TECHNICAL MEMORANDUMS No. 1 and No. 2

for the
Cities of Hayden, Post Falls and Rathdrum
with Kootenai County

Rathdrum Prairie
Wastewater Master Plan

Flow Basins, Conveyance, and Computer Model

Final Draft

November 2008

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J-U-B

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PROFESSIONAL ENGINEER
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STATE OF IDAHO
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Section 1 – Introduction

1.1 Purpose and Goals

The primary goal of the Rathdrum Prairie Wastewater Master Plan is to provide the Management Committee with the technical evaluations, costs, and alternatives it needs to guide long-term wastewater planning over the Rathdrum Prairie. The Master Plan will provide flexibility for future growth by outlining logical service areas, phasing, construction, maintenance, and operation costs. The items specifically addressed in this Technical Memorandum include the following:

- Reviewing the Wastewater Master Plans of each cooperating entity (Hayden, Post Falls, and Rathdrum) and working with them to integrate their wastewater master planning assumptions.
- Developing a color base map from Avista aerial mapping showing the following:
  - Elevation contours
  - Kootenai County Assessor parcel boundaries
  - Major roadways
  - Public drinking water wells and recharge areas
  - Existing wastewater facilities
- Determining sewer system improvements necessary for logical service areas, interceptor trunk lines, force mains, and pumping stations for the "most likely" development intensity scenario within the study area.

1.2 Master Planning Area, Zoning and Land Use

The study area for the Rathdrum Prairie Wastewater Master Plan refers primarily to the "Shared Tier" and is generally described as the unincorporated area bounded between the current ACIs for the cities of Hayden, Post Falls, Hauser, and Rathdrum as well as Highway 53 and the Washington State border. The Shared Tier was defined in the 2004 Coordinated Area of City Impact agreement between the cities and Kootenai County (Kootenai County Ordinances No. 339 and No. 340). **Figure 1.1** shows the Shared Tier as well as the Cities' Exclusive Tiers or Areas of City Impact (ACI). The Shared Tier encompasses approximately 17 square miles (10,460 acres). The study area includes an additional 1,460 acres in Post Falls' Exclusive Tier north of Prairie Avenue and near Pleasantview Road, which was never included in other master planning efforts. The study area totals approximately 18.6 square miles (11,920 acres) and can be viewed on **Figure 1.2**.

The current zoning in the study area is predominantly agricultural with significant rural, industrial, and mining activities. The Kootenai County Zoning District Map dated July 1, 2005, with an issue date of July 13, 2006, is applicable and appears here as **Figure 1.3**. The Kootenai County Zoning Ordinance defines zoning classifications in the following manner:

- Agricultural Zones- a district that is suitable for farming and agriculture, including tree farms.
- Rural Zones- a district suitable for rural residential uses and agricultural pursuits.

- Industrial Zones- a district suitable for manufacturing and processing of all types.
- Mining Zones- a district suitable for excavation and processing of materials from the earth.

The mining zones areas appear on **Figure 1.4** and represent areas where material may be excavated from the earth, modifying its spatial representation. Mining comprises approximately 1,620 acres within the study area. It should be noted that mining on the Prairie is a significant economic activity, with phasing plans often lasting 50 or more years. Also, modifications to the topography in mining zones could directly affect the sewer model in these areas. Therefore, trunk and interceptor lines are routed through these areas only along existing rights-of-way. It should be noted that the mining areas shown are from zoning information from Kootenai County. Other mining areas may exist if they were "grandfathered" in before the County created the current zones. The other zoning districts do not have as significant an effect on the master planning effort or the configuration of the model.

Zoning is specific to parcels of property throughout the County. Zoning is guided by the more general Comprehensive Plan and its land use designations, which are not specific to existing parcels. Kootenai County is currently in the process of finalizing their Comprehensive Plan Update and expects to complete it in 2008. The Comprehensive Plan guides landowners and decision makers when reviewing specific development and zoning requests. The County has closely coordinated with communities and rural areas through a series of regional meetings, workshops, and an extensive public review process. Although the Comprehensive Plan Update is not finalized, the draft plan along with the current Comprehensive Plan and Zoning Map can be utilized to represent existing zoning obligations within the Shared Tier.

The current Comprehensive Plan was approved in 1994 and shows the land use categories for the study area as being mostly agricultural and rural residential, with some suburban residential and industrial areas. The 1996 Future Land Use Map depicts these areas as they were projected to develop and appears here as **Figure 1.5**. These areas were defined in the comprehensive plan as:

- Agricultural: Areas that the primary use is agriculture with dwellings that are incidental to the primary use.
- Rural Residential: Areas where the primary use is residential but either borders a rural area or is rural in appearance.
- Suburban Residential: Areas generally close to population centers but are not expected to be annexed in the near future.
- Industrial: Large areas where large industrial development is desirable to the community and infrastructure can be efficiently provided.

The October 2008 Second Draft Comprehensive Plan re-categorized existing land uses in the study area in decreasing total acreage (Kootenai County, 2008), as:

- Resource: Includes privately-owned parcels over 20 acres in size and lands that have agricultural or timber property tax exemptions. These lands are typically considered rural in nature.
- Rural 2: One of four residential designations that encompasses parcels from two to five acres in size with no agricultural or timber property tax exemptions.
- Public: Land owned by Federal, State, Tribal, County, or municipal government. The land in this designation is primarily the 932 acres owned by the cities of Post Falls and Rathdrum in the study area. The currently intended use is for wastewater treatment, reclamation, and reuse.
- Industrial: Includes light and heavy industry such as mining as well as manufacturing and assembly.
- Commercial: Uses typically consist of retail and wholesale sales, professional offices and services, and are a relatively small percentage of the study area.
- Rural 3 and Rural 4: Residential uses with parcels between 5 and 20 acres in size comprising a relatively small percentage of the study area.

The Draft Comprehensive Plan designates the vast majority of the study area's future land use as "Urban Reserve" (UR). The remainder is simply designated as urban. Urban Reserve designation is to reserve land for future annexation into an incorporated area. The UR designation limits development in these areas to one residential unit per ten acres until adequate roads and utility services are in place. The designation enables cities to plan and phase growth based on the need and ability to provide the necessary facilities and services to support additional growth. The cities and County must reach an agreement that allows the private property owners within a UR area to develop their land within a reasonable time frame. Urban land use designations are applied to ACIs suitable for residential densities above four to the acre. Urban land must be served by public sewer in the near future along with other services and transportation to accommodate the highest density of any land use. **Figures 1.6** and **1.7** show Kootenai County's existing and future land uses as detailed in the Draft Comprehensive Plan, respectively.

Although existing Comprehensive Plans have guided land owners, regulators, and public officials in Hayden, Post Falls, Rathdrum, and Kootenai County, those Plans are all being updated on varying schedules, within specific legal and procedural requirements. Therefore, the Rathdrum Prairie Wastewater Management Committee agreed to utilize "equivalent population" values for the majority of the study area with some areas of potentially higher intensity. These equivalent population values will be discussed in detail in subsequent sections.

The cities of Hayden, Post Falls, and Rathdrum have historically taken a proactive approach to provide sewer planning within their ACIs and have provided up to date Master Plans as well as critical information required for the analysis of the Rathdrum Prairie Study Area.

