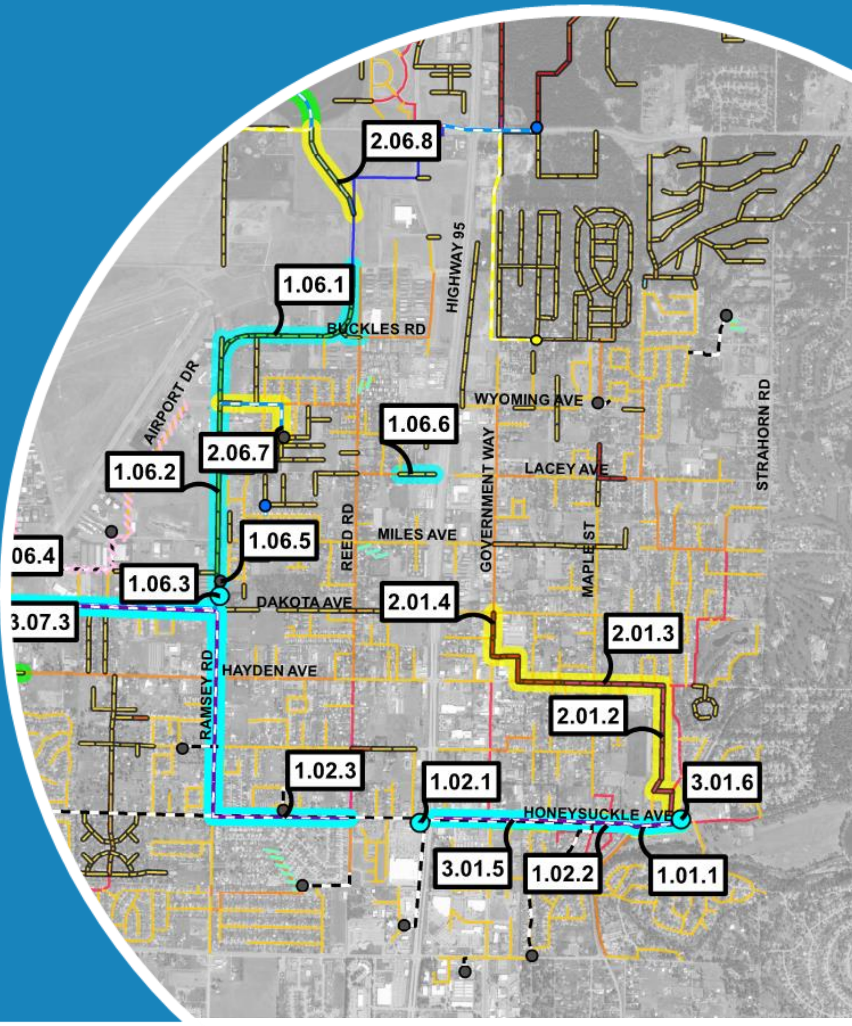
2020 COLLECTION SYSTEM MASTER PLAN UPDATE



COMPREHENSIVE PARKS SEWER TRANSPORTATION

IMAGINE HAYDEN

It's just a dream unless there's a plan.

February 2021

2020 COLLECTION SYSTEM MASTER PLAN UPDATE

Prepared by

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2/3/2021
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Abbreviations

ACI	Area of City Impact
cf (CF)	cubic feet
cfs	cubic feet per second
IDEQ	Idaho Department of Environmental Quality
EPA	Environmental Protection Agency
fpm	feet per minute
fps	feet per second
ft	feet
gpcd	gallons per capita day
gpm	gallons per minute
HARSB	Hayden Area Regional Sewer Board
hp	horsepower
IE	Invert Elevation
KMPO	Kootenai Metropolitan Planning Organization
mg/L	milligrams per liter; same as ppm
Mgal	million gallons
mgd	million gallons per day
MSL (msl)	Mean Sea Level
ppm	parts per million; same as mg/L
PVC	Polyvinyl Chloride
sf (SF)	square feet
TDH	Total Dynamic Head
WWTP	Wastewater Treatment Plant

Executive Summary

ES.1 Background and Overview

The City of Hayden will utilize this Sewer Master Plan Update as a roadmap to maintain its high level of service to existing users as well as provide the sewer service necessary for new development. This plan updates the 2012 Sewer Master Plan. The system-wide re-evaluation documents its overall conditions, mapping, capacity, and characteristics. The evaluation provides the information needed to prioritize system improvements and inform the financial plan to provide funding for those improvements.

The City of Hayden and the Hayden Area Regional Sewer Board (HARSB) Staff led this Sewer Master Plan Update. Special recognition is due to Hayden's Alan Soderling, Melissa Cleveland, Rob Wright, and Donna Phillips as well as HARSB's Ken Windram and Brock Morrow. It was also made possible by City Administrator Brett Boyer, Mayor Steven Griffitts, and City Council. Everyone involved provided timely input to policy and implementation concerns. The results of the planning effort are summarized in the following sections, but the reader is urged to examine the full details of the plan.

ES.2 Existing Conditions

The Sewer Master Plan expands the logic of the 2012 Sewer Master Plan Update by establishing a calibrated hydraulic computer model of the sewer system. The hydraulic model is the primary tool for sewer system analysis. The calibrated hydraulic model, verified with 2019 flow monitoring on Reed Road and 2012 – 2019 lift station data, is now the best available predictive tool for understanding the sewer system capacity.

The existing system analysis includes a wet weather hydraulic analysis which combines weather data and flow data obtained from the City and HARSB. The wet weather analysis is the key for predicting the capacity needed during the worst-case flow scenario. Peak wet weather flows in the Hayden sewer system are caused by rain-on-snow events in combination with frozen ground during the winter. The water rapidly accumulates on the ground surface and ultimately enters the sewer system as inflow through manholes and illicit drainage connections. The peak wet weather flow conditions historically last up to one week or even two weeks.

The calibrated sewer model and wet weather analysis generate an understanding of the system's overall condition and capacity during the system's worst-case scenario. This is the key first step before projecting future growth and improvement priorities, with the existing model extrapolated to the future model.

ES.3 Future Conditions – Near Term and Build-out Master Planning

This evaluation utilizes both a near-term and a build-out master plan model to estimate future flow in the system and size pipes and lift stations to convey this flow. The future conditions incorporate all elements of the existing model plus the major collector and trunk piping anticipated to be required to serve build-out of the City's Area of City Impact (ACI). Piping within individual developments, where included, are placed in approximate locations only, as the interior layout cannot be reliably predicted at this point. Developers will be responsible for connecting their sewer to the City's collector and trunk lines located in existing rights-of-way. Development will also be required to install the City collector and trunk lines to their development and through their development. Flows in the future model correspond to the wet weather flow assumptions defined through the calibration process and wet weather evaluation.

The goals of near-term future master planning are:

- Simulate the 10-year (2030) flow conditions generated by land uses most likely to occur within the term.
- Identify the areas in need of more immediate improvement.

The goals of future master planning are:

- Simulate the future build-out (2062) flow conditions generated from land uses defined by the proposed update to the Comprehensive Plan
- Identify the ultimate wastewater infrastructure needs of the system.

ES.4 Capital Improvement Plan Projects

Analysis using the near-term and future build out conditions generates an understanding of the infrastructure needed and the upgrades necessary to serve the City's ACI build-out. The majority of the system infrastructure required to serve the City’s ACI build-out are new collection system infrastructure. In some cases, existing infrastructure is required to be upsized in order to support the future flow conditions, or where deficiencies are noted. Those projects, along with key basin expansion projects are prioritized and recommended for the Capital Improvement Plan (CIP). The CIP consists of gravity pipes, lift stations, and force main improvements.

Projects considered for Capital Improvement Plan (CIP) Projects must be:

- Capacity/Expansion Projects - projects necessary to expand service to a new area and/or to increase system capacity to adequately serve the future flow conditions
- Rehabilitation/Replacement – Required to maintain the integrity of the existing system

Operations and Maintenance (O&M) of the system are not considered for Capital Improvement Plan (CIP) Projects. System O&M are funded through monthly user fees. If CIP projects include O&M activities, those portions shall be funded by the City through monthly user fees.

The upgrades and improvements identified through the Master Plan analysis generates a CIP table with further analysis and cost allocation. Projects may be funded by the City, developer, or with other funding sources. Other funding sources may consist of Local Improvement Districts (LIDs), grants, or Urban Renewal funding sources which may be required to fund a portion or all of a given project. In the case that infrastructure is required to serve a particular isolated area, the City may only fund the component necessary to serve the more generalized area of the City. Development is fully responsible for their portion of the upgrade or improvement project serving its development service area.

A discussion of each potential project (with City staff) detailed in the CIP table resulted in ratings for each project with respect to the following categories:

- High priority (construction begins in 0 to 5 years)
- Medium priority (construction begins in 6 to 10 years)
- Low priority (construction begins beyond 10 years)

The City should address high priority issues first, followed in turn by medium and low priority projects. This plan recommends a periodic reassessment, generally every 5 to 10 years, to account for changes in development or other areas that may result in readjustment of the CIP priorities. The projects identified as system improvements or upgrades appear on **Table ES-1**. **Figure ES-2** and **Figure A15** show each project on the City map. **Appendix F – CIP Packets** includes the full details for each project. These projects are prioritized based on City sewer infrastructure needs and not based on individual private development possibilities. The CIP Packets contain pertinent information for the improvements deemed necessary from this Master Plan.

