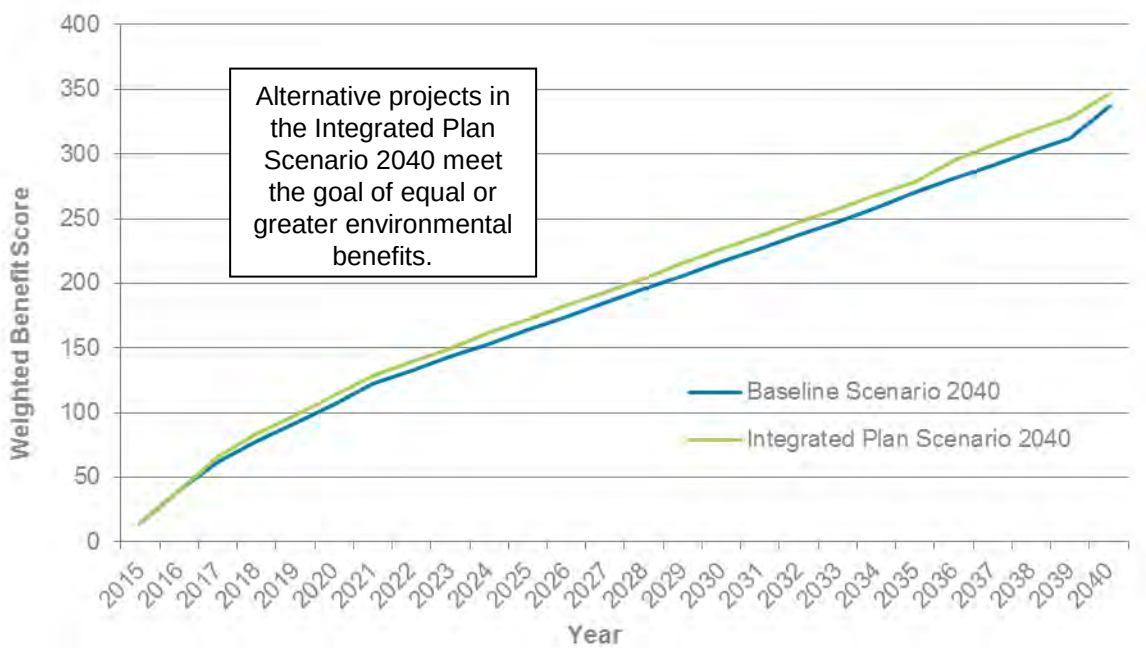

Figure 6-6. Akron Environmental Only TBL Benefit Curve Comparison

Similar to the previous comparison, it is difficult to discern the difference between the two lines, so the graph shown in Figure 6-7 was produced that shows ONLY the difference between the two lines above. This clearly shows that the Integrated Plan 2040 scenario results in greater environmental benefits in every year during the planning period. The benefit curve for the Integrated Plan Scenario 2040 starts equal to the Baseline Scenario 2040 benefit curve, but quickly exceeds the Baseline Scenario 2040 benefit curve and results in greater environmental only benefit.

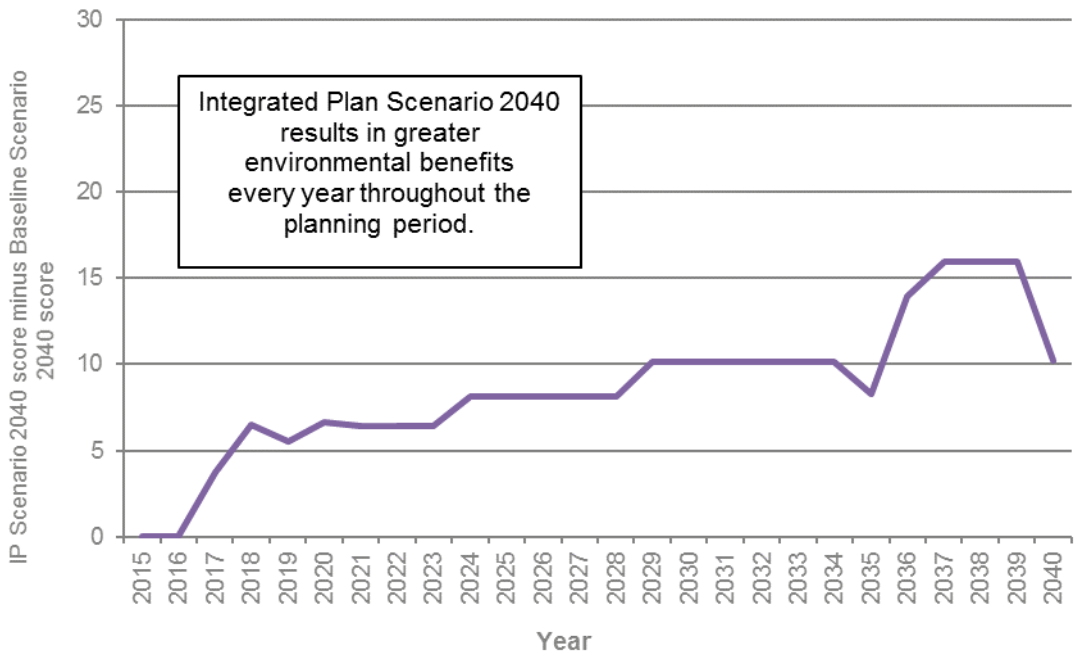

Figure 6-7. Difference in Environmental Benefit Scores between Scenarios

6.3.2 Overflow and Bypass Volume Reduction Over Time

Each scenario contributes a different amount of annual CSO discharge and secondary treatment bypass volume based on various project designs and alternative sequencing. This analysis shows the expected overflow volume and secondary bypass reduction for the Typical Year for each scenario. Overflow reduction is calculated by summing the estimated Typical Year overflow volume for each rack annually and eliminating these overflow volumes as projects are completed in each scenario. Similarly, secondary bypass volumes are calculated based on the anticipated capacity of secondary treatment in each year of the scenarios, using the Typical Year flows to the WPCS.

In lieu of the two Baseline Scenario 2040 designated WPCS improvements, the Integrated Plan Scenario 2040 proposes upgrading WPCS secondary treatment capacity to 220 MGD as illustrated in Figure 6-8. The remaining small volume of bypass flow remaining after equalization in the existing SRT will be treated with CEPT and disinfected to meet NPDES permit limits. The City is currently conducting a pilot project to gauge the effectiveness of CEPT as an alternative to BioACTIFLO, and has observed outstanding results. The results show that CEPT can meet or exceed the Performance Criteria for secondary bypass treatment contained in the CD. The secondary treatment capacity expansion to 170 MGD contained in the LTCP would result in 20 bypasses per year and 265 MG per year to be treated with BioACTIFLO. The proposed alternative project would result in 5 bypasses per year and only 41 MG per year to be treated with CEPT. The secondary expansion project would also be completed 3 years sooner than required in the LTCP. See WPCS Phase 2, Part 1 and Part 2 Alternative Projects in Appendix C, Integrated Plan Project Descriptions, for further information.