As discussed more thoroughly in other sections of this plan, another unique aspect to this master planning effort is that the study area is directly over the Rathdrum Prairie Aquifer (RPA). The RPA is the only Sensitive Resource Aquifer in Idaho. It is an aquifer high on the public's awareness for protection with following regulation history:

- 1977 Panhandle Health District (PHD) and Kootenai County create “5-acre rule” to limit onsite septic tank and drainfield wastewater treatment to one residential unit per five acres
- 1978 U.S. Environmental Protection Agency (EPA) Sole Source designation
- 1980 Idaho Department of Environmental Quality (IDEQ) designation as “Special Resources Water”
- 1995 IDEQ Supplement to Land Application Guidelines over Special Resource Aquifer
- 1997 IDEQ designates as “Sensitive Resource Aquifer”
- 2002 Idaho Department of Water Resources (IDWR) creates the Rathdrum Prairie Groundwater Management Area leading to adjudication
- 2003-2007 Bi-State Hydrologic Study, with the U.S. Geological Survey (USGS) and the State of Washington, focuses on water quantity
- 2006 Voters approve Aquifer Protection District

In support of the efforts of the three cities, IDEQ has authorized funds to review and further refine the established policies and procedures relative to wastewater reclamation and reuse over the Aquifer. This separate scope of work is also scheduled for completion in 2008.

1.3 Equivalent Population Projections

Populations for the Rathdrum Prairie and surrounding cooperating areas in Kootenai County are expected to increase substantially in the future. While areas within existing City ACIs have been projected by each respective City, such projections within the study area are considerably more complex due to possible future land uses and their resulting densities.

Variations in entity comprehensive planning approaches and schedules make a land use basis of projecting future densities even more difficult. Therefore, the Management Committee reviewed various Master Plans with the consulting team and ultimately recommended an equivalent population approach to planning ultimate densities in the study area. In terms of wastewater flow, equivalent population can range from less than one per acre in rural environments (5-acre rule) to greater than 20 per acre (urban core). The Management Committee believes that it would be unwise to plan for ultimate build-out intensities to be less than an equivalent population of 12 per acre in developed areas. The planners also believe that areas around major thoroughfare intersections and where specific development plans are known should utilize an increased intensity of 20 equivalent population per acre.

On April 12, 2007, the Management Committee and consulting team met with elected officials and administrators from Kootenai County, Hayden, Post Falls, and Rathdrum as well as the cities of Coeur d’Alene and Hauser to consider this approach along with potential future ACI boundaries. The elected officials and administrators agreed to the equivalent population/intensity approach and values. With some relatively minor modifications, they also agreed to preliminary future ACI boundaries to help define planning level sewer flow basins. **Figure 1.8** shows the results of those efforts.

Extrapolating the equivalent population approach to existing and future ACI produces equivalent populations that can be utilized for future build-out wastewater master planning. **Table 1-1** summarizes those equivalent population estimates.

Table 1-1 – Equivalent Population Estimates

Community	Estimated 2005 Population [1]	Estimated Existing ACI Build-Out Population [2]	Rathdrum Prairie Master Plan Equivalent Population [3]	Future ACI Build-Out Equivalent Population [4]
Hayden	11,900	38,000	15,283	53,283
Post Falls	23,160	84,500	101,770	186,270
Rathdrum	5,740	73,000	26,568	99,568
Total	40,800	195,500	143,621	339,121

[1] *U.S. Census Bureau Coeur d'Alene/Post Falls Press, North Idaho Gold Special Edition, Summer 2006*

[2] *Hayden Sewer Master Plan Update, Welch Comer Assoc., December 2006, Page 17; Demographic Analysis Growth Projections for Post Falls, J.P. Stravens Planning, January 2007, Pages 7-10; Rathdrum Provisional Sanitary Sewer Evaluation, June 2006, Welch Comer & Assoc., Pages 5-6*

[3] *Rathdrum Prairie Planning and Wastewater Management Committee, Meeting with Elected Officials and City Administrator's Memorandum, April 12, 2007*

[4] *Sum of existing plus Rathdrum Prairie Master Plan Study Area*

Typical population projection analysis for this region accounts for a maximum 3 percent annual growth. Applying this annual growth to the build-out populations results in a build-out timeline demonstrated on **Figure 1.9**. Directly related to the equivalent population estimates at build-out is understanding the duration and timeline of this study. It is important to understand the duration and timeline cannot be precisely quantified since it is impossible to predict development trends and future growth. Applying typical population projections for this region may provide an estimated duration and timeline.

Section 2 – Base Map

2.1 General

Existing City and County maps and record drawings were used to develop a reference base map showing streets, property boundaries, and water bodies. This base map was used for establishing sewer alignments, land use areas, and drainage basin service areas in the planning and modeling efforts.

2.2 Aerial Images

Due to the extent of the study area boundary, multiple aerial images are required to attain adequate resolution. The images used are categorized as either high or low resolution and are described as follows:

- High Resolution Aerial Images: 2005 Avista Utility Aerial Images
- Low Resolution Aerial Images: USDA 1 Meter Digital Orthophotography Image in Multi-resolution Seamless Image Database (MrSID) referred herein as MrSID image.

2.3 Spatial Information

Vertical elevation information is critical to the wastewater system model since the pipes are laid out utilizing the natural drainage potential of the Prairie. The contours used as the basis for vertical elevation when entering data in the Hydra model have been generated from the Avista Digital Elevation Model (DEM) information from the 2005 flight data. Major and minor contours of 5-foot and 10-foot vertical intervals help display the vertical changes in elevation, ridges, valley, and flat spots to a resolution of ±5 feet. It is important to note that the aerial mapping for this has a published precision of ±5 feet vertically and ±2 feet horizontally. Spot checking between known Kootenai County elevation datum monuments at major intersections and the DEM-generated map showed no differences greater than ±2 feet vertically in the study area. This spot check points out the importance for survey grade information prior to design for specific improvements in the study area.

Another important aspect associated with this mapping information is understanding both the horizontal and vertical datum. The Avista DEM information is based on State Plane West coordinates, horizontal North American Datum 1983 (NAD 83), and North American Vertical Datum 1988 (NAVD 88). The data act as geo-spatial reference points positioning the ground features to their actual locations on the earth’s surface. The City of Hayden’s Wastewater Master Plan completed in December 2006 references a vertical datum of NAVD 88, as is this study. The City of Post Falls Wastewater Master Plan completed in 2001 references the National Geodetic Vertical Datum of 1929 (NGVD 29). The vertical translation from NAVD 88 to NGVD 29 is to subtract approximately 3.8 feet, respectively, in the study area. This is more fully discussed in Section 5.2.

2.4 Kootenai County Assessor Parcel Boundary Information

The parcel information used in this study is available to the public from the Kootenai County Geographic Information System (GIS) and Digital Map Data (GIS and Mapping) website at www.kcgov.us/departments/mapping/mapsearch. Data has been downloaded and compiled over the entire study area representing the parcel information provided by the Assessor's Office (January 2006).

The owners of the largest parcels in the study area have been identified from Kootenai County records to aide future communications with landowners regarding the feasibility of sewer infrastructure planned in this study. **Figure 2.1** shows the 20 largest contiguous parcels. The figure coincides with **Table 2-1**, which provides detailed data regarding the landowner, parcel number, and associated acreage.

2.5 Public Water Systems and Wells

While Post Falls and Rathdrum own and operate public drinking water systems within their existing City limits, the City of Hayden does not have a water system. There are also numerous other public water systems within the City and County study area. As each entity expands to its future ACI boundaries and incorporate areas into their City limits, public water will need to be provided by the entities or an existing public drinking water system. Until then, private wells serve a majority of the homes in the Rathdrum Prairie Study area.