Each CIP project is attached a unique project number that relates the priority of the project (High = 1 through Low = 3), the basin where the project is located, and the anticipated order or priority in which the project is anticipated to occur within the basin. The numbering system is shown in **Figure ES-1** below:

Figure ES-1 – CIP Numbering System

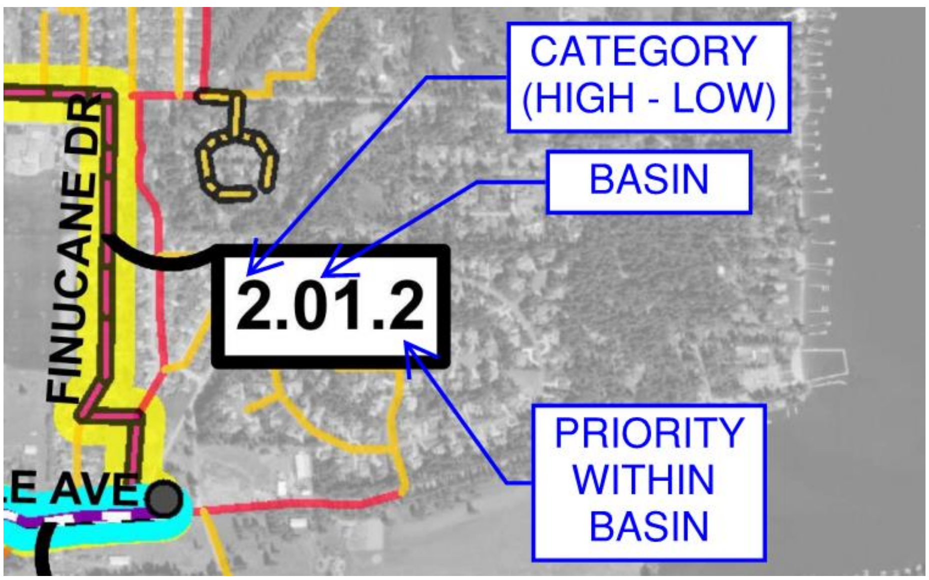
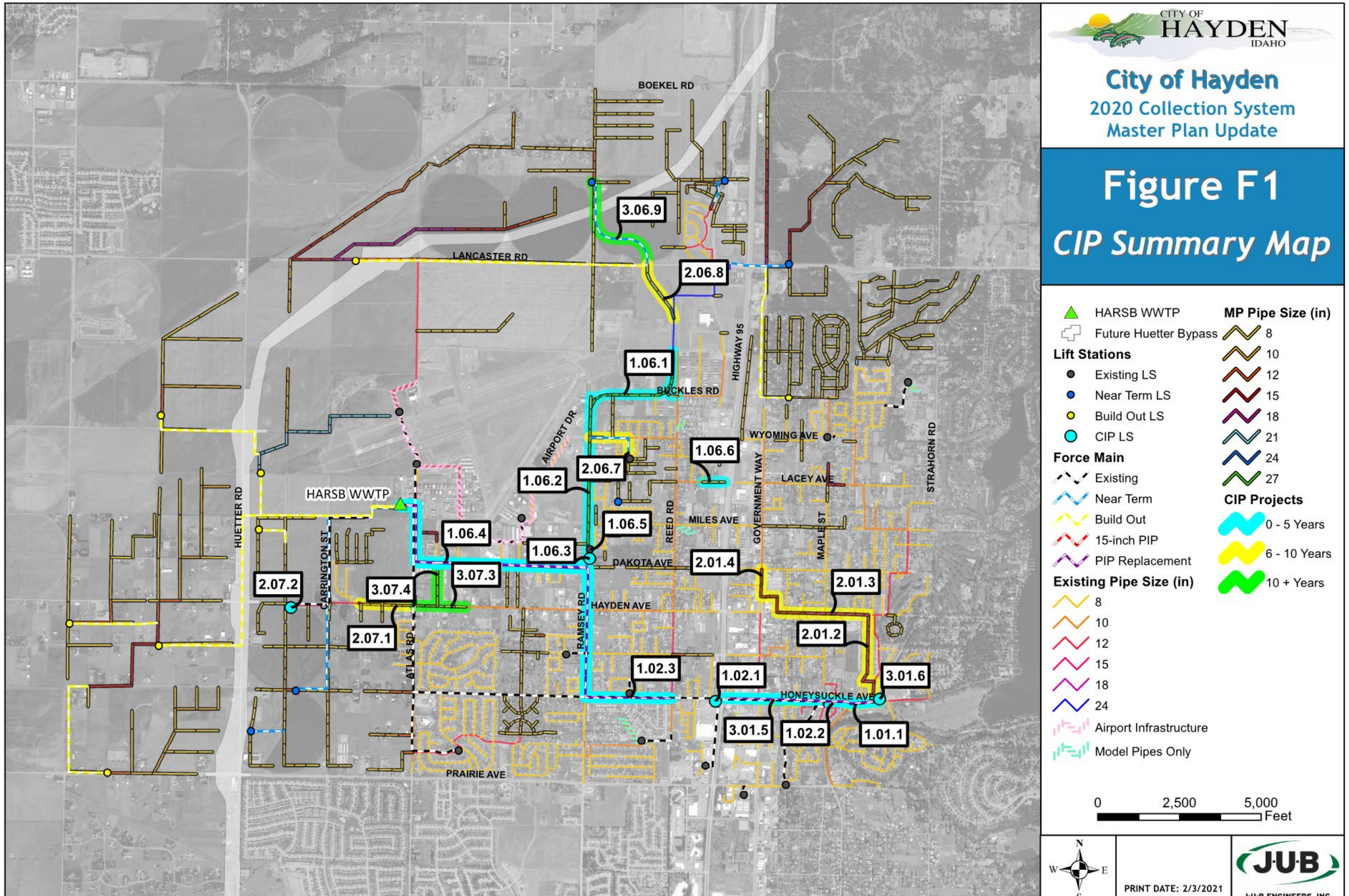


Table ES-1 – Capital Improvement Plan Projects

PROJECT NUMBER	PROJECT NAME	TOTAL PROBABLE COST IN 2020 DOLLARS	PROJECT TYPE
HIGH PRIORITY PROJECTS (CONSTRUCTION BEGINS IN 0 TO 5 YEARS)			
1.06.1	Ramsey Phase 1	$1,702,000	Capacity/Expansion
1.06.2	Ramsey Phase 2	$1,574,000	Capacity/Expansion
1.06.3	H-6 LS	$2,419,000	Capacity/Expansion
1.06.4 [(a)]	H-6 FM	$5,491,000	Capacity/Expansion
1.06.5	Moonridge FM	$19,000	Capacity/Expansion
1.06.6	Lacey Gravity	$130,000	Capacity/Expansion
1.02.1	H-2 Piping Improvements	$48,000	Rehab/Replacement
1.02.2 [(a)]	Honeysuckle FM Phase 1	$1,800,000	Rehab/Replacement
1.02.3 [(a)]	Honeysuckle FM Phase 2	$2,490,000	Rehab/Replacement
1.01.1	Honeysuckle Upsize Phase 1	$194,000	Capacity/Expansion
MEDIUM PRIORITY PROJECTS (CONSTRUCTION BEGINS IN 6 TO 10 YEARS)			
2.06.7	Riley FM	$136,000	Capacity/Expansion
2.06.8	Ramsey Phase 3	$502,000	Capacity/Expansion
2.01.2	Finucane Dr. Upsize	$769,000	Capacity/Expansion
2.01.3	Hayden Ave Upsize	$892,000	Capacity/Expansion
2.01.4	Government Way Upsize	$380,000	Capacity/Expansion
2.07.1	Hayden Phase 1	$348,000	Capacity/Expansion
2.07.2	H-7 Lift Station Upsize	$505,000	Capacity/Expansion
LOW PRIORITY PROJECTS (BEYOND 10 YEARS)			
3.01.5	Honeysuckle Upsize Phase 2	$415,000	Capacity/Expansion
3.01.6	H-1 Lift Station Pump Upsize	$491,000	Capacity/Expansion
3.06.9	Ramsey Phase 4	$354,000	Capacity/Expansion
3.07.3	Hayden Phase 2	$373,000	Capacity/Expansion
3.07.4	Dakota Elimination	$136,000	Capacity/Expansion

(a) HARSB project noted for coordination and management purposes

Figure ES-2 - CIP Summary Map



ES.5 Master Plan Implementation

The 2020 Plan update was completed as a part of Imagine Hayden – a City-wide planning effort that updated the Comprehensive, Parks, Sewer Collection, and Transportation plans simultaneously. The plan functions as a guide for maintaining the City's high level of service to existing users as well as to provide the sewer service necessary for new development.

The Draft for Public Comment (December 2020) was posted on the City website in early December 2020 and subsequently properly noticed by the City of Hayden. Following the public comment period, a City-initiated public hearing occurred at the January 12, 2021 regular City Council Meeting. Public comments were addressed during the public hearing by City Staff. Council approved the plan with staff recommendations as outlined in the staff report. The January 12, 2021 City Initiated Public Hearing information is included in **Appendix G – January 12, 2021 City Initiated Public Hearing Record Information**.

CHAPTER 1
Introduction

Chapter 1 | Introduction

1.1 Background

Kootenai County has experienced significant periods of rapid growth throughout its history. The City of Hayden is the third largest of the communities in the County, even while its growth rate has often exceeded Coeur d'Alene and Post Falls. Hayden's proactive approach to providing local services and infrastructure during times of growth has continued to allow the City to manage these expansions. This Sewer Master Plan Update provides the City with a roadmap to maintain its current ability to provide the cost-effective sewer service necessary to grow and sustain a vibrant community.

The Sewer Master Plan was most recently updated in 2012 utilizing the commercially available Hydra hydraulic modeling software as the primary tool for system analysis. The *Reed Road Line Flow Monitoring at Lacey Avenue Technical Memorandum* evaluated the model assumptions and summarized the use of 2017 high flow data for system-wide model re-calibration that was executed in order to determine design flows (J-U-B ENGINEERS, Inc., 2019). This Master Plan Update revises the 2012 existing and future system models by providing a calibrated Hydra hydraulic model representative of the current and future flow scenarios to serve the Area of City Impact (ACI). The model also helps generate the list of future system improvements needed to update the Capital Improvement Plan (CIP). The updated hydraulic model is compatible with the City's Hydra software version.

1.2 Study Scope

The City of Hayden authorized J-U-B to undertake a Sewer Master Plan Update in June 2019. The plan's objectives follow Hayden's Public Works Department mission to provide excellent customer service to the community and responsible stewardship of Hayden's municipal infrastructure. The items specifically addressed in this plan are as follows:

Existing system model update, which consists of:

- Existing sewer trunk lines evaluation for integrity and completeness, updated where required.
- Existing system Hydra model update with record information provided by the City for growth between 2012-2019.
- Flow generation layer update based on the methodology consistent with current City planning.
- Analysis of lift station and HARSB treatment plant influent flow data to delineate system characteristics and determine high and low inflow flow periods. Apply inflow data to the model with a sewer-basin flow per acre approach.
- Flow parameter adjustments to obtain satisfactory calibration to flow monitoring data, calibrated to a full 24-hour diurnal hydrograph.
- Existing collection system trunk lines evaluation based on existing wet weather flow to determine recommended improvements.