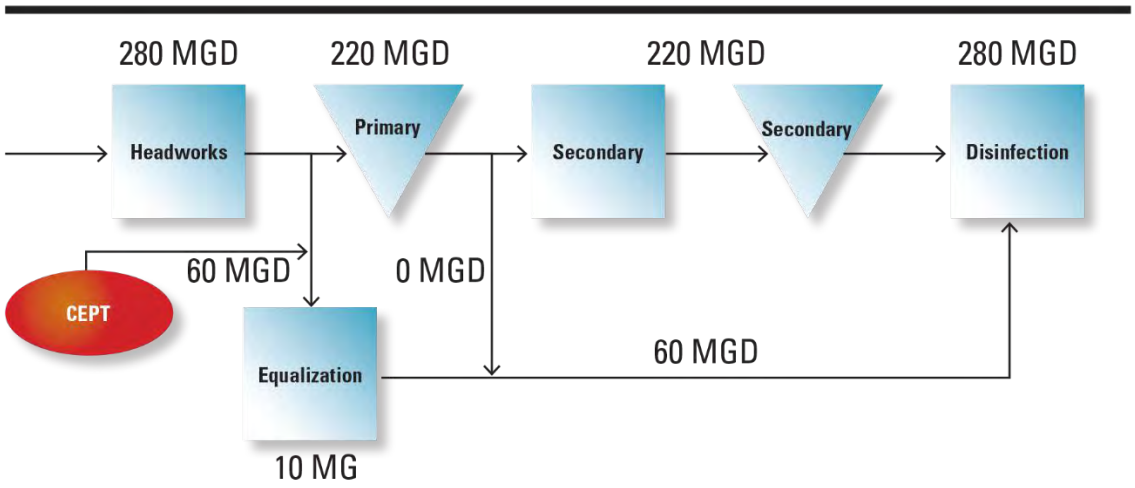

Figure 6-8. Akron WPCS Enhanced LTCP Configuration Flow Schematic

Under the Integrated Plan Scenario 2040, secondary treatment capacity expansion occurs three years earlier than required in the CD, and results in a higher capacity of secondary treatment. This results in reduced frequency and volume of secondary bypass and means the environmental benefits of bypass reduction are realized sooner. The secondary expansion project will require taking one of the WPCS's six secondary treatment trains offline during construction. This will lead to a short-term increase in overall secondary treatment bypass during the construction phase. The City has been able to significantly exceed the anticipated secondary capacity of 130 MGD following the Phase 1 expansion due to additional modifications and interim upgrades to the system.

Figure 6-9 shows the Typical Year overflow and bypass volumes for each scenario, and illustrates that the Integrated Plan Scenario 2040 provides greater reduction in discharge volumes. The cumulative difference in overflow and bypass volumes over the period is equal to approximately 11 BG through 2040. While there would still be a small residual annual overflow from the OCIT location in the Integrated Plan Scenario 2040, it would take approximately 183 years to equate to the number of gallons removed sooner through 2040.

Under the Integrated Plan Scenario 2040, secondary treatment capacity expansion occurs three years earlier than required in the CD, and results in a higher capacity of secondary treatment. This results in reduced frequency and volume of secondary bypass and means the environmental benefits of bypass reduction are realized sooner. The secondary expansion project will require taking one of the WPCS's six secondary treatment trains offline during construction. This will lead to a short-term increase in overall secondary treatment bypass during the construction phase. The City has been able to significantly exceed the anticipated secondary capacity of 130 MGD following the Phase 1 expansion due to additional modifications and interim upgrades to the system.

Figure 6-9 shows the Typical Year overflow and bypass volumes for each scenario, and illustrates that the Integrated Plan Scenario 2040 provides greater reduction in discharge volumes.

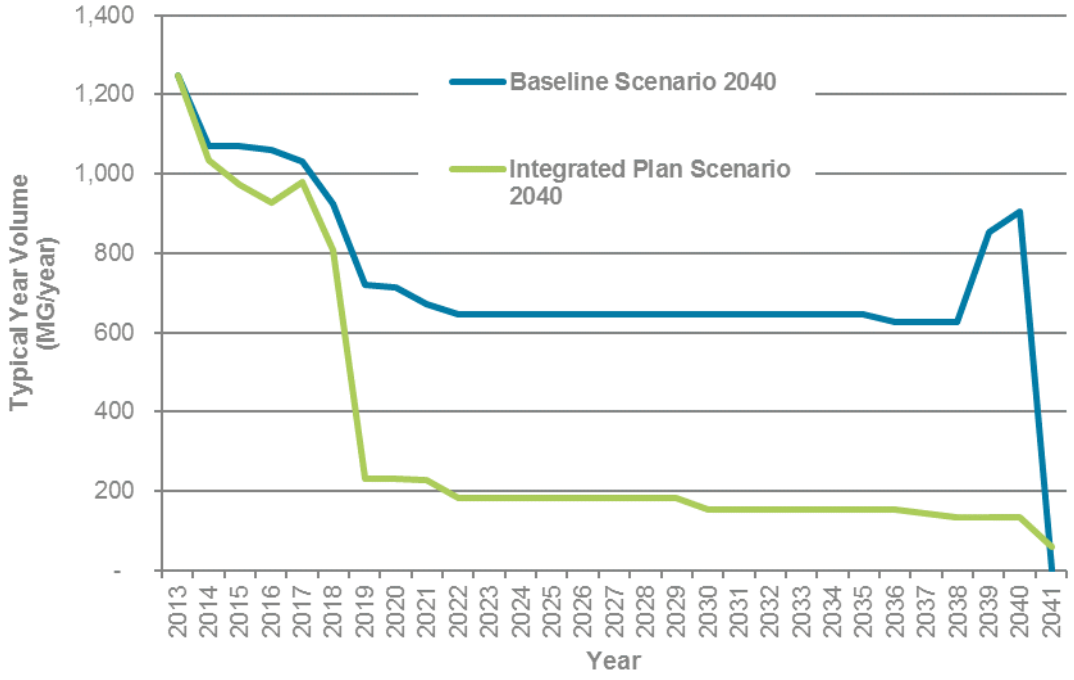

Figure 6-9. Predicted CSO Typical Year Reduction Achieved Over Time

6.3.3 Receiving Water Quality Scenario Evaluation

Section 2, Water Quality, Public Health, and Regulatory Issues, describes the water quality model developed as part of the Akron integrated planning process. This model evaluates the effects of CSOs on *E. coli* within Akron's waterways. *E. coli* levels are reported in cfu/100 mL. The sampling locations used to collect water quality samples for use in model development are shown in Figure 6-10.