Issues related to specific water service territories and water rights are beyond the scope of this study. However, it will be important to address these issues and coordinate with the public water purveyors in the area as ACIs change and developments occur. Other water purveyors in or adjacent to the study area include:

- East Greenacres Irrigation District
- Ross Point Water District
- Units Water Association
- Hayden Lake Irrigation District
- Avondale Irrigation District
- North Kootenai Water District
- Happy Valley Water System
- Morrison Estates Homeowners Water Association
- Meadowland Acres

2.6 Current Area of City Impact (ACI) Boundaries

The current ACI boundaries established in 2005 were previously described and shown on **Figure 1.1**. The Rathdrum Prairie Area of City Impact (April 2, 2007) was prepared by the Kootenai County GIS and provided by the Building and Planning Division. The figure shows the existing City limits and ACI of the cities of Post Falls, Rathdrum, Hauser, and Hayden, which are also referred to as the "Excusive Tier" ACI. The "Shared Tier" is the unincorporated area between the current exclusive tier ACI boundaries and generally forms the study extents of this Wastewater Master Plan.

2.7 Future Area of City Impact (ACI) Boundaries

As discussed earlier, conversations with the Rathdrum Prairie Wastewater Management Committee led to proposed future ACI boundaries. The future ACI boundaries are a product of the cooperative efforts of the vested entities working to establish likely ACI boundaries. Several elements were taken into consideration upon the establishment of these boundaries. The cooperating entities provided insight on likely ACI extents, the ramification of these boundaries were then discussed on several levels from land planning, transportation corridors, and wastewater planning. The proposed boundaries were then discussed with the elected officials and administrative representatives from each of the cooperating entities as well as the cities of Coeur d'Alene and Hauser. The proposed future ACIs appear on **Figure 1.8** (April 16, 2007) prepared by the Kootenai County GIS and provided by the Building and Planning Division.

Although the map showed areas where there is general agreement for future ACIs and areas of higher intensity equivalent population, the Cities and County are utilizing these boundaries for wastewater master planning only. Specific agreements and entity planning will be developed at a later date in accordance with the September 2004 Kootenai County Ordinance No. 339, County Coordinated Area of City Impact Agreement.

Table 2-1 – Largest Landowners of Record in Study Area

Total Ownership Rank	Owner	Map No.	Parcel Number	Acreage		
				Within Boundary	Outside Boundary	Total
1	Jacklin Land Co.	1	51N04W186100	311		
		10	51N04W193700	154		
		12	51N04W198900	153		
		15	51N05W138300	148		
		29	51N04W183200	80		
		45	51N04W183800	24		
			Subtotal	870	0	870
2	City of Post Falls	2	51N05W222900	310		
		13	51N05W233700	152		
			Subtotal	464	0	464
3	Beck, Donald	3	51N05W314700	305		
		14	51N05W311100	154	92	
			Subtotal	455	92	547
4	Meyer, Wallace	8	51N04W170900	155		
		16	51N04W172700	145		
		19	51N04W181300	118		
			Subtotal	418	0	418
5	Howell, Larry	4	51N05W144550	174		
		24	51N05W153700	106		
			Subtotal	280	0	280
6	Crystal Creek LLC	18	51N05W208500	132		
		22	51N05W201570	113		
		44	51N05W202300	26		
			Subtotal	271	0	271
7	Satchwell Property	13	51N05W131300	152		
		21	51N05W243700	116		
			Subtotal	268	0	268
8	Beck Family Trust	20	51N06W362600	117		
		27	51N06W255000	88		
		38	51N06W365000	60	57	
			Subtotal	265	57	322
9	M M Investment Corp	7	51N06W360200	159		
		28	51N06W258900	80		
			Subtotal	239	0	239

Table 2-1 (continued)

Total Ownership Rank	Owner	Map No.	Parcel Number	Acreage		
				Within Boundary	Outside Boundary	Total
10	Hendrickson Farms	5	51N04W082700	160		
		35	51N04W079100	74		
			Subtotal	234	0	234
11	Meyer, Wayne & Bros	6	51N04W082000	160		
			Subtotal	160	0	160
12	Haman, David	30	51N05W134395	79		
		33	51N05W133100	77		
			Subtotal	156	0	156
13	Rathdrum 352 LLC	11	51N05W241300	153		
			Subtotal	153	0	153
14	Meyer Wayne ETUX	32	51N04W072700	77		
		36	51N04W076500	70	230	
			Subtotal	147	230	377
15	CMP Development Corp	17	0573200A0010	140		
			Subtotal	140	0	140
16	Poe Asphalt Paving	37	51N05W3054700	69		
		39	51N05W306200	60		
			Subtotal	129	0	129
17	Burley, Emmett	23	51N05W161950	111		
			Subtotal	111	0	111
18	The Links, LLC	25	51N05W195330	104		
			Subtotal	104	0	104
19	Satchwell Donald Dorothy	31	51N05W231100	77		
		46	51N05W243220	23		
			Subtotal	100	0	100
20	Long, Michael	26	51N05W145100	96		
			Subtotal	96	0	96
21	Johann, David	40	51N05W150150	59		
		43	51N05W151350	28		
			Subtotal	87	0	87
22	Satchwell Roy	34	51N05W238500	75	37	
			Subtotal	75	37	112
24	MCD Properties	41	51N05W224950	36		
		42	51N05W225200	36		
			Subtotal	72	0	72

Section 3 – Modeling Assumptions

General

It is important to understand that there are many acceptable ways to develop a sewer model. A computer model of a sewer system is based on assumptions that characterize the area and system under study. The assumptions used in a model are typically based on general knowledge of sewer flow characteristics gained through past experience with monitoring flows and modeling other sewer systems. Consequently, the development of this model is based on detailed discussions with the Rathdrum Prairie Wastewater Technical Advisory Committee as well as J-U-B's modeling philosophy and past experience.

The Hydra Version 6.3 (Pizer, Inc.) sewer computer model has three layers—the system layer, the service area layer, and the land use layer. The following is a brief discussion of the current assumptions associated with each element of the preliminary system model.

3.1 System Layout

Please note the following discussions and recommendations are associated with each parameter of the system layer of the Rathdrum Prairie Wastewater Master Plan Model. The system layer houses physically measurable information about the system, but it also holds information that requires assumptions as listed below

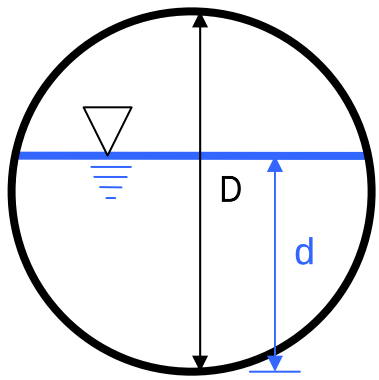
3.1.1 Roughness Factor - Manning's "n"

Description	The roughness factor (n) is used in the standard Manning's formula $Q = (1.49/n)AR^{2/3}S_o^{1/2}$. The Manning's formula relates flow in a pipe with the depth of flow, diameter of the pipe, and the slope of the pipe. Typical "n" values range from 0.009 for very smooth glass or plastic to greater than 0.016 for unfinished concrete.
Discussion	A Manning's "n" of 0.013 is the standard roughness value for sewers. A slime layer develops on any pipe material in contact with sewage, providing a consistent roughness regardless of material.
Model Assumption	A Manning's "n" of 0.013 is used regardless of material and age unless field flow data supports changing this globally in the system.