Near-Term system model update, which consists of:

- System-wide analysis with the addition of the H-6, H-7 and H-8 Basins and lift stations.
- Future land use layer update to account for near-term growth based on the KMPO average annual growth rate and City provided input.
- Identify system deficiencies to prioritize revisions necessary to meet the City's near-term system needs.

Future system model update, which consists of:

- Future model land use layer update based on the City's Comprehensive Plan and the City's recommendations regarding land uses and zoning.
- Future model pipes, lift stations, and force main revisions necessary to meet the City's ultimate build-out goals.
- System analysis for incorporation of the Shared Tier to the City's ACI.

Capital Improvement Plan Update, which consists of the following:

- 2020 CIP table update with required improvements for the revised future model.
- CIP cost development and share preliminary results with FCS and the City.
- Improvement prioritization criteria with City and HARSB staff.
- CIP phasing plan development, which utilizes the prioritization routine to develop the Capital Improvement Plan for immediate (within five years), near-term (5 to 10 years), and long-term (beyond 10 years) improvement projects.

Subsequent chapters and appendices in this report document the development of the Master Plan and are summarized as follows:

Chapter 2 – Existing System Hydraulic Computer Model

The initial phase of the project consists of developing and calibrating a Hydraulic Model that forms the basis for subsequent evaluations and scenarios. Background information collected and assimilated into the model generally includes the following:

- Flow data from segments of the collection system, lift stations, and the Hayden Area Regional Sewer Board (HARSB) wastewater treatment plant (WWTP)
- Current land uses, zoning, densities, and flow generation from different land uses
- Record drawing information provided by the City for new residential developments built between 2012-2019

Once collated, this information is used to create a calibrated model of the existing collection system under dry weather and wet weather conditions, and to identify any potential deficiencies within the current system.

Chapter 3 – Near-Term Hydraulic Computer Model

The Near-Term Model is a representative layout of a future sewer system that will serve the City to the build-out conditions identified as most likely to occur within the next 10 years and accommodate potential changes in land use within the existing service area. The model identifies probable solutions to resolve the observed deficiencies within the existing system by evaluating preliminary design criteria for future lift stations, opportunities to remove or reroute existing lift stations, and routing alternatives through the existing collection system. The Near-Term Model assists in generating a list of high priority improvements for the existing system.

Chapter 4 – Master Plan (Future) Hydraulic Computer Model

The Master Plan Model is a representative layout of a future sewer system that will serve the City to the delineated build-out conditions and accommodate potential changes in land use within the existing service area. The model identifies probable sizing and alignments for future trunk lines, areas serviceable by gravity, preliminary design criteria for future lift stations, opportunities to remove existing lift stations, routing alternatives through the existing collection system, and ultimately a list of long-term improvements for the existing system.

Chapter 5 – Capital Improvement Plan

The Master Plan Model described in Chapter 4 is used to develop a Capital Improvement Plan (CIP) and long-term improvement plan.

Appendix A – Figures

In general, figures in the document are included in **Appendix A** rather than immediately within the text. This allows figures to be grouped and accessed more readily.

Appendix B – Data Compiled for Use in Model Development

Background data is summarized with the source and date of acquisition. Flow monitoring data from the collection system is also presented.

Appendix C – Lift Station Evaluation

General description, evaluation, and recommendations of lift station improvements for all lift stations in the existing system.

Appendix D – Model Assumptions

The hydraulic model consists of two main components–a system layer and a flow generation layer. Assumptions made regarding specific model parameters are documented.

Appendix E – Model Calibration

Calibration of the model is summarized. Graphs are included for each flow monitoring site comparing the calibrated model output to the monitored flow.

Appendix F –CIP Packets

The CIP Packets contain pertinent information for the improvements deemed necessary from this Master Plan. These packets include a brief narrative of the issue, maps, and cost estimates.

Appendix G – January 12, 2021 City Initiated Public Hearing Record Information

The January 12, 2021 City Initiated Public Hearing information includes the documentation from the City Council meeting and public comment period.

CHAPTER 2

Existing System Computer Model

Chapter 2 | Existing System Computer Model

The 2020 Existing System Computer Model utilizes the City's 2012 collection system master plan and subsequent analysis as a starting point for updates. The updated model utilizes Hydra computer software Version 7.1 to represent the physical layout and hydraulic properties of the existing sewer system. The use of Hydra provides consistency with previous Master Planning efforts and can interface with the City's Geographic Information System (GIS) for populating existing system data. The primary purposes of updating the existing model are to:

- Provide a snapshot of current system flows, calibrated to flow monitoring data obtained from the City's ongoing flow monitoring program and lift station data logging to establish the system characteristics for use in the Master Plan Model
- Identify existing system capacity issues

The 2020 Existing Model consists of three layers–the System Layer, the Service Area Layer, and the Land Use Layer. Additional information on the hydraulic model and the technical data and assumptions appear in **Appendix D – Model Assumptions**. Each layer includes multiple parameters and assumptions that characterize the area and portion of the collection system being modeled. Assumptions are based on the previous model information, record drawing data, flow monitoring data, field observations, similar studies done for other entities in the region, historical knowledge from City and HARSB staff, and general knowledge gained by J-U-B through previous work. Key assumptions used in the 2020 Existing Model are documented in **Appendix D – Model Assumptions**. The 2020 Existing Model is representative of the City's sewer system and flows as of the end of Fiscal Year (September) 2019.

2.1 2020 Existing Model System Layer Update

The 2020 Existing Model System Layer (SY layer) consists of the manholes, gravity sewer pipes, force mains, and lift stations in the collection system. A map of the 2020 Existing Model System Layer is found on **Figure A1** in **Appendix A - Figures**.

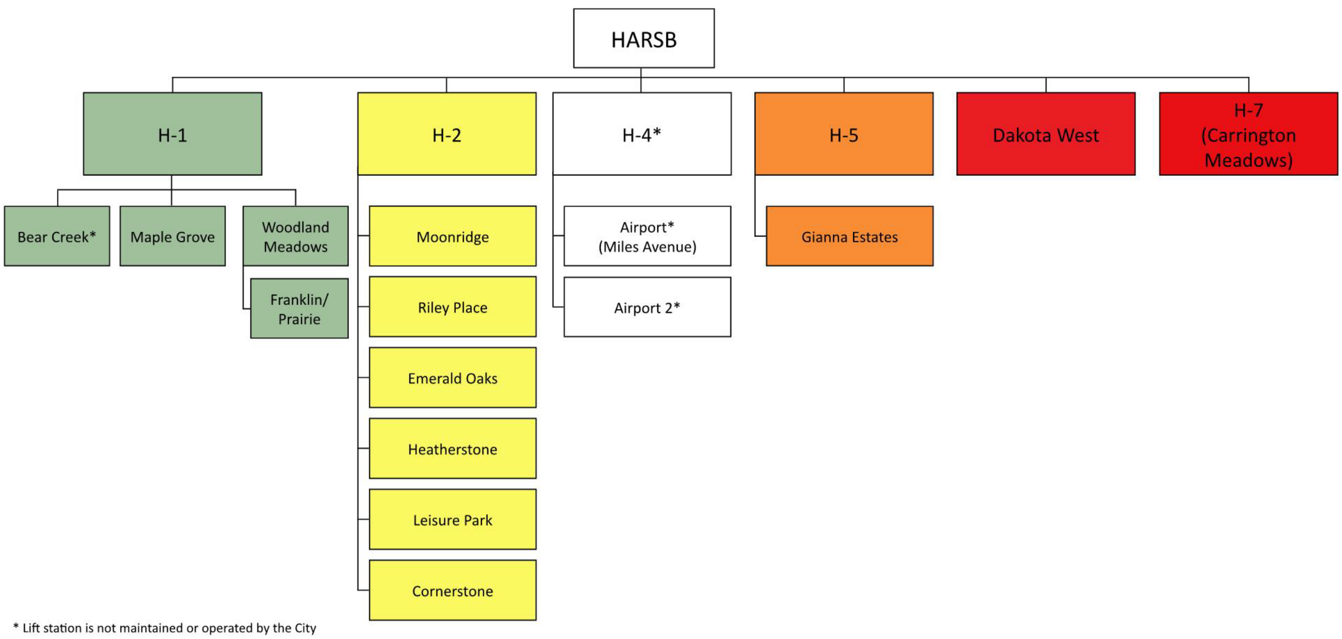
2.1.1 Collection System

The City's Hydra Model (2012 version) was used as the primary source for manhole rim and invert elevations, pipe size, and pipe length information. The first phase of this master planning effort consisted of identifying deficiencies and updating the model's sewer system with infrastructure installed since the 2012 Master Plan Update. The primary focus of this update centered on developing a complete understanding of system collector lines (8-inch) and trunk lines (10-inch and greater) at the time of this study. Missing or questionable data was reviewed with the City and/or Record Drawings for inclusion into the updated model. A list of Record Drawings used to create the 2020 Existing Model is included in **Appendix B – Data Compiled for Use in Model Development**.

2.1.2 Lift Stations

Lift station and force main data were updated or removed in the 2020 Existing Model based on Record Drawings and discussions with City staff in order to best represent current conditions. The flow chart below depicts how gravity flows are pumped to the treatment facility. **Figure 2-1**Figure ES-1 depicts the existing lift station flow paths to the treatment facility. The lift station's respective sewer sheds are color coded to match the sewer shed colors presented in **Figure A2** in **Appendix A - Figures** which displays the existing system lift station locations within their respective sewer sheds. The H-4 Basin is not delineated on Figure A2 as the H-4 Lift Station is not a City lift station and therefore is displayed in the figure below in white.