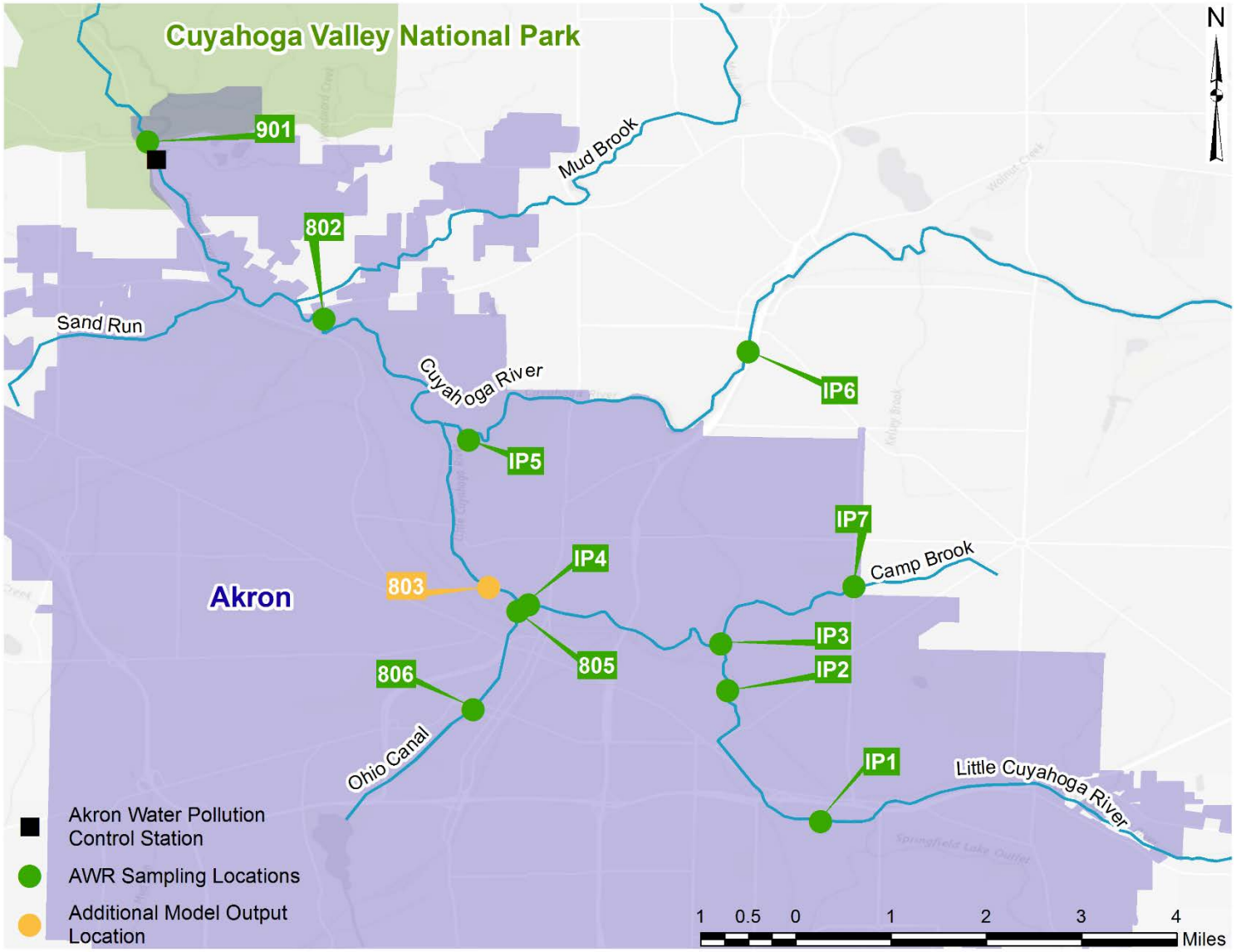

Figure 6-10. Water Quality Model Output Locations

The water quality model was used to compare the reduction in *E. coli* levels from existing conditions with the LTCP and the Integrated Plan. These comparison were done using the RWQC for *E. coli* which are described in Table 2-3 in Section 2.1.3. The RWQC includes criteria for both a single sample maximum criterion and a seasonal geometric mean criterion. The single sample maximum criterion is not to be exceeded in more than 10% of the samples taken during any 30-day period. These criteria differ depending on the waterway.

The first comparison was done using the overall percent of time that *E. coli* levels are greater than the single sample maximum, as presented in Figures 6-11 through 6-14 (which includes a separate figure for each of the four waterways: the Cuyahoga River, the Little Cuyahoga River, the Ohio Canal, and Camp Brook). The figures represent the percent of days within the recreational season (May 1 through October 31; 184 days) for which the instream bacteria levels are predicted to be greater than the applicable single sample maximum criteria. This measure is not part of the RWQC and therefore does not represent exceedances of a criterion, but it is an easily understood measure of water quality. Figure 6-11 through 6-14 are also segregated by the monitoring locations established for the 2014 AWR sampling effort discussed in Section 2, Water Quality, Public Health, and Regulatory Issues.

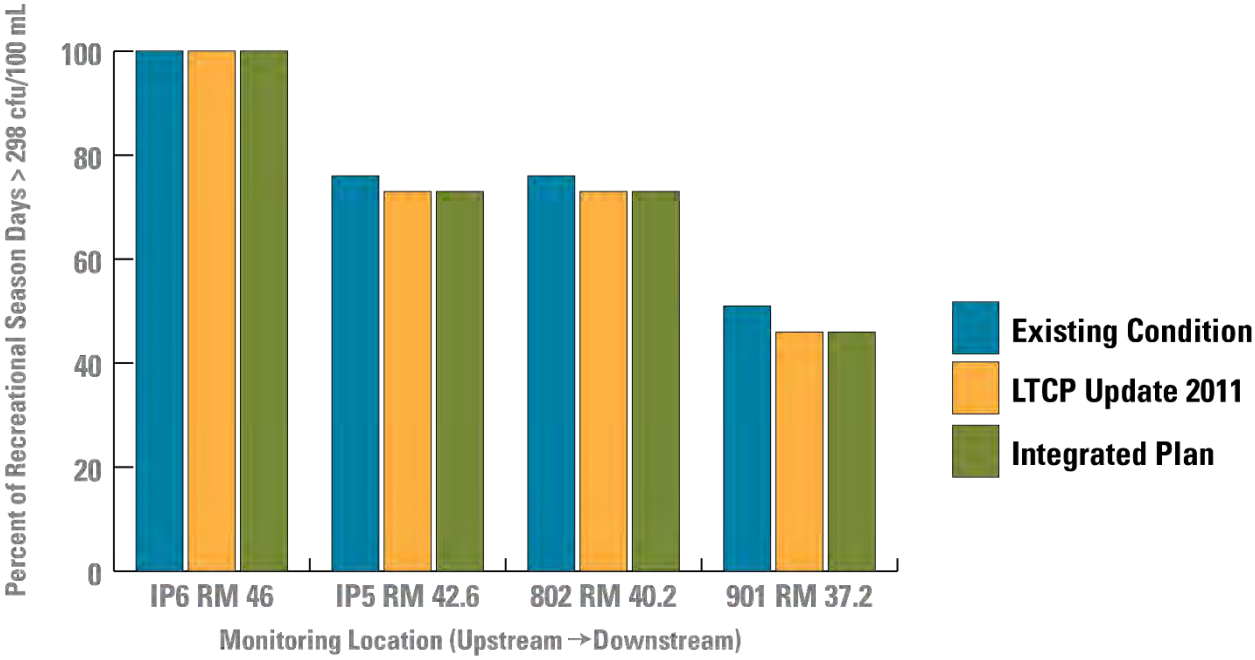

Figure 6-11. Predicted Percent of Days Bacteria is Greater Than 298 cfu/100 mL in Cuyahoga River

Figure 6-11 reflects the relatively poor water quality that was measured at the upstream location on the Cuyahoga River (IP6 at River Mile 46.0) during the AWR sampling program. The impact of the upstream sources on downstream locations is reduced as bacteria decays. The figure illustrates that CSO control results in very little improvement in the number of days where bacteria levels are less than the single sample maximum criterion. There is no discernable difference between the Integrated Plan and the LTCP.