3.1.2 Design Pipe Sizing Methodology and Safety Factor

Description

Hydra has the capability to size future pipes based on several parameters, including maximum depth of flow/diameter (d/D) of pipe ratio. The d/D is the ratio of depth of flow to the diameter of the carrier pipe as shown on the figure below. When the flow in a pipe reaches the point where the d/D ratio is greater than the maximum d/D ratio, the pipe diameter will increase to the next size.



Discussion

A graduated scale for maximum d/D dependent on the size of the pipe originated with the ASCE manual "Design and Construction of Sanitary Sewers." The manual recommends master planning sewer systems at a d/D of less than 0.5 for sewers less than 18 inches in diameter and 0.75 for larger sewers. This allows for a larger safety factor for smaller sewers where variations in land use and extensions of the service area can have large impacts on the available capacity of the sewer. The larger sewer lines have a smaller safety factor because isolated variations in land use tend to balance out over the larger area served by the larger sewer.

Model Assumption

The use of a graduated scale for the maximum d/D as listed below for the master planning purpose of the model.

Size	d/D	Resultant Safety Factor
8"	0.50	2.46
10"	0.55	2.10
12"	0.60	1.83
15"	0.65	1.53
>18"	0.75	1.27

3.1.3 Design Pipe Slope Determination

Description Hydra has the capability to set the slopes of future pipes based on several parameters, including minimum velocity.

Discussion Most sewer designs in the region use minimum pipe slopes based on the Great Lakes and Upper Mississippi River Basin's (Ten States Standards) minimum slopes rather than velocity. The use of a minimum velocity may result in master plan slopes that differ from the slopes used in final design and construction of the master plan line. Although the minimum velocity is set at 2 ft/second, the model calculates pipe slope based on Ten State Standards. IDEQ directly incorporated the Ten States Standards into their Administrative Procedures in 2007.

Model Assumption The use of Ten State Standards minimum slopes rather than velocity to set the minimum slopes of design pipes.

Size	Pipe Slope (%)
8"	0.40
10"	0.28
12"	0.22
15"	0.15
18"	0.12
≥21"	0.10

3.1.4 Design Pipe Sewer Match Point

Description When sewer lines of different sizes meet, Hydra can match inverts, match crowns, or match somewhere in between.

Discussion Convention and some sewer standards require the design to match the crowns or to match the design depths of the sewers to keep from surcharging the smaller line.

Model Assumption Match crown for simplicity during design and construction and to reduce the potential of surcharging laterals.

3.1.5 Allowable Decreases

Description Hydra allows the user to select the number of pipe size decreases that will be allowed in a model simulation.

Discussion Decreases are not recommended in smaller lines (<24") due to the tendency of obstructions to lodge at locations where trunk lines decrease in size. Decreases may be necessary when tying a master planned line into an

	existing trunk line, but the allowable decreases command does not affect those situations.
Model Assumption	Pipe size decreases are not allowed.

3.1.6 Design Pipe Distance between Manholes

Future "design" pipes must be routed with distances between manholes to account for established regulation. The requirements of IDEQ's adopted regulation, Ten State Standards, are 400 feet maximum for lines less than 18 inches in diameter and 500 feet maximum for lines larger than 18 inches. J-U-B has examined several adjacent constructed systems and a value for the average distance between manholes is approximately 275 feet. This model accounts for manhole spacing consistent with adjacent constructed systems while allowing for maximum pipe lengths entered in the model at 1,320 feet

Description	Distance between manholes is determined by the modeler for each individual case.
Discussion	The distance between manholes may vary, typical values for average distance between manholes in several adjacent constructed gravity systems is approximately 275 feet.
Model Assumption	For modeling purposes, the maximum distance between manholes will be 1,320 with manholes accounted for every 300 LF. Due to various different topographical situations (ridges, valleys, etc.), check manholes may be placed at strategic locations to reflect an accurate representation of the topography.

3.1.7 Design Pipe Routing and Depths

Description	Hydra allows minimum depths to be set, but maximum depths must be checked by the modeler.
Discussion	Minimum depth may be set within Hydra, and care must be taken to check that a trunk line has sufficient depth to serve to the boundary of its service area. This can be accomplished by using check lines extending to locations within a service area that may be difficult to reach. Check lines force the trunk line deeper if necessary to serve an area at a specified minimum depth. The minimum depth is dependent on the type development being served, the setback of the buildings from the sewer, and whether basements need to be served. Conversely, care must also be taken to check maximum depth of the system.

Model Assumption	Conversations with the TAC concluded the following parameters for minimum depth: • 12 feet minimum for trunk lines (10-inch pipes and larger) • 8 feet minimum for check lines Conversations with the TAC concluded the following parameters for maximum depth: • 12 to 20 feet deep is the preferred depth • 20 to 25 feet deep is considered deep sewer • 25 to 30 feet deep is considered excessive depth • Greater than 30 feet deep is not allowed Conversations with the TAC concluded the following parameters to minimize excessive depth. • One increase in pipe size is allowable for 8-inch and 10-inch pipes in order to decrease depth to acceptable ranges.

3.1.8 Manhole Drop and Meander Factor

Another topic of discussion typical of sewer master planning is to provide flexibility in the model for future implementation. "Design" pipes are typically laid out along the natural drainage alignments and/or on a large-scale square grid without knowing the actual future street layout. Typically, sewer alignment within a development occurs in a non-linear fashion, producing greater length of installed pipe and a greater number of manholes. J-U-B typically accounts for pipes meandering through development with a "meander factor" employed in the Hydra model by increasing the standard invert drop through each manhole.

Description	Invert drop through manholes of master planned lines.
Discussion	The invert drop through manholes allows for headloss in manholes. Large diameter lines are not as likely to have significant headloss through the manholes; therefore, the manhole drop can be reduced for large diameter lines. At the master planning level, modeling must account for extra manholes and meandering pipes due to curvy roads, intersections, and alignment changes. This can be accounted for with an increased value for allowable drop.
Model Assumption	The value for the manhole drop will be assigned as follows. A required manhole drop of 0.10 feet for each manhole required for Ten State Standard pipe lengths plus an added drop to account for an additional 20 percent increase in pipe length will be assigned to each manhole for potential meandering pipes. The drops shown below are based on the assumption that the lines are at minimum slope. As previously discussed in 2.1.6 Design

Pipe Distance Between Manholes, this value will also be assigned to account for manholes at 300-foot intervals.

Size	MH Drop/300-feet (ft)	MH Drop/1320-feet (ft)
8"	0.34	1.496
10"	0.27	1.188
12"	0.23	1.012
15"	0.19	0.836
18"	0.17	0.748
≥21"	0.16	0.070

3.1.9 Manhole Type

Description

Hydra allows for the following three types of manholes, depending on the shelf configuration:

1. Flat bottom, no bench.
2. Channeling to ½ the depth of the incoming and outlet pipes.
3. Channeling to the full depth of the incoming and outlet pipes. This is common for municipalities and is recommended for new construction. This type of channeling decreases the headlosses through manholes and reduces the potential for odor and maintenance issues.

Discussion

The Type 3 manhole with channeling to the full depth of the pipes is the standard configuration for the ISPWC.

Model Assumption

Type 3 manhole is used in this model.