Figure 2-1 - 2020 Existing Model Lift Station Diagram



The lift stations are modeled as "ideal pumps" (i.e., the flow rate at the discharge manhole matches the influent to the wet well and there is no storage). As such, the Hydra software does not perform a head loss analysis to adequately size force mains. This is a design-level concern that should be thoroughly investigated for each station when upgrade or replacement work is undertaken. This Master Plan Update simply compares the current and future lift station capacities and then makes recommendations as to whether improvements are necessary, or force mains require upsizing. Further discussion on existing lift station conditions and recommended maintenance can be found in **Appendix C – Lift Station Evaluation**.

2.2 2020 Existing Model Flow Generation Layer

2.2.1 Land Use, Zoning, and Flow Allocation

Land use areas were updated to reflect information provided by the City regarding current and projected future land uses. Land use areas are generally drawn around areas of the City that have similar uses (i.e., residential, commercial, or industrial). While some areas are strictly single use, many land use areas have a combination of uses. Land use, density, and flow generation from a given use/density were based on information from the City's 2040 Comprehensive Plan (SCJ Alliance October 20,2020) and input from City staff.

Flow generation types and their corresponding flow volumes per acre appear in **Table 2-1**. Discussion on land use areas and how the flow values were generated is included in **Appendix D – Model Assumptions** along with a table showing how flow generation types were applied in blended use areas across the City. **Figure A3** displays the resulting Equivalent Flow Potential in gallons per day per acre (gpd/acre) applied to the ACI. The figure includes color coded land use areas and numbers that correlate to the land use area numbers in **Appendix D – Model Assumptions** tables to use when connecting the tabular data to the map.

This approach utilizes land use, zoning, and flow allocation to determine flow generation values and provides a baseline for future comparison as the areas are developed and land use changes. The assumptions and results should be reviewed approximately every five years and compared to previous assumptions to determine what changes, if any, are needed. These assumptions can also be compared to additional flow monitoring data collected by the City or HARSB to better determine flow values for a given land use.

Table 2-1 – Flow Generation Types and Values

Flow Generation Type (Sub-Areas)	Flow Generation Value (gpd/acre)
Agriculture (3.5 ER/Acre)	600
Commercial	900
Light Industrial	450
Mixed Residential (7.0 ER/Acre)	1,200
Mixed Use	2,350
Recreation	15
Residential Suburban (1.0 ER/Acre)	173
Single Family (3.0 ER/Acre)	520

2.3 2020 Existing Model Calibration

Calibration is the process of globally modifying assumptions and parameters in the model in order to match flow monitoring data in multiple locations. Sewer flows were monitored at six locations in the system between April 4, 2012 and May 10, 2012 and one location was monitored again between May 8, 2019 and May 28, 2019. It is assumed that observed flows during this period are representative of the dry weather flow condition for the City since there was relatively little precipitation during this time (dry weather). The infiltration and inflow (I/I) values were also revised to reflect the most current information for the spring of 2017 high flow values obtained from lift station flow data provided by HARSB. Spring of 2017 was the year with the highest spring precipitation and is therefore considered the most accurate information on record. The data significantly decreases from the prior 2012 master plan assumptions for I/I, as a result of improved data logging and records from lift station flow data during the wet weather periods. A summary of the City's 2012 and 2019 flow monitoring is contained in **Appendix B – Data Compiled for Use in Model Development**. Flow monitoring locations are shown on **Figure A4** in **Appendix A - Figures**.

There are inherent limitations that hinder precise calibration between model output and real-time flows measured in the field. A computer model cannot capture all the variability that exists in a built system receiving flow from highly variable sources. The data obtained in the 2019 flow monitoring study shows a reasonable increase in peak flow from prior model evaluations due to a significant development that occurred upstream of the flow monitoring location since prior evaluations. A discussion on model assumptions and parameters is included in **Appendix D – Model Assumptions**.

2.3.1 Dry Weather Calibration

The model was calibrated to weekend flows, which typically have a larger magnitude than weekdays. Individual days were plotted to show the uncertainty and variability of flow at any given point in the system. Large service areas showed less variability in flow than smaller service areas due to the number of connections upstream and attenuation that occurs as individual contributions mix in time and location toward the lowest end of each flow basin. Average weekend flows were determined for each site from the flow monitoring data. Dry weather flows for basins without flow monitoring data were determined using lift station data provided by HARSB. Final calibrated flow monitoring graphs and lift station information are included in **Appendix B – Data Compiled for Use in Model Development**. Additional information on dry weather calibration is included in **Appendix E – Model Calibration**.

2.3.2 Wet Weather Calibration

Wet weather calibration was performed by comparing lift station flow data from the dry weather periods with data from periods of significant precipitation. By comparing the wet weather and dry weather flows, a daily wet weather peaking factor was established for each major basin. Wet weather conditions were modeled by imposing inflow and infiltration (I/I) on the entire system on a gallon per acre served per day basis. The model I/I input value was adjusted until the model peaking factor closely matched the peaking factor observed at the lift stations. Additional information on wet weather model calibration is included in **Appendix E – Model Calibration**.

2.4 2020 Existing Model Analysis

After adjusting input parameters, land use proportions, and calibration, the 2020 Existing Model was run in Hydra for a wet weather scenario. Dry weather values can be extrapolated from the wet weather data. **Table 2-2** summarizes the layer and run naming convention for this analysis.

Table 2-2 – Existing Model Layer and Run Naming Convention

Parameter	Wet Weather
System Layer	SY_EX_19
Service Area Layer	SE_ALL
Land Use Layer	LU_EX_R1
Model Run	Existing_2019

2.5 2020 Existing Model Results

Results for the 2020 Existing Model wet weather scenario are presented on **Figure A5** in **Appendix A**. **Figure A5** shows depth to diameter (d/D) ratios for existing pipes in the system under the wet weather scenario. Generally, pipes with d/D ratios less than 0.50 are not recommended for replacement and are acceptable with only long-term monitoring. d/D ratios between 0.50 and 0.75 indicate replacement may be needed within 5 to 10 years, depending on build-out rate. Finally, d/D ratios above 0.75 indicate replacement should be considered as a high priority (within 5 years). Wet weather scenarios are appropriate to identify problem areas because they typically represent a worst-case scenario (more flow) when compared to a dry weather scenario.

As shown on **Figure A5**, the majority of the existing system has d/D ratios less than 0.50. Five areas exist with d/D ratios between 0.5 and 0.75 and should be placed on a watch list for potential improvements in the future.

0.50 ≤ Depth over Diameter (d/D) ≤ 0.75:

- Reed Road south of Kyler Avenue to Hayden Avenue
- Government Way from Dakota Avenue to Hilgren Avenue
- Hayden Avenue east of Government Way to Finucane Drive
- Finucane Drive south of Hayden Avenue to the H-1 Lift Station
- Honeysuckle Avenue from 4th Street to Strahorn Road

One area in the 2020 existing wet weather model shows a d/D ratio greater than 0.75 and should be considered high priority for replacement to avoid surcharging manholes and service connections.

Depth over Diameter (d/D) > 0.75:

- Hayden Avenue between Juno Street and Baack Street

Table 2-3 shows the existing condition and remaining capacity for the worst-case pipe in the reach with d/D ratio greater than 0.75.

Table 2-3 – Existing Conditions and Remaining Capacity for Pipes with d/D Greater Than 0.75

Parameter	Hayden Ave East of Government Way to Finucane Dr
Pipe Number (HYDRA GID) [(b)]	174
Diameter (inches)	8
Slope (ft/ft)	0.0017
Flow (cfs)	0.499
d/D Ratio	1.0
Maximum Capacity (cfs)	0.495
Remaining Capacity[(a)] (cfs)	0.00

(a) Negative values indicate pipe is over capacity (zero remaining capacity) but are included to indicate the magnitude.

(b) GID (or G_ID) is the hydraulic computer modeling software's unique identifier for various attributes (pipes, manholes, land use areas all have unique G_ID numbers).

CHAPTER 3
Near-Term System Computer Model

Chapter 3 | Near-Term System Computer Model

3.1 Overview

This part of the Master Plan utilizes the Hydra modeling software to simulate future build-out of the sewer system that is most likely to occur within the next 10 years. The near-term model estimates future flow in the system to appropriately size pipes and lift stations to convey the projected flow for the year 2030. Flows in the near-term model correspond to the wet weather flow assumptions defined through the calibration process. The goals of analyzing the near-term model are to:

- Appropriately model flow potentially generated from land uses as defined by the proposed update of the Comprehensive Plan and define the near-term wastewater infrastructure needs of the system
- Identify potential near-term future system capacity issues that should be prioritized for improvements

3.2 Growth Projections

3.2.1 Population Projection

Population projections were developed using the Kootenai Metropolitan Planning Organization (KMPO) Future Growth Projections average annual growth rate of 3.8% information provided by the City of Hayden and coordinated between Imagine Hayden planning documents. This growth rate is higher than the historical growth rate for the City of Hayden, however, it provides a level of conservatism to account for large future residential greenfield developments. Near-term population was applied to the model by increasing existing land use areas by the average annual growth rate over the 10-year planning period or until the area reached the maximum density as allowed by the City's Comprehensive Plan. In areas where the maximum density was reached before the end of the planning period, the population was capped and the remaining population was applied to the land use areas expected to develop outside of the City's existing service area as growth. **Figure A7** shows how the residential growth allocations were applied to the Near Term system service area. **Figure A8** shows the sewer basins for the future system. Basins expected to develop outside of the existing service area within the 10-year planning period include:

- H-6
- H-7
- H-8

Table 3-1 summarizes the population projections utilized in this model.