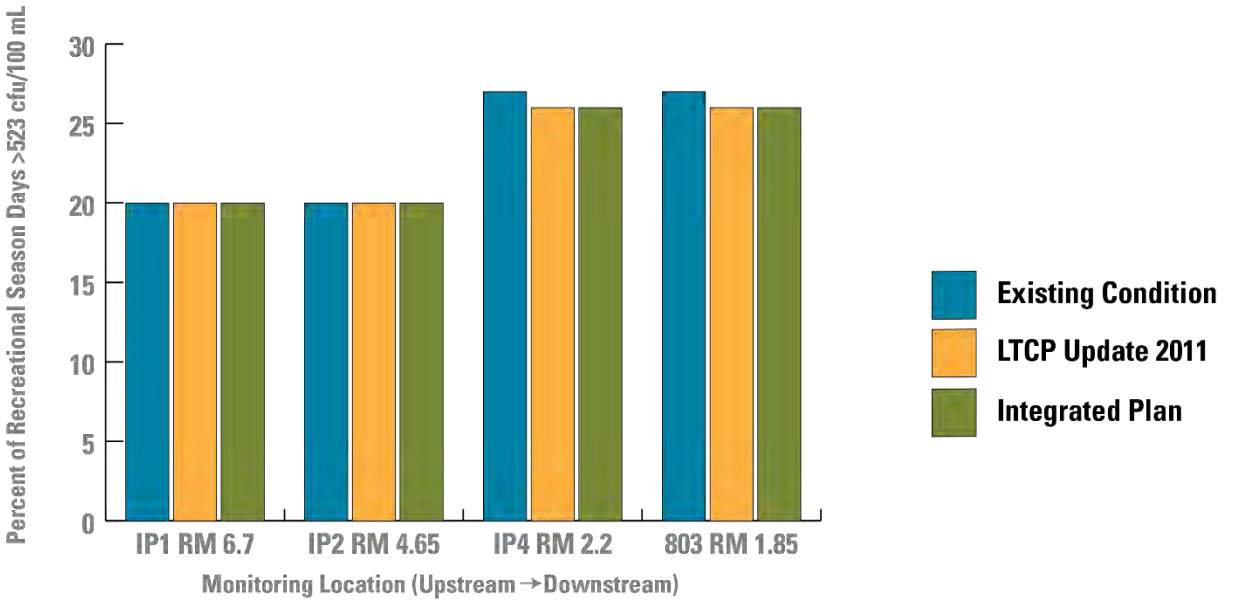

Figure 6-12. Predicted Percent of Days Bacteria is Greater Than 523 cfu/100 mL in Little Cuyahoga River

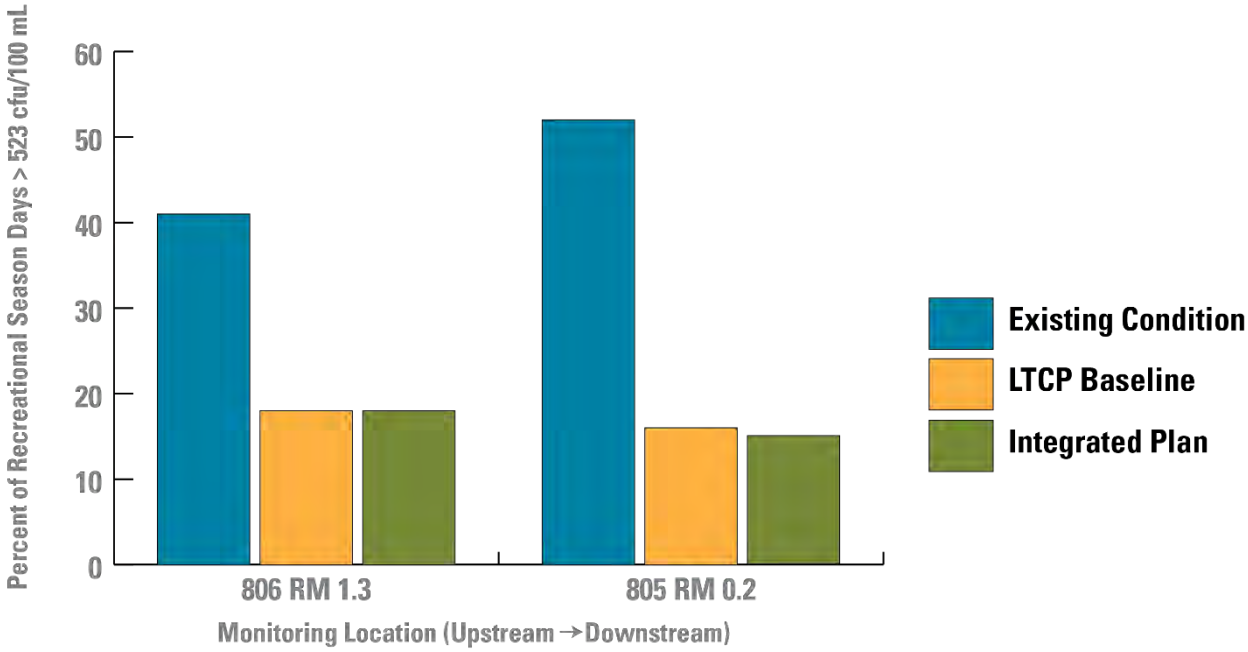

Figure 6-13. Predicted Percent of Days Bacteria is Greater Than 523 cfu/100 mL in Ohio Canal

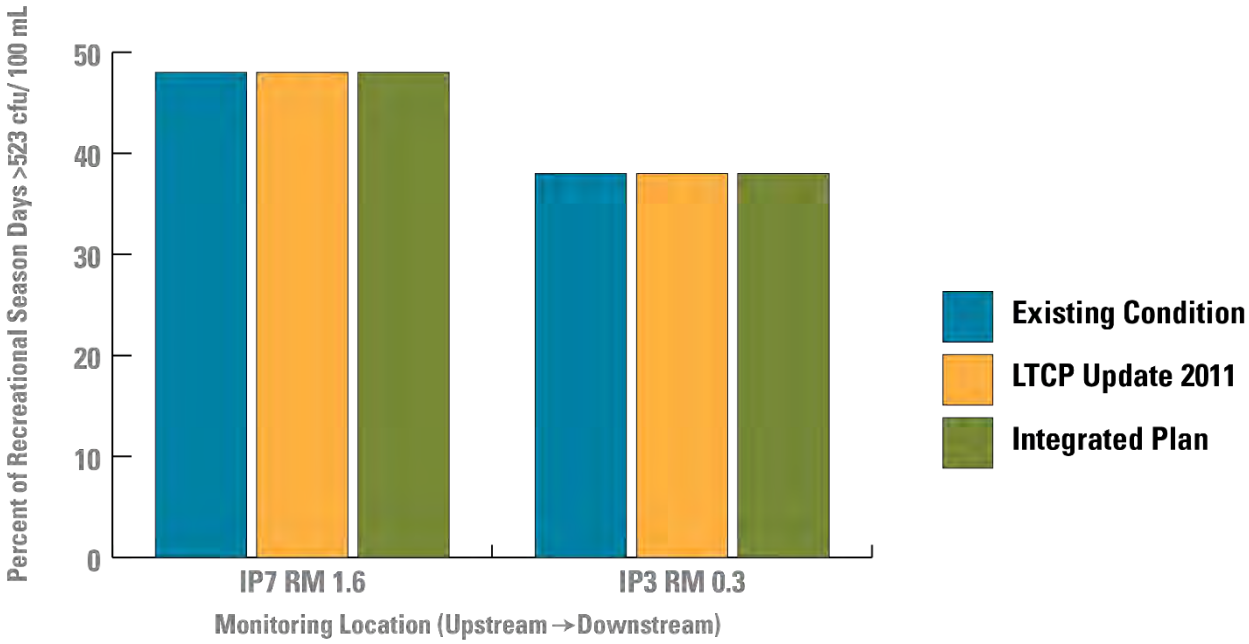

Figure 6-14. Predicted Percent of Days Bacteria is Greater Than 523 cfu/100 mL in Camp Brook

The Little Cuyahoga River, Ohio Canal, and Camp Brook are subject to different RWQC than the Cuyahoga River. For the Little Cuyahoga River and Ohio Canal, sources within Akron (CSOs and stormwater), increase the number of days where *E. coli* levels are greater than the single sample maximum criterion. CSO control provides little benefit for the Little Cuyahoga River and Camp Brook, but does significantly improve conditions in the Ohio Canal. Again, there is no discernable difference in the number of days under the Integrated Plan and the LTCP.