3.1.10 Future Constant Speed Pump Station Capacity

Description

The capacity of each lift station in the model is set individually.

Discussion

Lift stations tend to be designed based on assumptions that are more conservative and yield peak flows higher than the Hydra model. A safety factor for the lift station is desirable to reduce the chance of overloading the lift station.

Model Assumption

Set the lift station capacity at least ten percent higher than the master planned incoming peak flow.

3.2 Service Layer

Please note the following discussions and recommendations are associated with each parameter of the service area layer of the Rathdrum Prairie Master Plan Model.

3.2.1 Service Area Size

Description	The area and shape of each service area is determined for each service area.
Discussion	The service area size should be small enough to provide reasonable incremental increases in flow along a trunk line but not so small to unnecessarily increase the complexity of the model. In addition, they should correspond to the diurnal curve for daily flow generated by the service area.
Model Assumption	Service area size will be looked at on an individual basis and will be topographically driven, but are generally sized 40 acres and smaller.

3.2.2 Service Area Connection Point

Description	Each service area has a point on the system where it connects to the system.
Discussion	The service area connection point can affect the sizing of the trunk lines. If service areas are small, the connection point is not as critical.
Model Assumption	At locations where a given service area will tie into the system at one point, connect the service area at that point. At locations where the service may tie into the system along the length of the bordering trunk line, connect at the upper two thirds of the trunk line.

3.2.3 Service Area Delay

Description	Delay of flows for travel time from the service area to the system. Can be calculated based on a velocity and the distance from the centroid of the service area to the connection point.
Discussion	The service area delay is particularly useful when a service area is not adjacent to the trunk line that serves it. A value of 2 to 2.5 ft/second is generally representative of flow velocities in small collectors and service laterals. However, Hydra calculates the delay from the centroid of the service area straight to the trunk line.

	The flow path is typically more circuitous. To account for the longer flow path, the delay velocity should be reduced to 1 to 1.5 ft/second.
Model Assumption	A value of 1 ft/second as a basis for flow delays calculated from the service area connection point of each service area.

3.3 Land Use Layer

Please note the following discussions and recommendations are associated with each parameter of the land use layer of Rathdrum Prairie Master Plan Model.

3.3.1 Land Use

As previously discussed in this memorandum, comprehensive and land use planning is ongoing throughout Kootenai County as well as within the exclusive tier of the ACIs. To facilitate consistent planning across multiple jurisdictions, the Technical Advisory Committee reviewed several wastewater master planning approaches with the consulting team. It was mutually decided with the planners, elected officials, and City administrators to apply a blanket value for "typical" predicted build-out equivalent population. Areas of higher equivalent population intensity will be utilized at selected major thoroughfare intersections and known future developments. The value for "typical" population intensity used in this run of the model is 12 equivalent population per acre with 20 equivalent population per acre used for areas of expected higher intensity. This value for equivalent population results in a flow generation of 876 gallons/acre/day and 1,460 gallons/acre/day, respectively. The flows were calculated as follows:

$$12.0\,\frac{Equivalent\ \ Population}{Acre}\times 73\,\frac{Gallons}{\dfrac{Equivalent\ \ Population}{Day}}\approx 876\,\frac{Gallons}{\dfrac{Acre}{Day}}$$

$$20.0\,\frac{Equivalent\ \ Population}{Acre}\times 73\,\frac{Gallons}{\dfrac{Equivalent\ \ Population}{Day}}\approx 1460\,\frac{Gallons}{\dfrac{Acre}{Day}}$$

Description	Land use is a means of describing zoning to produce estimated population densities within an area.
Discussion	Specific land use data will not be utilized for this project. Instead, equivalent population intensities are assigned in order to satisfy a global demand in order to model the area without a future land use map.
Model Assumption	The equivalent population data currently in the model represents an assumed ultimate global land use of 12 equivalent population/acre, with areas of 20 equivalent population/acre (Rathdrum Prairie Planning Map (GIS

mapping information provided by Kootenai County, April 16, 2007).

3.3.2 Population

Description

Population is the estimated number of people in a residential and visiting population land use area, and it can consist of existing and future population in areas that are outside the service area extents.

Discussion

When available, existing population is typically determined from house counts from aerial photographs, recent census data, or GIS information. This model will represent the future ultimate build-out scenario through an equivalent population based on a blanket value for typical equivalent population intensity for areas with higher predicted intensity at major intersections.

Model Assumption

Population assumptions represent the ultimate build-out condition of the Rathdrum Prairie as established by the TAC. A value of 12 equivalent population per acre for typical predicted intensity and a value of 20 equivalent population per acre used for areas of higher predicted intensity, as determined through detailed reviews with the TAC and concurrence by elected officials and administrators on April 12, 2007.

3.3.3 Flow Contribution in Gallons per Capita per Day (gpcd)

Description

Average sanitary sewer flow per person.

Discussion

Wastewater flow rates can vary greatly depending on several factors. Flow rates should be based on actual flow data from selected locations within the modeling area or, if not available, in similar communities or adjacent locations. The surrounding areas of Coeur d'Alene and Post Falls typically see values of 73 to 74 gpcd. Hayden utilized 80 gpcd in its December 2006 Sewer Master Plan.

Model Assumption

With water-saving fixtures and irrigation systems becoming a requirement for most entities, a value of 73 gpcd, as used by the City of Post Falls, will be utilized in this model.

3.3.4 Diurnal Curves

Human activities produce varying flows to a system over a 24-hour period. In sewer modeling, diurnal curves represent these varying sanitary flow contributions to the collection system. The different diurnal curves typically used in the sewer modeling are residential, public, commercial, industrial, and school. Each diurnal curve has a different shape to represent the sewer flow generated by that type of activity. For instance, a typical residential diurnal curve has low early morning flows while residents are sleeping; a morning peak when they get up, take showers, and get ready for the day; a mid day low; an evening peak; and then it drops to the early morning low. Residential diurnal curve information can vary greatly, especially from weekday to weekend flows. Commercial diurnals tend to rise sharply in mid morning toward a relatively consistent midday flow and remain more consistent until the early evening when they fall back to minimal levels. Diurnal curve information should be based on actual flow data from selected locations within the modeling area or, if not available, in similar communities or adjacent locations. As previously noted, the service area for this analysis includes multiple jurisdictions, some of which have looked strongly at the different diurnal shapes in their system. The diurnal curve information from the cities of Post Falls, Hayden, Rathdrum, and Hauser sewer planning will be utilized in their areas of city impact when available. Several different adjacent and similar communities, including the cities of Post Falls, Coeur d'Alene, and Boise, have been consulted and a typical diurnal curve has been generated and will be used when diurnal information is not available.

3.3.4.1 Residential Diurnal

Description	A diurnal curve is the shape of a type of sanitary flow contribution to the collection system over a 24-hour period. For instance, a typical residential diurnal curve has low early morning flows while residents are sleeping; a morning peak when they get up, take showers, and get ready for the day; a mid day low; an evening peak; and then it drops to the early morning low.
Discussion	Residential diurnal curve information can vary greatly depending on several different factors. Diurnal curve information should be based on actual flow data from selected locations within the modeling area or, if not available, in similar communities or adjacent locations.
Model Assumption	The diurnal curve information from the City of Post Falls will be used for the City of Post Falls, and the diurnal curve information from the City of Hayden December 2006 Sewer Master Plan update will be utilized in the Rathdrum and Hayden Areas of City Impact. The diurnal curve information is provided on **Figure 3.1**.