Table 3-1 – Hayden Population Projections

Year	Population
2010	13,294 [a]
2019	15,254 [b]
2020	15,803 [c]
2030	24,082 [c]
2040	34,955 [c]
2062	76,991 [c]

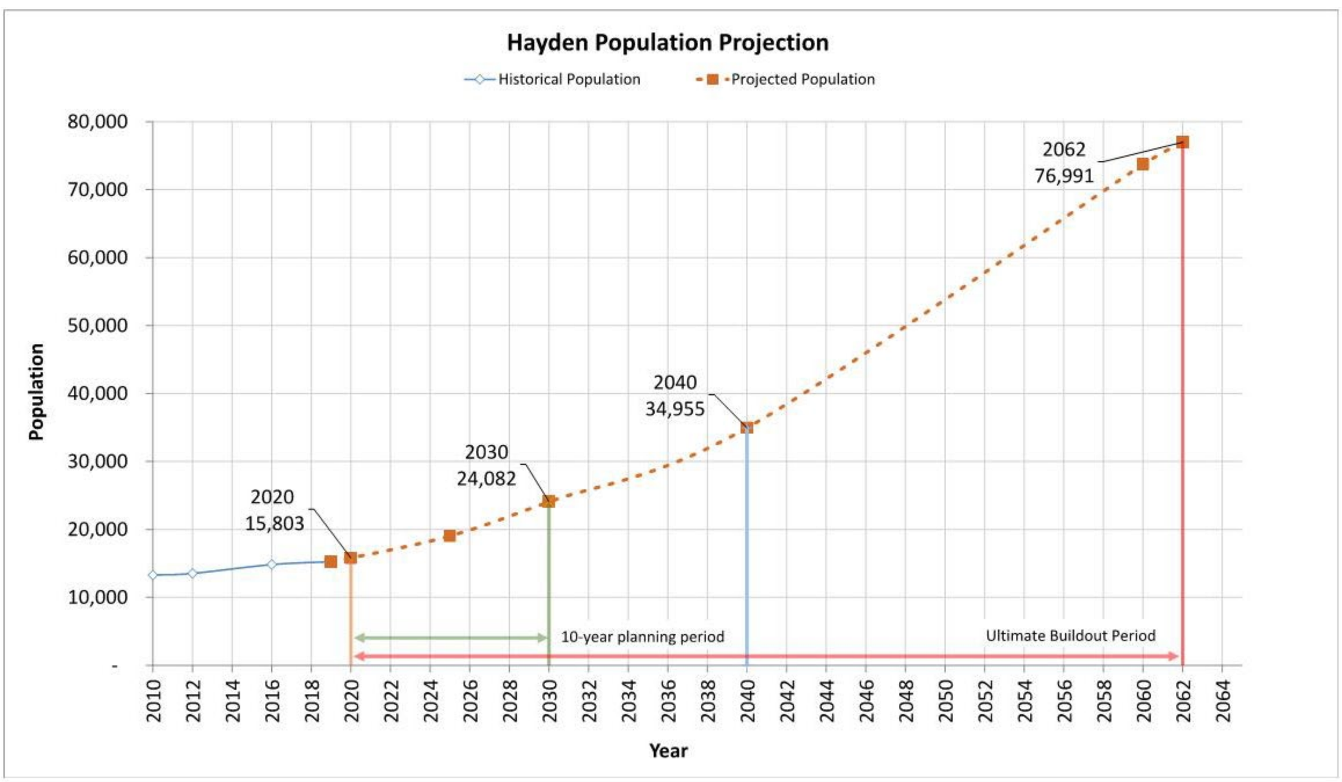
[a] US Census Bureau

[b] City of Hayden Future Land Use Development and Redevelopment Data

[c] Projected population using Kootenai Metropolitan Planning Organization (KMPO) Average Annual Growth Rate of 3.8% for City of Hayden, information provided by the City of Hayden and coordinated between Imagine Hayden planning documents.

The ultimate build out population occurs in the year 2062. This was determined from the number of homes allowed to develop within each land use area determined from Future Land Use data and assuming the Hayden average of 2.55 residents per equivalent residence (ER) reported by KMPO. **Figure 3-1** shows the historical and projected population growth. Flow contribution per capita is discussed in **Appendix D – Model Assumptions**.

Figure 3-1 - Hayden Historical and Projected Population Growth



3.2.2 Non-Residential Flow Projection

Non-residential flow is expected to reach ultimate build out levels along the same time frame as residential population. With that assumption, the maximum flow as allowed by the proposed update to the Comprehensive Plan was used as the 2062 built out value. The average annual growth rate can then be calculated between existing and ultimate build out and used to project the non-residential flow to the year 2030. **Table 3-2** and **Figure 3-2** show the results of the non-residential flow projection.

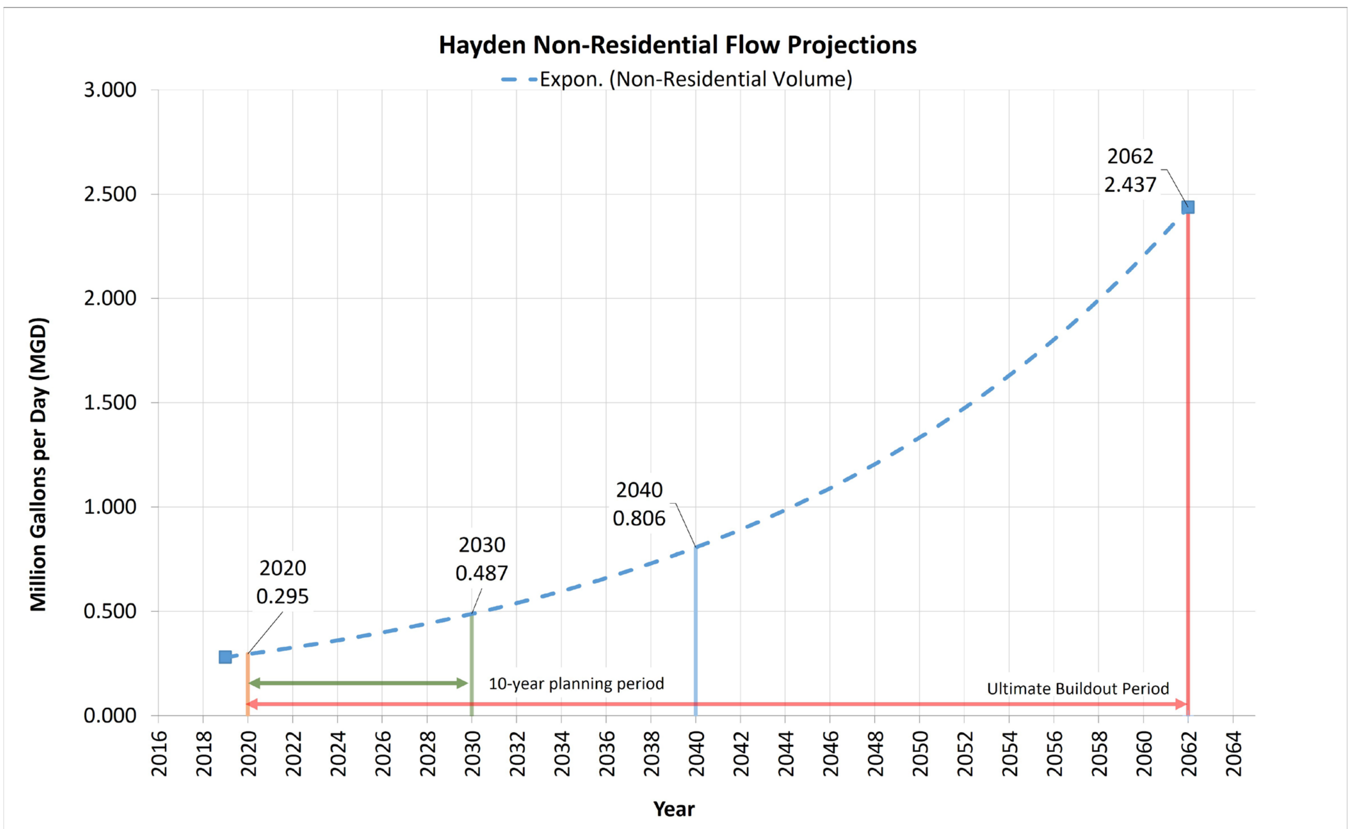
Table 3-2 - Hayden Non-Residential Flow Projection

Year	Non-Residential Flow (MGD)
2019	0.280 (a)
2020	0.295 (b)
2030	0.487 (b)
2040	0.806 (b)
2062	2.437 (b)

(a) City of Hayden Provided Sewer Craze (Wastewater Unit) Data - listed in Appendix B – Data Compiled for Use in Model Development

(b) City of Hayden Flow Allocation per GID, Average Annual Commercial Growth Rate of 5.0%, J-U-B Engineers Inc.

Figure 3-2 – Hayden Non-Residential Flow Projections



3.3 Near-Term Flow Generation Layers

3.3.1 Land Use, Zoning, and Flow Allocation

Near-term land use and zoning designations were applied according to the methodology discussed in Chapter 2. Land uses and percent of the use occurring in a given area were determined with input from the City based on the developments expected to occur within the next 10 years. Flow generation was accomplished by increasing settings in the model to the projected build-out levels. The flow allocation generated from zoning and land use is only a portion of the system flow. The Master Plan Model was run and analyzed with a wet weather scenario. The I/I factors defined in the existing system analysis were also imposed on the near-term model. See **Appendix D – Model Assumptions** for additional information.

3.4 Near-Term System Layer

3.4.1 Near-Term without System Improvements Scenario

The near-term model was run without system improvements to determine which areas require improvements in order to meet the near-term future system needs. This scenario uses the existing system layer as described in Chapter 2.

3.4.2 Near-Term with System Improvements Scenario

The near-term with system improvements scenario was run with system improvements for areas identified with capacity issues and in the system expansion areas within the designated time. **Appendix D – Model Assumptions** documents the key assumptions used in the Near-Term Model. The conceptual trunk layout remains similar to previous studies, with the following major changes that will be discussed in more detail in Chapters 4 and 5:

- North Ramsey Road Alignment (C.I.P. Projects 1.06.1 – 1.06.5, 2.06.7 – 2.06.8, and 3.06.9)
- H-1 gravity trunk upsizing (C.I.P. Projects 2.01.2 – 2.01.4)
- Honeysuckle Avenue gravity upsizing (C.I.P. Project 1.01.1)

3.5 Near-Term Model Analysis

The Near-Term Model was run and analyzed with wet weather flows. Wet weather was modeled by imposing I/I on the future model in addition to increased flows from projected population growth. This process is similar to that used for the 2020 Existing Model scenario. After adjusting input parameters, land use proportions, and calibration, the Near-Term Model was run in Hydra. **Table 3-3** summarizes the layer and run naming conventions for this analysis.