As discussed above, the RWQC has two components – a single sample maximum criterion and a geometric mean criterion. To understand compliance with the RWQC, it is necessary to integrate *E. coli* levels at a location over time. This includes calculating compliance during every 30-day period in the recreation season (which is May 1 to October 31) for the single sample maximum criterion and over the entire recreation season for the geometric mean criterion.

The single sample maximum is not to be exceeded in more than 10% of the samples taken during any 30-day period. There are 155 30-day periods during the recreation season in the Typical Year. The following were observed for the model results when compared to the single-sample maximum criterion:

- In the Cuyahoga River, CSO control only benefits the most downstream station (901 at RM 37.2). Compliance was improved for three (2%) of the 155 30-day periods with the LTCP compared to the Existing Condition. This same level of compliance was achieved for the Integrated Plan scenario.
- In the Little Cuyahoga River, CSO control did not affect compliance with the RWQC.
- For the Ohio Canal, CSO control was calculated to provide an additional 69 30-day periods (45%) at downstream location (805 at RM 0.2) under the LTCP and the Integrated Plan.
- For Camp Brook, CSO control did not affect compliance with the RWQC.

The geometric mean criterion is assessed across the entire recreation season. The following were observed for the model results when compared to the geometric mean criterion:

- Under Existing Conditions, no locations were calculated to comply with the seasonal geometric mean criterion.
- CSO control was calculated to reduce the geometric mean at all locations downstream of the upstream boundaries. The only location, however, where compliance is achieved is on the Ohio Canal (station 805). The Integrated Plan scenario maintains compliance at this location.

The results demonstrate that there is an indiscernible effect on the water quality of the City's waterways between the LTCP and the Integrated Plan Scenario 2040**.** Unless other sources of bacteria are controlled, the waterways are not forecasted to comply with water quality standards despite significant investments in CSO control.

The receiving water quality model was also used to evaluate the scenarios under what is commonly referred to as the "distilled water" condition. The "distilled water" condition evaluates the single sample maximum threshold of the RWQC for *E. coli* contributions from only CSOs and assumes that there are no other sources of *E. coli* from runoff and other sources. This comparison does not show violations of the RWQC because there is sufficient dilution of flows during the two overflow events that occur in the recreational season under the Integrated Plan Scenario 2040. These runs were done by removing the *E. coli* contributions from the upstream drainage areas and the separate storm sewer areas. This type of comparison is routinely conducted for CSO communities to determine the degree to which CSOs may be causing violations of RWQC.

The results of this evaluation are shown in Figures 6-15 through 6-18, at representative locations in the drainage area. Location 803 in the Little Cuyahoga River downstream of the Ohio Canal is included in addition to the most downstream monitoring locations in the Cuyahoga River, Ohio Canal, and Camp Brook. This location provides a representation of the water quality just downstream of the OCIT overflow discharge. In Figures 6-15 and 6-18, there is no resultant *E. coli* from the Integrated Plan.

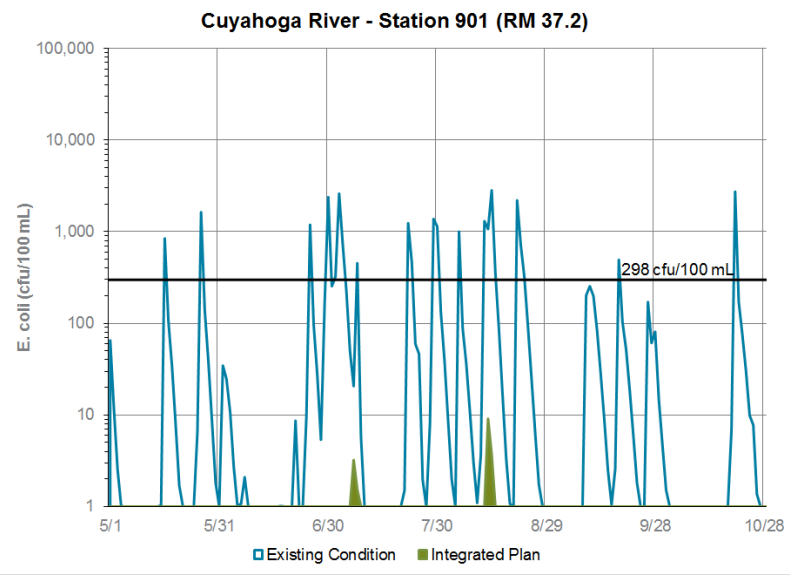

Figure 6-15. Predicted *E. coli* Contributions of Only CSOs in Cuyahoga River (Distilled Water Test)

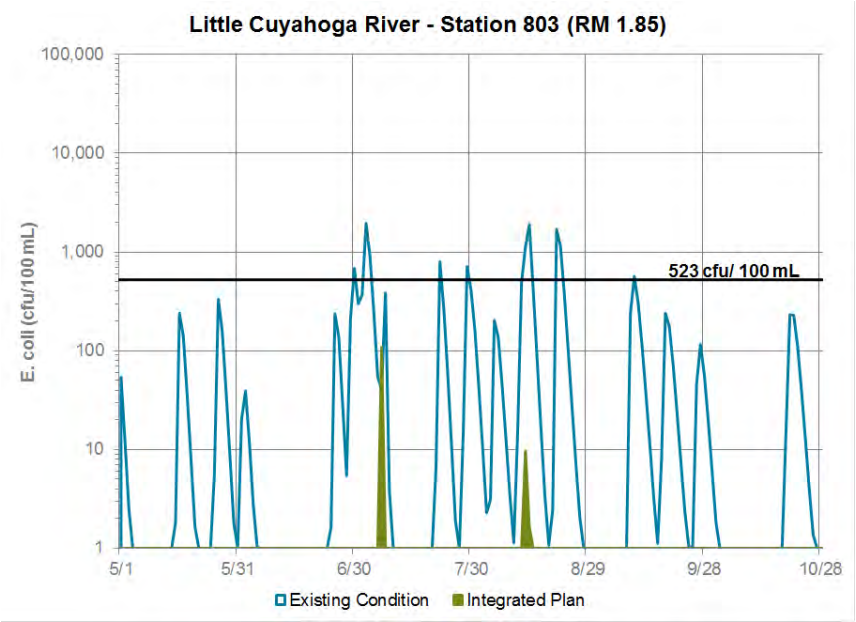

Figure 6-16. Predicted *E. coli* Contributions of Only CSOs in Little Cuyahoga River (Distilled Water Test)