3.3.4.2 Commercial Diurnal

Description	A diurnal curve is the shape of a type of sanitary flow contribution to the collection system over a 24-hour period. For instance, a typical business area diurnal curve shows an increase in flow as people arrive to work between 7:30 AM and 9:00 AM, a gradual increase until noon, and then a gradual decrease until early evening when people leave work, at which point the flow drops off more rapidly.

Discussion	Commercial diurnal curve information can vary greatly depending on several different factors. Diurnal curve information should be based on actual flow data from selected locations within the modeling area or, if not available, in similar communities or adjacent locations.
Model Assumption	The diurnal curve information from the cities of Post Falls, Hayden, Rathdrum, and Hauser sewer planning will be utilized in their ACIs, as available. Several different adjacent and similar communities, including the cities of Post Falls, Coeur d'Alene, and Boise, have been consulted and a typical diurnal curve has been generated and will be used when diurnal information is not available.

3.3.5 Commercial Volume

Description	The average amount of daily commercial flow in gallons.
Discussion	The commercial flow volume is based on zoning and surrounding flows from areas with similar uses.
Model Assumption	The TAC has elected to account for commercial flows in their equivalent population density assumptions.

Section 4 – Rathdrum Prairie Wastewater Model Results

As discussed previously, the natural drainage of the Prairie flows from the northeast toward the southwest and is a key factor in establishing the routes of the future pipes. When the natural drainage causes sewer flow to cross political boundaries, agreements between the entities will be required to optimize the gravity collection system and ensure the most cost-effective approach. Flows may be quantified with metering manholes installed at strategic locations totaling flows crossing political boundaries.

4.1 Wastewater Model Results

The Rathdrum Wastewater Hydra hydraulic model results are summarized in the following figures:

Figure 4.1 - Future Equivalent Population and Impact Areas

This figure provides a representation of the equivalent population assumptions that were utilized in the model and directly influence flow value outputs of the Hydra model.

Figure 4.2 - Pipes by Drainage Basins

This figure provides a representation of the pipes as they are routed in the Hydra model. The pipes are color coded by drainage basin.

Figure 4.3 - Drainage Basins Naming

This figure provides a representation of the drainage basins as they are utilized in the Hydra model. Flow values for the Hydra peak output flow values are shown for each basin as well as the major output values as the flows are routed through the system.

Figure 4.4 - Pipes by Size

This figure provides a representation of the pipes as they are sized in the Hydra model.

Figure 4.5 - Pipes by Depth

This figure provides a representation of the depth of bury of pipes routed in the Hydra model.

Appendix A – Rathdrum Prairie Wastewater Model Results: Pipe Depth, Manholes, and Lift Station

This appendix provides tabulated results for the pipe depth, manholes, and lift stations currently in the Hydra hydraulic model. The results are separated by entity and flow basin.

4.2 Flow Basins by Entity

4.2.1 Hayden

Recent updates to the City of Hayden wastewater master planning efforts were completed in December 2006 with the Hayden Sewer Master Plan Update (Welch Comer and Associates, Inc.). The study extended the City of Hayden's planning efforts to cover the City's current Area of City Impact. With respect to the Rathdrum Prairie Study, Hayden's December 2006

Sewer Update extended sewer planning to the City's western ACI border of Huetter Road. The Rathdrum Prairie Wastewater Master Plan provides wastewater planning from Huetter Road west and covers the future ACI as discussed previously. J-U-B Engineers, Inc., the primary modeler for the Rathdrum Prairie Master Plan, has teamed with the City of Hayden's wastewater modeler, Welch Comer, to provide sewer master planning within this area to meet the City of Hayden's sewer planning goals.

4.2.1.1 Hayden Flow Basins

The City of Hayden's future ACI includes three flow basins. The flow basins are as follows:

- RP-H-North
- RP-H-Central
- RP-H-South

Flow basin size and lift station information are shown in tabulated form for the flow basins on **Table 5.1**.

4.2.2 Post Falls

The City of Post Falls' Wastewater Master Plan hydraulic model has continually been updated to keep pace with the City's needs driven by growth and development. A summary of these upgrades since the original completion of the Post Falls' Master Plan in 2000 are as follows:

- 2001 model updates for revised anticipated build-out densities
- 2002 through 2007 model updates from record drawing information by the City's Assistant Engineer
- March 2006, Technical Memorandum Wastewater Lift Station Capacity Evaluation and Capital Improvement Plan Update Through 2012
- January 2007, Proposed Foxtail Development Sewer Service Evaluation
- 2007 model updates to reflect the rapidly developing western potion of the City
- April 25, 2007 Design Memorandum for the City's Idaline Lift Station with recommendations for revisions to the City's diurnal curve information
- June 18, 2007 model updates by the City's Assistant City Engineer to reflect revised diurnal curve information

It is important to note that since the final completion of the hydraulic model in 2000, flow monitoring data has been limited. The model is not calibrated to existing conditions and is used strictly as a predictive tool for future sewer infrastructure capacity requirements based on typical wastewater parameters.

With respect to the Rathdrum Prairie Study, the most recent Post Falls hydraulic model has been supplied and is considered the best available knowledge for wastewater sewer infrastructure planning. The City's sewer model has a general northern border of Prairie Avenue. It should be noted that the 1.75 square miles added to the Post Falls ACI will be planned as part of this Rathdrum Prairie study. The Rathdrum Prairie Wastewater Master Plan provides wastewater planning from Prairie Avenue north and covers the future ACI. J-U-B Engineers, Inc. has communicated regularly with the City of Post Falls to provide sewer master planning meeting the Post Falls' sewer planning goals.

4.2.2.1 Post Falls Flow Basins

The City of Post Falls' future ACI includes seven flow basins. The flow basins are as follows:

- RP-PF-Meyer
- RP-PF-Hwy 41
- RP-PF-Central
- RP-PF-Major
- RP-PF-West
- RP-PF-Southwest
- RP-PF-Stateline

Flow basin size and lift station information are shown in tabulated form for the flow basins on **Table 4.1**.

4.2.3 Rathdrum

City of Rathdrum wastewater master planning efforts were most recently updated in with the Provisional Sanitary Sewer Evaluation completed in June 2006 (Welch Comer and Associates, Inc.). Previous planning efforts extend planning to the City's existing ACI southern border of Wyoming Avenue. The Rathdrum Prairie Study extends planning efforts south to Wilkes Avenue. J-U-B Engineers, Inc., the primary modeler for the Rathdrum Prairie Master Plan, has teamed with the City of Rathdrum wastewater modeler, Welch Comer, to provide sewer master planning within this area to meet the City of Rathdrum's sewer planning goals.

It should be noted that special care must be taken near the extents of the current planning from the Provisional Sanitary Sewer Evaluation and the planning from the Rathdrum Prairie Study Area. The southern boundary of Rathdrum's existing planning slightly overlaps with the Rathdrum Prairie Study area in the northeast corner of the system.

4.2.3.1 Rathdrum Flow Basins

The City of Rathdrum's Future ACI is made up of two flow basins. The flow basins are as follows:

- RP-R-Major
- RP-R-Central

Flow basin size and lift station information are shown in tabulated form for the flow basins on **Table 4-1**.