Table 3-3 – Near-Term Model Layer and Run Naming Convention

Parameter	Near-Term without System Improvements	Near-Term with System Improvements
System Layer	SY_EX_19	SY_NT
Service Area Layer	SE_ALL	SE_ALL
Land Use Layer	LU_NT	LU_NT
Model Run	Near Term_2030 No Build	Near Term_2030

3.6 Near-Term Model Results

Figure A8 shows future sewer shed basins. Basins are relatively similar to those identified in the previous Master Plan Update. One notable difference is an expansion of the H-6 basin to include some area previously shown in the H-10 and H-2 basins. The additional area mostly includes the service area for the North Ramsey lift station on the east and west sides of Ramsey Road north of Lancaster Road and the northern portion of the existing H-2 Basin. This Master Plan Update also incorporates the Shared Tier as an additional sewer basin in the build out model. Each basin typically has a large lift station that pumps all of the basin flow to the HARSB treatment plant. However, smaller lift stations may serve sewer sheds within a basin. For example, the Lancaster lift station serves a sewer shed within the H-6 basin. Flow from the Hayden Canyon development through the Lancaster lift station eventually reaches the H-6 lift station, which will pump it to the HARSB WWTP.

Near-term model results are presented in **Appendix A – Figures**. **Figure A6** shows near-term model results without system improvements scenario pipes by depth to diameter (d/D) ratio. The majority of existing infrastructure in the near-term future system have d/D ratios less than 0.5 without any improvements. This is a good indication that most of the current pipes are sized appropriately to handle the near-term flow conditions.

Three areas exist with d/D ratios between 0.5 and 0.75 and were the prioritized for improvement projects within the 10-year planning period:

- Reed Road south of Wyoming Avenue to Honeysuckle Avenue
- Government Way South of Dakota Avenue
- Honeysuckle Avenue from the H-1 Lift Station to Maple Street

Two areas exist with d/D ratios greater than 0.75 and are recommended to be considered high priority for replacement in the near-term future:

- Hayden Avenue east of Government Way
- Finucane Drive South of Hayden Avenue to the H-1 Lift Station

Figure A9 shows near-term build scenario pipes and system revisions required to alleviate capacity issues at the locations above. The largest pipe size required to handle near-term future wet weather flows is a 27-inch-diameter trunk line in Ramsey Road from Lancaster Avenue to the H-6 lift station. This pipe is a short reach immediately upstream of the lift station. This pipe should be sized during the design of the H-6 lift station.

Figure A10 shows the near-term model results with system improvements (shown on **Figure A9**) pipes by depth to diameter (d/D) ratio. By redirecting flow out of the H-2 basin and into the H-6 basin (building the H-6 Basin), the Reed road line shows improvement. All gravity pipes that were upsized show improvements with d/D ratios between 0.26 and 0.50.

CHAPTER 4
Master Plan (Future) Model

Chapter 4 | Master Plan (Future) Model

4.1 Overview

This part of the Master Plan utilizes the Hydra modeling software to simulate the future build-out of the sewer system. The master plan future model estimates future flow in the system to appropriately size pipes and lift stations to convey the projected flow. The master plan model represents the trunk piping required for ultimate build out. Trunk piping is generally considered to be located in existing or known public right-of-way to serve multiple parcels and/or future potential developments. Piping for individual developments was approximated, as the layout cannot be known at this point. Developers will be responsible for connecting their sewer to the City's trunk lines if they exist. If the trunk lines are not pre-existing, the developer shall construct the trunk lines per this Master Plan. Flows in the future model correspond to the wet weather flow assumptions defined through the calibration process. The ultimate goal is to appropriately model flow potentially generated from land uses as defined by the proposed update of the Comprehensive Plan and define the ultimate wastewater infrastructure needs of the system.

4.2 Master Plan Flow Generation Layers

4.2.1 Land Use, Zoning, and Flow Allocation

Build-out land use and zoning designations were applied according to the methodology discussed in Chapter 2. Land uses and percent of the use occurring in a given area were determined by combining Sewer Craze and Future Land Use Redevelopment data provided by the City. Flow generation was accomplished by increasing settings in the model to build-out levels. Based on land use, densities, and flow prediction from the model, 90 percent active is average build-out value rather than 100 percent of the projected build-out land use. This correlates well with current build-out densities in fully developed areas of the City. It also agrees with WWTP flow data from HARSB (*Detailed in the January 29, 2020 HARSB Wastewater Unit Evaluation Amendment No. 1*), which currently sees, on average, approximately 172.5 gallons/day/ER, which is approximately 90 percent of the City's previous flow generation value of ~200 gal/day/ER (6,000 gal/month/ER) from the 2012 Master Plan. The flow allocation generated from zoning and land use is only a portion of the system flow. The Master Plan Model was run and analyzed with a wet weather scenario. The I/I factors defined in the existing system analysis were also imposed on the future model. See **Appendix D – Model Assumptions** for additional information.

4.3 Master Plan System Layer

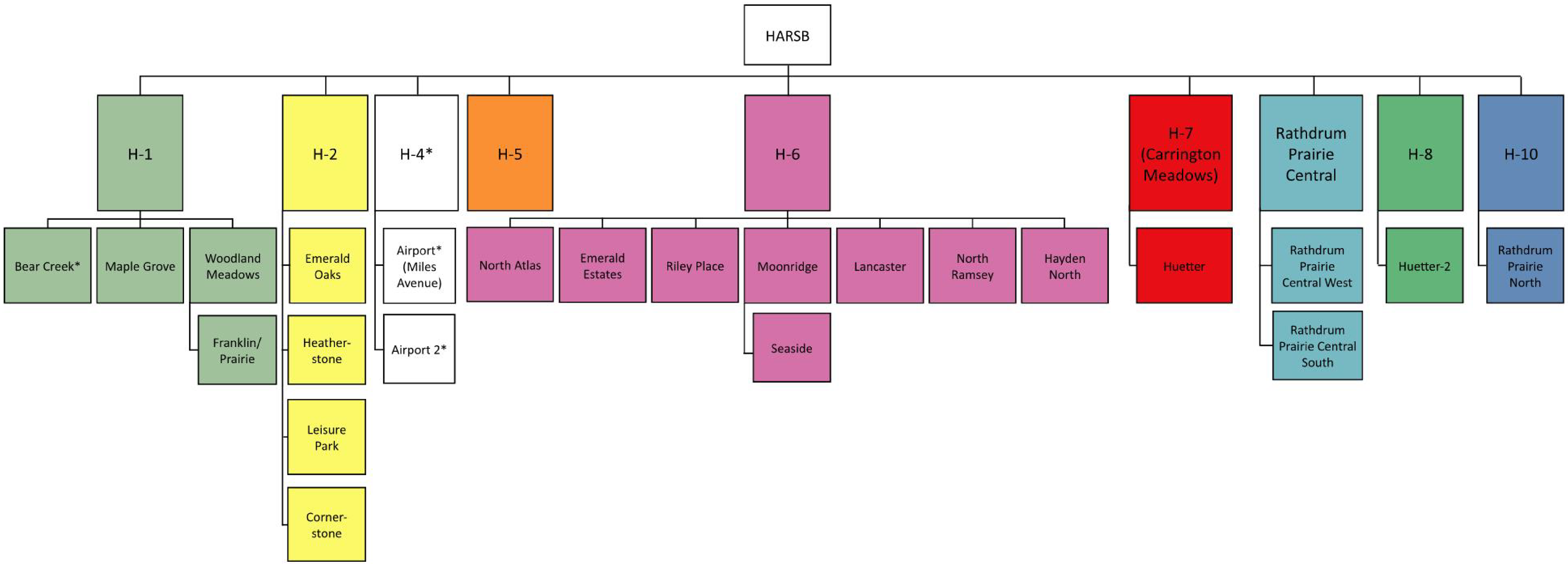
Revisions to the future model system layer occurred for all future trunk line pipes. **Appendix D – Model Assumptions** documents the key assumptions used in the Future Model. The conceptual trunk layout remains similar to the previous Master Plan study, with the following major changes:

- **North Ramsey Road Alignment** – The North Ramsey Road alignment is currently being evaluated as part of the Ramsey Road project. The final alignment for the new Ramsey Road corridor is undetermined at the time of this analysis. Therefore, piping from Wyoming to Lancaster Avenue is based on the Ramsey Road Right-of-Way design provided by the City.

- **Meander Factor for Future Piping** – Future trunk lines are generally routed along natural drainages and major roads based on existing topography as identified from City-provided digital elevation models. The model is used to size the future trunk lines and estimate the vertical alignment. Since exact alignment is unknown, allowance for pipe meander along the actual alignment is accounted for in both the Near-Term and Master Plan future models with additional drop in each manhole as detailed in **Appendix D – Model Assumptions**.
- **Meander Factor Exceptions** – In certain cases, meander factor was removed from the analysis for certain pipe reaches. Typically, this occurred for one of two reasons. First, meander factor was removed in areas where pipe alignment is set. A future alignment may be set due to an existing pipe being upsized and replaced in the same location or knowing that the sewer line will follow a future road alignment that has also been set. In these cases, the alignment is set and meander factor does not apply. Areas where meander factor was removed due to a set alignment include the following CIP Projects:
    - Honeysuckle Avenue (C.I.P. Projects 1.01.1 and 3.01.5)
    - Finucane Drive (CIP Project 2.01.2)
    - Hayden Avenue (CIP Project 2.01.3)
    - Government Way (CIP Project 2.01.4)

  The second scenario where meander factor was removed was in areas where future pipes need to tie into an existing manhole or pipeline. It was necessary to remove the meander factor in order for the future pipes to “make grade” and not end up below the existing pipeline at the connection point. When these pipes are constructed, it will be important to closely follow the layout shown in the model. If significant changes to alignment are proposed, elevations and inverts will need to be checked to verify the connection can be made between future and existing pipes. Areas where meander factor was removed in order to facilitate a connection between future and existing pipes include:
    - Hayden Avenue (CIP Project 3.07.3)
    - Hayden North Development
- **Future Model Lift Stations** – Future model lift stations were modified to accept the revised depth and flow of the updated model collection system. Existing lift station firm capacity and future lift station recommended design capacity appear in **Table 4-1**.
- **Future Model Force Mains** – Future model force mains were modified to accept the revised flow of the updated model and rerouted where necessary. **Figure 4-1** depicts the revised lift station flow paths to the treatment facility. The lift station’s respective sewer sheds are color coded to match the sewer shed colors presented in **Appendix A Figure A8**.