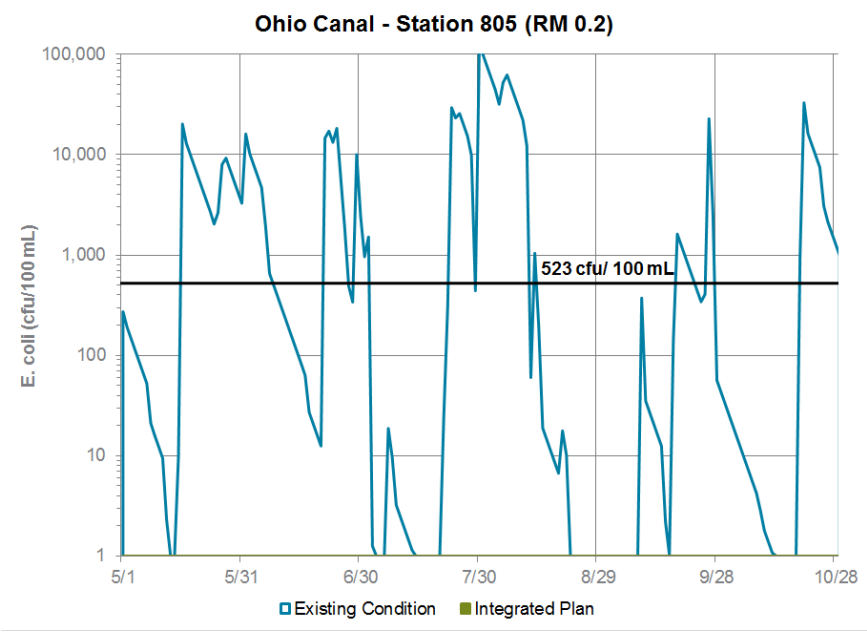

Figure 6-17. Predicted *E. coli* Contributions of Only CSOs in Ohio Canal (Distilled Water Test)

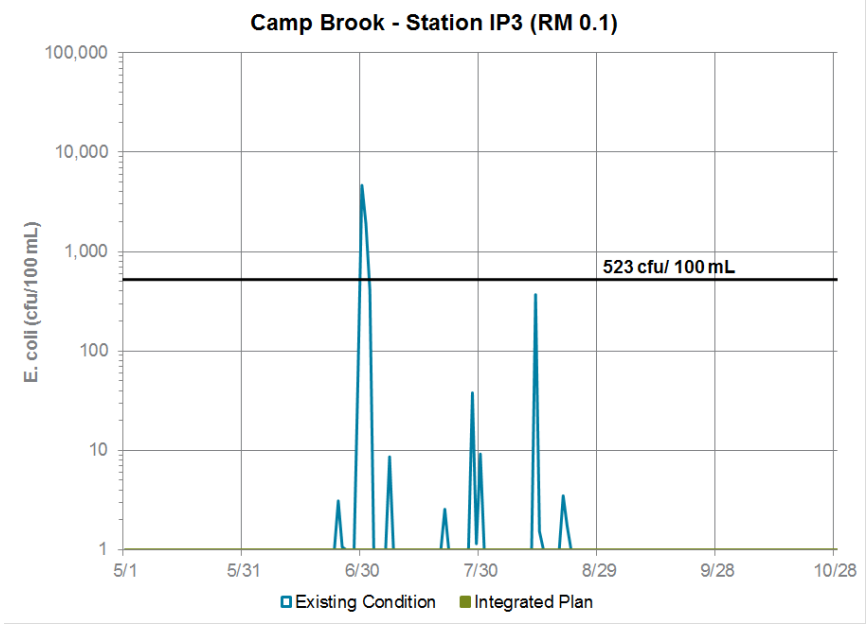

Figure 6-18. Predicted *E. coli* Contributions of Only CSOs in Camp Brook (Distilled Water Test)

The results of this evaluation demonstrate under a “distilled water” condition evaluation, the Integrated Plan Scenario 2040 is not predicted to cause exceedances of the RWQC in the City’s waterways. Therefore, addressing other pollutant sources through a watershed approach is needed.

The Integrated Plan Scenario 2040 also includes an alternative project to remove the Gorge Dam. While it was not possible to model water quality improvements associated with removal of the dam in this Integrated Plan analysis, improvements in water quality can be predicted based

on experience with other dam removal projects. Removal of the Gorge Dam is expected to result in the following improvements:

- Improved habitat associated with restoration of flowing water conditions;
- Improved fish index scores associated with greater fish passages; and
- More uniform DO concentrations.

6.4 Integrated Plan Scenario 2040

Based on complete analysis of TBL values, financial considerations, and environmental benefits, Akron recommends implementing the Integrated Plan Scenario 2040. The Integrated Plan Scenario 2040 meets the goals stated earlier in this section, and provides for a less unaffordable program that can be funded over the proposed planning period. Benefits of the Integrated Plan Scenario 2040 are summarized below:

- Improved financial affordability. The Integrated Plan Scenario 2040 is the only scenario that meets funding availability constraints.
- Enhanced TBL measured benefits. The Integrated Plan Scenario 2040 provides greater cumulative benefits over time and an improved benefit cost ratio as compared to the Baseline Scenario 2040.
- Equal or better environmental benefit. Compared to the Baseline Scenario 2040, the Integrated Plan Scenario 2040:
- Achieves a higher environmental benefit score (as a portion of the complete TBL score).
- Earlier reduction of CSO volume.
- Reduction in secondary treatment bypass volume at the Akron WPCS sooner as compared to the current LTCP.
- Improved water quality, predicted improvements in habitat and fish index scores, and more uniform dissolved oxygen (DO) concentrations associated with the Gorge Dam removal.
- Improved Total Suspended Solids (TSS) and bacteria removal from stormwater flows that discharge to green infrastructure facilities and downstream BMP installation on new green infrastructure facilities.
- Remaining small frequency and volume of overflows at the OCIT in the Typical Year do not result in water quality exceedances for *E. coli* under the “distilled water” test. In addition, there is no statistically meaningful difference in water quality attainment between the two scenarios under actual “real world” conditions, due to the high level of *E. coli* loadings to the drainage area during both dry and wet weather.
- Allows for a much needed greater investment in stormwater and infrastructure repair and replacement projects.

By implementing this plan, City will realize reduced unaffordability, TBL value, and greater environmental benefits sooner.

7.0 MEASURING SUCCESS

USEPA's IPF Element 5 requires that a process be in place for evaluating the performance of implemented projects and that performance criteria and measures of success are identified.

Performance criteria and measures are useful in:

- Making operational decisions.
- Evaluating whether program objectives are being achieved.
- Identifying plan priorities and the best uses of resources, and appropriately aligning budgets.
- Providing accountability on how well a program is functioning over time.
- Providing information needed for grant funding applications.
- Facilitating communication among different levels of management, staff, and stakeholders.
- Providing a framework for continued integrated wastewater and stormwater planning and goal setting processes.

This section describes the City's plans to use success measures to evaluate the performance of the Integrated Plan's CIP projects and the overall Integrated Plan initiative.

7.1 Consent Decree Post-Construction Monitoring Requirements

The City intends to define success measures that are consistent with and in support of the specific performance monitoring required under the CD. Post-construction monitoring required by the CD is designed to:

- Support ongoing reporting of CSO activity as part of the semi-annual reports submitted to USEPA.
- Collect CSO outfall data to support a model-based determination of whether the City has achieved the performance criteria for CSO control measures.
- Demonstrate compliance with the City's current NPDES Permit requirements.