Table 4-1 – Flow Basin and Lift Station Information

Flow Basin	Service Area Size (acres)	Service Area Size (equivalent population)	Service Area Average Flow (Hydra Output cfs)	Service Area Peak Flow (Hydra Output cfs)	Largest pipe Diameter (inches)	Lift Stations (No.)	Lift Station G_ID	Lift Station Name	Discharge Location	Discharge G_ID	Average Discharge (cfs)	Peak Discharge (cfs)
RP-H-NORTH	278	3,345	0.38	0.90	12	1	1676	RP-H-NORTH LS	Hayden 2007 Wastewater Master Plan	1678	0.38	0.90
RP-H-CENTRAL	706	8,503	0.95	2.21	21	2	1281	RP-H-WEST LS	RP-H-CENTRAL	1241	0.29	0.68
							921	RP-H-CENTRAL LS	Hayden 2007 Wastewater Master Plan	1680	1.37	3.22
RP-H-SOUTH	285	3,435	0.42	1.01	12	1	366	RP-H-SOUTH LS	RP-H-CENTRAL	74	0.42	1.01
RP-PF-MEYER	596	7,186	0.84	1.63	15	1	1371	RP-PF-MEYER LS	RP-PF-MEYER Flow Basin	1109	0.72	1.42
							NA	NA	City of Post Falls Meyer Trunk	715	1.23	2.40
RP-PF-HWY 41	216	2,599	0.39	0.77	12	1	1666	RP-PF-HWY 41 LS	RP-PF-MEYER	1149	0.39	0.77
RP-PF-CENTRAL	176	2,123	0.24	0.47	8	0	NA	NA	RP-R-CENTRAL Flow Basin	662	0.24	0.47
RP-PF-MAJOR	2,636	31,769	3.83	6.79	33	2	1631	RP-PF-MAJOR RR LS	RP-PF-MAJOR Flow Basin	1632	0.20	0.40
							933	RP-PF-MAJOR LS	City of Post Falls WWTF	1663	7.09	13.65
RP-PF-WEST	1,422	17,136	1.93	3.77	21	1	1640	RP-PF-WEST LS	RP-PF-SOUTHWEST Flow Basin	1642	1.93	3.77
RP-PF-SOUTHWEST	957	11,531	1.36	2.56	27	1	1648	RP-PF-SOUTHWEST LS	City of Post Falls WWTF	1663	3.29	6.33
RP-PF-STATELINE	2,442	29,427	3.45	6.74	21	1	1067	RP-PF-STATELINE LS	City of Post Falls WWTF	1663	3.45	6.74
RP-R-MAJOR	1,632	19,666	2.24	4.72	24	2	1623	RP-R-MAJOR NE LS	RP-R-MAJOR Flow Basin	1619	0.07	0.16
							1626	RP-R-MAJOR SE LS	RP-R-MAJOR Flow Basin	1618	0.11	0.27
							NA	NA	RP-PF-MAJOR Flow Basin	613	2.24	4.72
RP-R-CENTRAL	573	6,902	0.77	1.67	18	1	1673	RP-R-CENTRAL LS	RP-PF-MAJOR Flow Basin	972	1.01	2.14
TOTAL RP-H Basins	1,268	15,283	1.75	4.12	NA	4	NA	NA	NA	NA	NA	NA
TOTAL RP-PF Basins	8,445	101,770	12.05	22.73	NA	7	NA	NA	NA	NA	NA	NA
TOTAL RP-R Basins	2,205	26,568	3.01	6.39	NA	3	NA	NA	NA	NA	NA	NA
TOTAL TO POST FALLS	9,714	117,053	15.06	29.12	NA	11	NA	NA	NA	NA	NA	NA
TOTAL TO HAYDEN	1,268	15,283	1.75	4.12	NA	4	NA	NA	NA	NA	NA	NA
STUDY AREA TOTAL	11,918	143,621	16.81	33.24	NA	14	NA	NA	NA	NA	NA	NA

Section 5 – Flow Routing Through Existing and Planned Infrastructure

5.1 Hayden

The City of Hayden's December 2006 Sewer Model and Master Plan Update is utilized as the best available predictive tool for future sewer infrastructure capacity requirements for the City's existing ACI. The City has not yet reached its ACI border in most areas but does have substantial infrastructure constructed based on assumed upstream conditions. An investigation of the potential to route flow from the Rathdrum Prairie Study area into the City's existing ACI has been conducted. Comparing planning infrastructure and natural drainage patterns from the City's December 2006 Master Plan Update and initial planning of the Rathdrum Prairie Study area indicates future sewer infrastructure of the Rathdrum Prairie will be routed through previous planned infrastructure in the City's Sewer Model. Additional flow to the City's master planned sewer could have an affect on both planned and constructed piping.

Conversations between J-U-B Engineers, Inc., Welch Comer, and the City of Hayden has resulted in a general modeling philosophy decision to provide sewer planning allowing for the least amount of lift stations while taking into account the feasibility to construct the system through build out.

5.1.1 Lift Station H10 and Upstream Gravity Sewer

The City's future lift station H10 is directly impacted by additional sewer flows from the Rathdrum Prairie Study Area. An additional peak flow of 4.14 cfs will be added to the previously planned peak capacity of 4.5 cfs from the following basins of the Rathdrum Prairie Study area:

- RP-H-NORTH - Hydra peak flow of 0.90 cfs from lift station RP-H-NORTH LS, which accounts for flow from the northwest.
- RP-H-CENTRAL - Hydra peak flow of 3.24 cfs from lift station RP-H-CENTRAL, which accounts for flow from the southwest.

Gravity piping into the H10 Lift Station will be affected by increasing the diameter of the upstream piping shown on **Figure 5.1**.

5.1.2 Hayden Area Regional Sewer Board WWTP

Increases to the City of Hayden's future ACI beyond the previously planned infrastructure to the west of Huetter Avenue will increase the wastewater flows routed to the City of Hayden for wastewater treatment. Flow from the City of Hayden is treated by the Hayden Area Regional Sewer Board (HARSB). Wastewater flow increases to the HARSB Wastewater Treatment Plant is summarized in **Table 5-1**.

Table 5-1 – Shared Tier Study Area Flow to HARSB WWTP

Flow Basin	Service Area Size (acres)	Service Area Equivalent Population	Service Area Average Flow (Hydra Output cfs)	Service Area Peak Flow (Hydra Output cfs)
TOTAL TO HAYDEN	1,268	15,283	1.75	4.12

5.2 Post Falls

Sewer planning intends to provide the most cost effective means of providing sewer to a study area. This is accomplished by routing flows utilizing the natural drainage potential of a study area. The City of Post Falls utilizes a sewer model as the best available predictive tool for future sewer infrastructure capacity requirements. The City has not yet reached its ACI border in most areas but does have infrastructure constructed based on assumed upstream conditions.

The City's model appears to be a complete representation for build-out conditions, making it a useful predictive tool to plan infrastructure for serving the City's current ACI, with two exceptions. Recent ACI adjustments have resulted in two areas currently in the City's ACI, which are not master planned or in the City's CIP:

- 2004 ACI expansion north of Prairie Avenue (see **Figure 1-1**, a half mile wide strip of 1,140 acres north of Prairie Avenue. It is bounded by Corbin Road on the west and one-half mile past Highway 41 on the east. Sewer planning for this area is accounted for in this study.
- 320 acres on the northwestern edge of the City bordered by Poleline Road on the north, Union Pacific Railroad tracks on the south, Corbin Road on the east, and one-quarter mile west of Pleasant View Road on the west. Sewer planning for this area is accounted for in this study.