Figure 4-1 - Future Model Lift Station Diagram



* Lift station is not maintained or operated by the City

Table 4-1 – Lift Station Capacities

Basin	Lift Station	Location	LS Status	Pump Discharge to …	2019 Firm Capacity [a] (gpm)	2020 Hydra Peak Flow (Wet Weather) [a] (gpm)	2030 Hydra Peak Flow (Wet Weather) [a] (gpm)	Build-Out Hydra Peak Flow (Wet Weather) [a] (gpm)	Recommended Design Capacity [a], [b] (gpm)
H-1	H-1[c]	East of the intersection of Honeysuckle Avenue and Strahorn Road	In Service	HARSB	1,250	842	1,104	2,277	2,740
H-1	Woodland Meadows	Rude Street just north of Prairie Avenue	In Service	Gravity System	950	133	149	277	N/A
H-1	Bear Creek	Northwest corner of Bruin Loop	In Service	Gravity System	_	0	8	24	N/A
H-1	Maple Grove	Northwest corner of intersection of E Wyoming Avenue and N Maple Street	In Service	Gravity System	_	38	59	101	N/A
H-1	Franklin/Prairie	East of Franklin Street and south of Prairie Avenue (behind Grace Bible Church)	In Service	Gravity System	_	7	8	15	N/A
H-2	H-2	Southwest corner of intersection of Honeysuckle Avenue and U.S. Highway 95 (northeast corner of Wal-Mart parking lot)	In Service	HARSB	1,650	613	604	1,313	N/A
H-2	Leisure Park	North of Heron Avenue and southeast of Retirewood Court	In Service	Gravity System	245	193	202	246	N/A
H-2	Cornerstone	East of Cornerstone Drive and west of U.S. Highway 95	In Service	Gravity System	280	17	17	28	N/A
H-2	Heatherstone	South of the intersection of Bounty Loop and N Heather Way	In Service	Gravity System	_	25	26	32	N/A
H-2	Emerald Oaks	South of Orchard Avenue east of the intersection with Entiate Street	In Service	Gravity System	222	25	29	94	N/A
H-4	H-4	North end of Atlas Road south of the Coeur d'Alene Airport	In Service	HARSB	__	13	25	308	N/A
H-4	Dakota West	South of the Intersection of Dakota Avenue and Navion Drive	In Service	HARSB	320	16	Eliminated in Future Scenario	Eliminated in Future Scenario	N/A
H-4	Airport (Miles)	West end of Miles Avenue east of the Coeur d'Alene Airport	In Service	Gravity System	_	8	8	27	N/A
H-4	Airport 2	North of Coeur d'Alene Airport	In Service	Gravity System	_	0	0	250	N/A
H-5	H-5 (Strawberry Fields)	West of the intersection of Strawberry Lane and Courcelles Parkway	In Service	HARSB	760	326	328	436	N/A
H-5	Gianna Estates	Northwest corner of intersection of W Robinson Avenue and Prince William Loop	In Service	Gravity System	_	8	Eliminated in Future Scenario	Eliminated in Future Scenario	N/A
H-6	H-6	Northeast corner of Ramsey Road and Dakota Avenue	Future	HARSB	N/A	N/A	229	3,591	4,310
H-6	Moonridge	Southeast corner of intersection of Ramsey Road and Olympus Avenue	In Service	Gravity System	155	25	37	58	N/A
H-6	Riley Place	South of the intersection of N Stinson Drive and N Cutlass Street	In Service	Gravity System	200	40	45	49	N/A

Basin	Lift Station	Location	LS Status	Pump Discharge to …	2019 Firm Capacity [a] (gpm)	2020 Hydra Peak Flow (Wet Weather) [a] (gpm)	2030 Hydra Peak Flow (Wet Weather) [a] (gpm)	Build-Out Hydra Peak Flow (Wet Weather) [a] (gpm)	Recommended Design Capacity [a], [b] (gpm)
H-6	Seaside	North of Seaside Street	Future	Gravity System	N/A	N/A	39	41	50
H-6	Lancaster	Lancaster Avenue east of Highway 95	Future	Gravity System	N/A	N/A	60	1,069	1,290
H-6	Hayden North[d]	Southwest corner of intersection of Bentz Road and Vernon J Baker Boulevard	Future	Gravity System	N/A	N/A	43	365	440
H-6	North Ramsey	Ramsey Road north of Lancaster	Future	Gravity System	N/A	N/A	15	586	710
H-6	Emerald Estates	South of intersection of Buckles Road and Pinetree Road	Future	Gravity System	N/A	N/A	N/A	101	130
H-6	North Atlas	Lancaster Avenue west of Atlas Road	Future	Gravity System	N/A	N/A	N/A	1,331	1,600
H-7	H-7 (Carrington)[e]	Southeast of Carrington Meadows development on W Hayden Avenue	In Service	HARSB	500	20	184	650	790
H-8	H-8	Honeysuckle Avenue and Huetter	Future	HARSB	N/A	N/A	179	429	520
H-10	H-10	Huetter Avenue and Lacey Avenue alignment west of the Coeur d'Alene Airport	Future	HARSB	N/A	N/A	N/A	513	620

(a) Lift station capacities listed as "N/A" represent an existing lift station that does not require an upsized future capacity or a future lift station that is not present in an earlier scenario.

(b) Recommended Design Capacity applies a safety factor multiplier of 1.2 to the Build Out Hydra Peak Flow. Final sizing should be confirmed during design.

(c) The H-1 Lift Station was designed with capability for future expansion with either adding a 4th pump or replacing all existing pumps. Build Out Hydra Peak Flow suggests that the expansion may need to occur in the future.

(d) The Hayden North Lift Station is currently in the process of design with a lower capacity than recommended above. The contributing land use areas should be considered for a limited density that is lower than the newly accepted land use in the 2040 Comprehensive Plan Update. The City elected to not program a lift station capacity increase for this lift station in the CIP, however, should consider a capacity increase if pumps are required to be replaced

(e) The H-7 (Carrington Meadows) Lift Station is to be upsized as a part of CIP Project 2.07.2.

4.4 Master Plan Future Model Analysis

The Master Plan Model was run and analyzed with wet weather flows, as this typically represents a worst-case scenario (more flow) when compared to dry weather. Wet weather was modeled by imposing I/I on the future model in addition to increased flows from projected population growth. This process is similar to that used for the 2020 Existing Model wet weather scenario. After adjusting input parameters, land use proportions, and calibration, the Master Plan Model was run in Hydra. **Table 4-2** summarizes the layer and run naming convention for this analysis.

Table 4-2 – Master Plan (Future) Model Layer and Run Naming Convention

Parameter	Wet Weather
System Layer	SY_BO_LR
Service Area Layer	SE_ALL
Land Use Layer	LU_BO_R1
Model Run	BuildOut_2019

4.5 Master Plan Future Model Results

Results for the future model scenario are presented on **Figures A11** through **A14** in **Appendix A – Figures**. **Figure A11** displays the future system, coding pipes by near-term or build out improvement status. **Figure A12** shows future pipes by size. The majority of the gravity piping system consists of 8-inch collectors and 10-inch- and 12-inch-diameter trunk lines. 15-inch-, 18-inch-, and 21-inch-diameter lines are required for major trunks and are needed primarily at the lower end of individual basins. The largest pipe size required to handle near-term future wet weather flows is a 27-inch-diameter line that runs down the H-6 trunk from Lancaster Avenue and into the H-6 Lift Station.

Figure A13 shows future pipes by average depth. Depths are generally shallower (i.e., less than 10 feet) in the upper reaches of a sewer shed or basin, with depth increasing downstream. Depths in the middle portions of basins range from 10 feet to 20 feet, while depths over 20 feet generally occur at the bottom of basins near large lift stations. Greater depths are occasionally encountered further upstream in a basin due to topography. One area with unique topography is the area north and east of Highway 95 and Lancaster Road. The area has highly varying terrain with a basalt ledge, generally referred to as the "Rimrock". Special attention should be given to this area during design to minimize pipe depth and to minimize the number of small lift stations required to serve the highly varying terrain. Current development plans for this area consist of the Hayden Canyon development. Master plan pipe layout for this area has been oriented to match the current development layout, as best possible, and incorporates a trunk line through a prominent topographic valley intended to serve the area above the Rimrock. The deepest pipe segment in this area runs through the Rimrock that connects the elevated area to the trunk line.

Figure A14 shows build out pipes by depth to diameter (d/D) ratio with improvements made to the system as shown in **Figure A12**. The majority of pipes in the future system have d/D ratios less than 0.75, including existing infrastructure. This is a good indication that most of the current pipes are sized appropriately to handle build-out flow conditions. For existing pipes that are not adequate to handle future flows, Hydra sizes them to have an acceptable d/D ratio and avoid surcharges, similar to the process for sizing future pipes. The ultimate goal with upsizing and installing new pipes is to pick a size that can accommodate future flows but not be so large that pipeline capacity goes unused. There are a few instances where future pipes have d/D ratios greater than 0.75 throughout the system, discussed below:

- Reed Road line from Hayden Avenue to Honeysuckle Avenue - Typically, this would be a concern. However, as the contributing area is sized for ultimate build-out, it is unlikely they will see additional flow beyond what was modeled. The solution is to route future flows into other nearby lift stations where possible to avoid surcharge and the need for upsizing the Reed Road line. Impacts to the Reed Road line should continue to be monitored in the future.
- Ramsey Road 24” near Lancaster – The existing 24-inch pipe consists of a few pipe reaches with at or near minimum slopes. The remainder of the mainline downstream will be installed with 27-inch diameter and a minimum of 0.08%. This will result in a carrying capacity of the entire H-6 trunk line that is necessary to maintain d/D values below 0.75 at peak hour flow during the build-out flow condition while limiting the resulting depth downstream.
    - The City should consider implementing special construction standards for the areas upstream of Lancaster Avenue, especially for the area east of Highway 95 where soils deviate from well-draining soils to help reduce I/I into the system. Special construction standards (more robust than the current standards) could consist of a combination of manhole joint wrapping, lining, watertight manhole lids, or other industry standard infiltration and inflow preventative measures. This area in the model currently utilizes a higher I/I than the rest of the future H-6 basin to account for poorly draining soils.