The required post-construction monitoring will be conducted in two phases. The first phase will occur after the Achievement of Full Operation of the first tunnel (i.e., the OCIT) and the second phase will occur after the Achievement of Full Operation of the remaining CSO control measures.

7.2 Proposed Post-Construction Monitoring Requirements

In addition to the CD-required CSO post-construction monitoring activities described in Section 7.1, Consent Decree Post-Construction Monitoring Requirements, the City is proposing to evaluate the performance of green infrastructure, stormwater projects, and overall river or stream health to verify that the fundamental reasons for engaging in the Integrated Plan process is working: better or quicker environmental and economic benefits are realized.

The performance measures that have been developed to formally set goals and evaluate the effectiveness and efficiency of Akron's Integrated Plan are described below.

7.2.1 CSO Control

The City will continue to follow the CD-required dynamic hydraulic model approach to assess compliance with LTCP provisions by performing five-year updates to the collection system hydraulic model and then using the model to define infrastructure performance using the Typical Year rainfall inputs.

The City believes that addressing the major issues identified during the refinement and recalibration of its sewer system model over the past year has resulted in necessary revisions to LTCP projects to meet the desired level of control. The City intends to continue to utilize flow monitoring equipment and to refine the hydraulic model accuracy over the coming years. The additions and refinements will likely result in additional project revisions that can be incorporated into the LTCP update process through a proposed adaptive management approach to the City's CD program as described in more detail in Section 8, Improving the Plan.

In addition, as already allowed for in Exhibit 3 of the CD, the City intends to evaluate green infrastructure alternatives or supplemental projects for future LTCP projects. Based on these factors, on CWA obligations, and on affordability issues, additional LTCP and project revisions are expected to be needed in subsequent updates to the Integrated Plan. The City believes that the most cost-effective approach for CSO control is to pursue integrated planning through an adaptive management approach that is embodied in USEPA's IPF.

7.2.2 Green Infrastructure

It is generally accepted that industry-wide attempts to measure the effectiveness of specific watershed BMPs on stream ecology have been unsuccessful due to a lack of a systematic framework for linking pollution reductions to instream biological conditions. Instead, effectiveness is measured on a case-by-case basis and the pollutant removal efficiency of a specific green infrastructure BMP is assessed by the reduction of pollutants from the inflow to the outflow of a system.[67] The efficiency obtained is site- and storm-specific and is dependent on design, operation, and maintenance.[68] However, it is equally infeasible to conduct extensive monitoring of every individual BMP. Consequently, performance monitoring is typically conducted on similar types of BMPs rather than on each individual BMP installations. Further, where previous experience and effectiveness monitoring is available for similar types of BMPs located in similar geographic and hydrographic areas, the previous monitoring is generally used rather than conducting new monitoring.

Based on these case-by-case monitoring issues, the City proposes to track and report on green infrastructure and stormwater projects using annual inspection reports and periodic inspections for O&M purposes. For projects involving sewer separation, dye testing will be used to confirm that private storm water sources are removed from the sanitary sewers. Where appropriate, flow monitoring data will be used to verify and/or recalibrate the InfoWorks model so that the model can be used to assess compliance with the relevant performance criteria.

For projects where post-construction water quality monitoring will be useful, the City will

[67] Center for Watershed Protection. September 2007. National Pollutant Removal Performance Database, Version 3.
[68] Water Environment Research Foundation, American Society of Civil Engineers Environmental and Water Resources Institute, USEPA, U.S. Department of Transportation, American Public Works Administration, Wright Water Engineers, Inc., and Geosyntec Consultants. International Stormwater BMP Database.

consider taking the following actions during the project planning and design phases of the project:

- Identify pre- and post-construction monitoring needs.
- Develop and implement an appropriate flow and water quality monitoring plan.
- Analyze pre- and post-construction monitoring data.

As noted in Section 4, Stakeholder Involvement, the Integrated Plan Stakeholder Green Infrastructure Subcommittee has been, and will be, working closely with the City to develop and refine green infrastructure strategies for effective implementation. Since the City is relatively new to implementation of green infrastructure projects, the monitoring results of these initial projects will help the City evaluate the applicability of BMPs in Akron's service area. The monitoring results will be used to evaluate and modify the Green Infrastructure Toolbox as appropriate with the Integrated Plan Stakeholder's Green Infrastructure Subcommittee's involvement. These efforts address how green infrastructure can be implemented throughout the City and the region to improve water quality and provide important co-benefits. Discussions are also underway to identify barriers to full implementation of green infrastructure that might exist in current City planning, zoning, and permitting requirements. Additionally, efforts are underway to identify plans for increasing grant funding, developing public-private partnership projects, and encouraging private projects.

To date, the City has identified and planned green infrastructure pilot projects, and has identified public, private, and commercial partners who may support green infrastructure implementation. Participating Green Infrastructure Subcommittee members, such as the Akron Zoo, have implemented green infrastructure projects at their sites. The Akron Zoo in particular has installed extensive green infrastructure to help the City reduce CSO discharges and address onsite stormwater flooding and stormwater quality issues in conjunction with storm sewer infrastructure improvements.

For LTCP projects, the green infrastructure planning activities address site ownership and legal impediments to implementation so that feasible project locations can be identified and implemented within the time constraints of the CD. Important aspects that are under consideration include the following:

- Location of projects in relation to a targeted overflow.
- Legal authority of the City or the property owner to install and maintain a green infrastructure BMP.
- Probability of finding partners willing to allow project construction and/or to partially fund projects.

The City has developed an analytical process to review areas and to model expected overflow reductions using green practices, and intends to evaluate green infrastructure project alternatives for future LTCP projects. The City will ultimately be responsible for the maintenance of CD-required green infrastructure control measures. However, where available, maintenance assistance will be solicited from willing property owners. In these instances, the City is considering the development of maintenance agreements with the property owners.

7.2.3 Ambient Stream Sampling

To help evaluate aquatic life and recreational beneficial use attainment, and to continue to evaluate the impact of sources of impairment on Akron's waterways, the City is considering establishing the AWR Watershed Health Monitoring Program (AWR WHMP). This monitoring program will be part of the CD's adaptive management process and will be in addition to sampling that is currently done in accordance with the City's NPDES permit.

The purpose of the AWR WHMP is to evaluate aquatic life (fish, macroinvertebrates), pathogen indicators (*E. coli*) and nutrients within and directly upstream and downstream of the Akron waterways. The AWR WHMP is intended to complement Ohio EPA's Statewide Biological and Water Quality Monitoring and Assessment Program,[69] which serves to determine the following:

- How the stream is doing compared to goals assigned in the Ohio WQS.
- If the goals assigned to the river or stream are appropriate and attainable.
- If the stream's condition has changed since the last time the stream was studied.

As shown in the Ohio 2014 Integrated Report (Section K),[70] Ohio EPA intends to conduct monitoring in the Cuyahoga River Watershed in 2020.

The City is considering convening a working group of stakeholders[71] to guide the design of the AWR WHMP. Work will include discussion of data gaps, development of a draft and final monitoring plan, and a Quality Assurance Project Plan.

Currently, it is anticipated that monitoring would be conducted on five-year cycles in conjunction with updates of the collection system and receiving water models.

The AWR WHMP may include instream sampling of the metrics shown in Table 7-1, as well as routine physical and chemical sampling (such as temperature and pH). It may include monitoring flow and pollutant loads entering the waterways upstream of the City's CSOs.