It is extremely important to note one key system design element of the Post Falls Model. The City of Post Falls Wastewater Master Plan completed in 2001 references a vertical datum of NGVD 29, whereas this study and the City of Hayden's 2007 Wastewater Master Plan references NAVD 88. The difference in elevation between the two vertical datum's vary with respect to location. Several locations adjacent to the connection points of the two hydraulic models have been investigated and an average difference is quantified. The results are shown on **Table 5-2**.

Table 5-2 – Vertical Datum Difference Quantification

Number	Location	Latitude	Longitude	NAVD 88 Elevation	NGVD 29 Elevation	Difference (ft)
1	RR Crossings (East of Poleline & McGuire)	47°43'46"	-116°58'24"	2135.43	2131.61	3.82
2	Greensferry & Hayden	47°45'34"	-116°24'28"	2238.42	2234.61	3.81
3	Highway 41 & Prairie	47°44'42"	-116°53'59"	2232.11	2228.3	3.81
4	Greensferry & Prairie	47°44'42"	-116°54'57"	2228.06	2224.25	3.81
5	Meyer & Prairie	47°44'42"	-116°58'22"	2241.14	2237.3	3.84
6	Idaho & Prairie	47°44'42"	-116°56'15"	2205.62	2201.82	3.8
					AVERAGE DIFFERENCE	3.81

The Rathdrum Prairie Hydra Model, on the NAVD 88 Vertical Datum, and the City of Post Falls Hydra Model, on the NGVD 29 Vertical Datum, have an average vertical difference of 3.81 feet. The Rathdrum Prairie reflects a higher elevation value for the same location. For modeling purposes, care must be taken that the invert elevations from the Rathdrum Prairie hydraulic model are converted correctly. The following rule of thumb shall be utilized when vertical information from the Rathdrum Prairie Wastewater Master Plan is utilized as an analysis in the City of Post Falls 2001 Wastewater Master Plan.

> Subtract 3.81 feet from Rathdrum Prairie Hydra Model vertical information when transferring to the City of Post Falls Hydra Model.

5.2.1 Meyer Trunk Line

The Meyer Trunk Line is the planned infrastructure in the City's northeast quadrant which carries flow from the northern boundary of Prairie Avenue south to the 12th Avenue Lift Station via the Meyer Road corridor. The 12th Avenue lift station is currently operating with some elements sized for previous build out flow conditions.

Flow Additions to the City's Meyer Trunk Line include 2.4 cfs from the RP-PF-MEYER flow basin. The Meyer Trunk Line is an ideal avenue for additional flow to be routed through previously planned infrastructure due to the following:

- Minimal length of pipe has been constructed as initially Master Planned with respect to the entire length (approximately 7 percent, or 900 LF, of 14,000 LF of the entire length is currently constructed and would need to be replaced).
- Check lines run east and west on the Northern extents of the system, allowing for planned depths.
- The planned depths on the Northern extents of the system allow for a feasible connection from the Rathdrum Prairie gravity sewer.

The System, Land Use, and Service information from Rathdrum Prairie Wastewater Master Plan which could be reasonably routed through the Meyer Trunk Line has been added to the most recent version of the City's Wastewater Master Plan. The difference in vertical datum information was taken into account when entered into the City of Post Falls Hydraulic Model. Increasing the capacity by an additional 2.4 cfs results in "design pipes" sized accordingly. The revised Master Plan size, as well as increased capacity of the 12th Avenue Lift Station is shown on **Figure 5.2**.

5.2.2 Highway 41 Trunk Line and Tullamore Piping

The Highway 41 Trunk Line is the planned infrastructure in the City's northeast quadrant which carries flow from the northern boundary of Prairie Avenue south to the 12th Avenue Lift Station (operating but partially constructed to build out flow) via the Highway 41 corridor.

No flow additions will be allowed into the Highway 41 Trunk Line for the following reasons:

- A substantial amount of gravity pipe has been constructed.
- Although a majority of the pipes have been upsized based on initial Master Planning to allow for additional flow, the sizes, slopes, and depths of the installed infrastructure are not sufficient to accommodate flow beyond currently planned flow basins.

The Tullamore piping planned in the City's northeast quadrant will carry flow from the northern boundary of Prairie Avenue south to an existing local pump station to lift the sewer to the Highway 41 Trunk Line.

No flow additions will be allowed into the Tullamore Piping for the following reasons:

- The pipes and Lift Station as constructed have been upsized based on initial Master Planning to allow for additional flow; however, the sizes, slopes, and depths of the installed infrastructure are not sufficient to accommodate flow beyond currently planned flow basins.

5.2.3 12th Avenue Lift Station

Currently, the lift station includes an 18-inch PVC inlet pipe flowing into a wet well that is designed around an ultimate capacity of 2.9 cfs. Planned and proposed development in the northeast quadrant of the City as well as modifications to the City's Wastewater Master Plan hydraulic model since its initial completion in 2000 has increased the ultimate capacity of the 12th Avenue Lift Station since its initial construction.

The additional flows routed through the 12th Avenue Lift Station consist of the 2.4 cfs routed through the Meyer Trunk Line. The revised ultimate capacity for the 12th Avenue Lift Station is approximately 7.90 cfs.

5.2.4 City of Post Falls' Wastewater Treatment Plant

The natural drainage pattern of the study area places the highest demand for wastewater flow increases on the City of Post Falls Wastewater Treatment Plant. The City's treatment plant has historically received wastewater flow from the City of Rathdrum, which is expected to continue throughout build out. Wastewater flow increases to the City's Wastewater Treatment Plant is summarized in **Table 5-3**.

Table 5-3 – Shared Tier Study Area Flow to Post Falls WWTP

Flow Basin	Service Area Size (acres)	Service Area Equivalent Population	Service Area Average Flow (Hydra Output cfs)	Service Area Peak Flow (Hydra Output cfs)
TOTAL RP-PF Basins	8,445	101,770	12.05	22.73
TOTAL RP-R Basins	2,205	26,568	3.01	6.39
TOTAL TO POST FALLS	9,714	117,053	15.06	29.12

5.3 Rathdrum

The City of Rathdrum Provisional Sanitary Sewer Evaluation completed in June 2006 by Welch Comer is utilized as the best available predictive tool for future sewer infrastructure capacity requirements for the City's existing ACI. The City has not yet reached its ACI border in most areas but does have substantial infrastructure constructed based on assumed upstream conditions.

The natural drainage pattern of the Rathdrum Prairie Study area remains consistent with Rathdrum's future ACI with flow routed from northeast to southwest. Combining planned infrastructure from the June 2006 Provisional Report and initial planning of the Rathdrum Prairie Study area indicates future sewer infrastructure of the Rathdrum Prairie is almost completely separate from previous planned infrastructure. The only flow from the Rathdrum Prairie Wastewater Master Plan that could logically be routed through existing planned infrastructure is from the Central Lift Station Sub-Basin on the western edge of Rathdrum's portion of the Shared Tier. RP-R-Central could be combined with Rathdrum's SW1 Lift Station planned for the southwest corner of their Exclusive Tier. Combining these flow basins would keep Rathdrum's total number of planned lift stations unchanged. The resulting combined flow could then be routed to either the Exclusive Tier or to the future gravity collection system in the Shared Tier, as appropriate at the time of development.

Figures

(Figures Bound Separately)

Appendices

(Appendices Bound Separately)

Appendix A – Rathdrum Prairie Wastewater Model Results: Pipe Depth, Manholes, and Lift Station