Figure A15 shows system upgrade and improvement projects necessary to serve the ACI. The projects represent areas in the existing system that need upgrades to handle future flows as well as future projects to provide the trunk to serve future development. Future lift stations and force mains required to convey flow to the HARSB WWTP are also included. Capital improvement projects are discussed in greater detail in Chapter 5, and additional information is included in **Appendix F – CIP Packets**.

CHAPTER 5
Capital Improvement Plan

Chapter 5 | Capital Improvement Plan

5.1 CIP Introduction

Analysis using the near-term and future conditions generates an understanding of the infrastructure needed and the upgrades necessary to serve the City's ACI build-out. The majority of the system infrastructure required to serve the City's ACI build-out are new collection system infrastructure. In some cases, existing infrastructure is required to be upsized in order to support the future flow conditions, or where deficiencies are noted. Those projects, along with key basin expansion projects are prioritized and recommended for the Capital Improvement Plan (CIP). The CIP consists of gravity pipes, lift stations, and force main improvements. A list of improvements, opinions of cost for each project, and recommendations on how to implement the plan are included in **Appendix F – CIP Packets**. The tables include a description of all items included to develop the project cost opinion. The total probable cost (in 2020 dollars) includes a contingency factor of 20 percent of the construction subtotal for unknown or unforeseen project conditions. Total cost opinions also include planning, engineering, and administration costs at 20 percent of the construction subtotal. These costs should be updated annually with current cost figures or cost indices, or at the very least to account for inflation. In addition, **Figure A15** graphically shows the system upgrade and improvement projects.

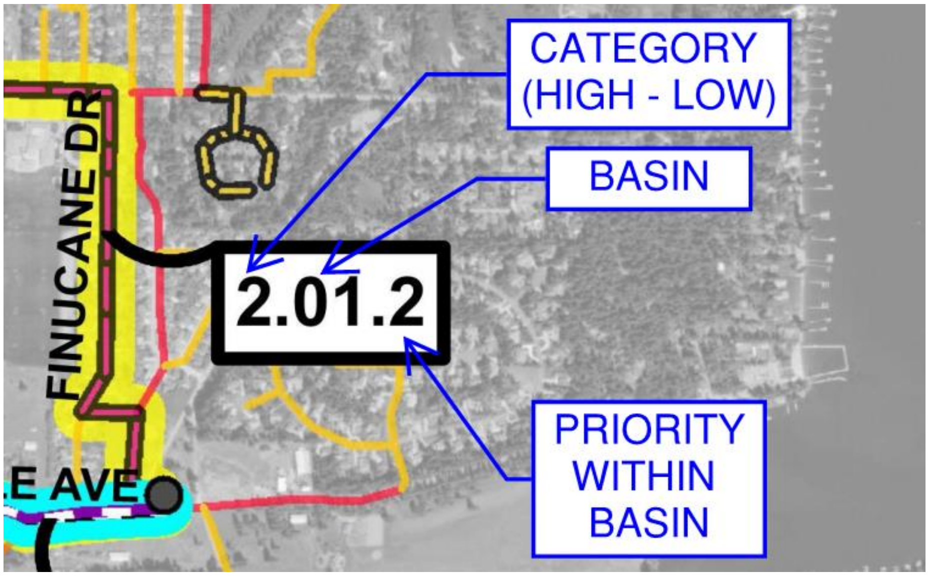
Projects considered for Capital Improvement Plan (CIP) Projects must be:

- Capacity/Expansion Projects - projects necessary to expand service to a new area and/or to increase system capacity to adequately serve the future flow conditions
- Rehabilitation/Replacement – Required to maintain the integrity of the existing system

Operations and Maintenance (O&M) of the system are not considered for Capital Improvement Plan (CIP) Projects. System O&M shall be funded through monthly user fees. If CIP projects include O&M activities, those portions shall be funded by the City through monthly user fees.

Each CIP project is attached a unique project number that relates the priority of the project (High = 1 through Low = 3), the basin where the project is located, and the anticipated order or priority the project is anticipated to occur within the basin. The Numbering system is shown in **Figure 5-1** below:

Figure 5-1 - CIP Numbering System



5.2 Lift Station Sizing and Opinions of Cost

Lift station improvement projects fit into four size classifications based on future flow as predicted by the model. **Table 5-1** explains lift station sizing and lists items incorporated as part of the design for each lift station size. Lift station costs are based on actual construction costs observed by J-U-B for the Coeur d'Alene/Hayden area. Costs are evaluated to include the features and overall magnitude of construction for large, medium, and small lift stations. Opinions of Cost for each CIP project appear in **Appendix F – CIP Packets**.

Table 5-1 – Lift Station CIP

Lift Station Feature	Small	Medium	Large	Regional
Projected Future Build-Out Wet Weather Flow (cfs/gpm)	< 0.22 cfs (<100 gpm)	0.22–1.11 cfs (100-499 gpm)	1.11–2.23 cfs (500-1,000 gpm)	>2.23 cfs (>1,000 gpm)
Duplex Lift Station	✓	✓		
Triplex Lift Station			✓	
Fourplex Lift Station				✓
Submersible Configuration	✓	✓	✓	
Submersible w/PREROSTAL self-cleaning wet-well system		✓	✓	✓
Generator	✓	✓	✓	✓
SCADA/Controls	✓	✓	✓	✓
Odor Control	✓	✓	✓	✓
Control Building			✓	✓
Overflow Basin			✓	✓

5.3 Collection System Improvements and Opinions of Cost

The majority of the collection system projects are lift station and gravity pipeline upgrades or improvements. Costs for gravity pipeline and manhole installation originate from actual construction costs observed and recorded by J-U-B for the Coeur d'Alene/Hayden area. Each project contains a planning level engineer's opinion of probable cost (included in **Appendix F – CIP Packets**).

5.4 Capital Improvement Plan (CIP) Projects and Implementation

The upgrades and improvements identified through the Master Plan analysis generate a CIP candidate project table requiring further analysis to allocate costs to anticipated funding sources. Funding CIP projects will be evaluated and determined by the City, when budgeting their projects. From those projects, developers or others (LIDs, grant funding, etc.) may fund a portion of the projects. The City, therefore, funds the portion of the upgrade or improvement projects necessary to serve multiple developments or more generalized flow basins. The City may also need to participate with developers to upsize infrastructure when the developers choose to construct in advance of the City's master planned construction schedule. That participation will be determined at the time of developer agreements.

The projects identified as system improvements or upgrades appear on **Table 5-2**. Each project is prioritized as follows:

- High Priority (construction begins in 0 to 5 years),
- Medium Priority (construction begins in 6 to 10 years), or
- Low Priority (construction begins beyond 10 years).

Project priority is determined in collaboration with City Staff where each potential project was discussed and evaluated prior to designating a priority. It is recommended that the City plan to address high priority issues first, followed by medium and low items. We recommend a periodic reassessment to account for changes in development or other areas that may result in readjustment of the CIP priorities. **Appendix F – CIP Packets** included the full details for each project. The CIP Packets contain pertinent information for the improvements deemed necessary from this Master Plan. These projects are prioritized based on City sewer infrastructure needs and not based on individual private development possibilities. These packets include the following:

- **Figure F1 - CIP Summary Map**
- **Figures F2 – F20** – CIP Project Detail for each project including a brief narrative of the core issues, recommended solution, maps, and cost estimates.
- **Detailed CIP Project Cost Opinions**

Table 5-2 – Capital Improvement Plan Projects

PROJECT NUMBER	PROJECT NAME	TOTAL PROBABLE COST IN 2020 DOLLARS	PROJECT TYPE
HIGH PRIORITY PROJECTS (CONSTRUCTION BEGINS IN 0 TO 5 YEARS)			
1.06.1	Ramsey Phase 1	$1,702,000	Capacity/Expansion
1.06.2	Ramsey Phase 2	$1,574,000	Capacity/Expansion
1.06.3	H-6 LS	$2,419,000	Capacity/Expansion
1.06.4 [(a)]	H-6 FM	$5,491,000	Capacity/Expansion
1.06.5	Moonridge FM	$19,000	Capacity/Expansion
1.06.6	Lacey Gravity	$130,000	Capacity/Expansion
1.02.1	H-2 Piping Improvements	$48,000	Rehab/Replacement
1.02.2 [(a)]	Honeysuckle FM Phase 1	$1,800,000	Rehab/Replacement
1.02.3 [(a)]	Honeysuckle FM Phase 2	$2,490,000	Rehab/Replacement
1.01.1	Honeysuckle Upsize Phase 1	$194,000	Capacity/Expansion
MEDIUM PRIORITY PROJECTS (CONSTRUCTION BEGINS IN 6 TO 10 YEARS)			
2.06.7	Riley FM	$136,000	Capacity/Expansion
2.06.8	Ramsey Phase 3	$502,000	Capacity/Expansion
2.01.2	Finucane Dr. Upsize	$769,000	Capacity/Expansion
2.01.3	Hayden Ave Upsize	$892,000	Capacity/Expansion
2.01.4	Government Way Upsize	$380,000	Capacity/Expansion
2.07.1	Hayden Phase 1	$348,000	Capacity/Expansion
2.07.2	H-7 Lift Station Upsize	$505,000	Capacity/Expansion
LOW PRIORITY PROJECTS (BEYOND 10 YEARS)			
3.01.5	Honeysuckle Upsize Phase 2	$415,000	Capacity/Expansion
3.01.6	H-1 Lift Station Pump Upsize	$491,000	Capacity/Expansion
3.06.9	Ramsey Phase 4	$354,000	Capacity/Expansion
3.07.3	Hayden Phase 2	$373,000	Capacity/Expansion
3.07.4	Dakota Elimination	$136,000	Capacity/Expansion

(a) HARSB project noted for coordination and management purposes

Appendices