Table 7-1. Metrics for Evaluating and Meeting Public Health and Water Quality Objectives

Metric	Criteria
Aquatic Life[1]	ICI, IBI, MIWb, EPT Taxa, and QHEI
Recreational	*E. coli*
Nutrients	Total phosphorus, dissolved inorganic nitrogen, DO, and benthic algae

[1] Ohio EPA. 1987, (updated 1988, 1989, 2006, 2015). *Biological Criteria for the Protection of Aquatic Life: Volume II: User's Manual for Biological Field Assessment of Ohio Surface Waters*.

[69] Ohio EPA, Division of Surface Water, Statewide Biological and Water Quality Monitoring.
[70] Ohio EPA. April 1, 2014. Ohio Integrated Water Quality Monitoring and Assessment Report (i.e., the "Integrated Report"). The 2012 Integrated Report is the last report approved by USEPA. The 2014 Integrated Report is being reviewed by USEPA. The 2016 Integrated Report is underway.
[71] Anticipated stakeholders on the AWR WHMP include Ohio EPA, Friends of the Crooked River, Summit MetroParks, Cuyahoga River Restoration, and Summit Soil and Water Conservation District.

8.0 IMPROVING THE PLAN

The final element of USEPA's IPF requires that a process is in place so that new projects or changes to ongoing or planned projects and implementation schedules can be identified, evaluated, and selected based on circumstances that change over time.

The City proposes to implement the Integrated Plan using an adaptive management approach to continuously improve the City's decision-making process. As new or additional data is acquired through such things as expanded flow monitoring, water quality monitoring, asset management analyses, and advanced and/or innovative technology evaluation, this information will be used to refine future project planning, design, and implementation steps. Adaptive management is a key element in implementing better projects, especially for new or innovative green infrastructure projects where program results are needed to refine subsequent project designs. On a system-wide level, adaptive management will allow the City to demonstrate that it is achieving the greatest and earliest project benefits at an affordable cost.

This section provides a summary of Akron's approach to ensure the City's Integrated Plan is continually refined and improved.

8.1 Adaptive Management Approach

Adaptive management is the systematic use of information to improve operations, especially in the face of uncertainty. This systematic process identifies uncertainties, monitors results and informs actions. USEPA's IPF acknowledges the need for adaptive management in both enforcement actions and NPDES permits. A formalized program that clearly identifies uncertainties and monitors results will reduce the risk of errors and allow the integrated planning process to move forward in the face of uncertainty. The adaptive management process can be applied from budget processes to individual projects to overall integrated planning efforts.

The City intends to use adaptive management to refine past decisions through continuous improvement of the physical and hydraulic information available for use with its analytical tools. The intent of this approach is to identify the "right type and right size" of projects. This will be accomplished by continuously gathering additional system-wide information through activities such as expanded flow monitoring, water quality monitoring, asset management analysis, and advanced and / or innovative technology evaluation. The adaptive management process will provide a better understanding of the City's infrastructure and its response to changing environments, financial circumstances and regulatory requirements.

The key elements of the City's adaptive management approach can be grouped into an ongoing, cyclical process, as illustrated in Figure 8-1. This process starts with the City establishing its goals and objectives. As mentioned previously, the City's goals are:

- Reduce the amount of unaffordability.
- Use of an enhanced Triple Bottom Line to measure benefits and evaluate projects.
- Achieve equal or better environmental benefits at a less unaffordable cost.
- To the extent feasible and when cost effective, use green solutions.

The process continues with determining current conditions based on available information and identifying additional information needs that may be required to support an enhanced level of decision making. The next steps in the process consist of developing, implementing, and monitoring an action plan to gather required information. Once this information is available, the results from the newly acquired data are evaluated, particularly in regard to supporting the decision making process. The City's goals and objectives are continuously refined to incorporate the results, and the process starts again.

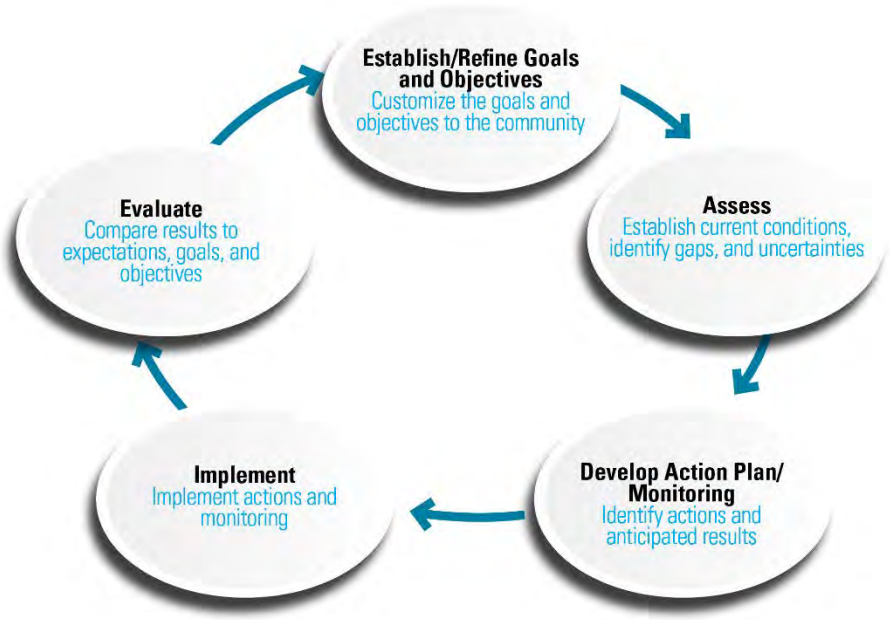

Figure 8-1. Akron's Adaptive Management Approach

8.2 Moving Forward

The City is committed to a continuous improvement processes at all levels of operations. The City's primary current objective is continued compliance with the CD. In parallel with this objective, the City will continually optimize capital projects based on new information and revised asset management considerations.

The integrated planning process is designed to be an iterative process. As new CIP projects are identified and existing CIP projects refined or adjusted, the weighted benefits of projects will need to be evaluated, scored, and reprioritized. In addition, necessary projects resulting from future changes to regulatory requirements related to nutrient control and phosphorus reduction, Ohio EPA's 303(d) listing, stormwater regulations or other issues will also be considered in context of the Integrated Plan.

As the City's financial situation changes, the capital availability fund constraints will need to be refined or adjusted. Similarly, the project-specific constraints will need to be updated. These changes may need to be input into the Expert Choice Comparion model and the model re-run on an annual basis during the initial implementation years with less frequent updates in future implementation years.

As additional projects are defined, it is possible that the TBL criteria used in this analysis will also need to be updated and refined to better reflect the CIP project list. All of these changes

are appropriate when operating under an adaptive management process for continuous improvement in decision-making processes.

The City will require a CD modification in order to implement the Akron Integrated Plan as recommended in this report. Assuming the CD modification incorporates adaptive management principles, future changes to the Integrated Plan should be able to be accomplished as minor CD modifications that require only USEPA approval, rather than necessitating the development of a formal future CD modification request.

As mentioned previously, adaptive management is also helpful in instances where new regulatory requirements are added such as nutrient and phosphorus loads. The City will suggest a CD re-opener clause so that this process is available to re-prioritize its future approach to meeting its regulatory requirements.