



KERR WOOD LEIDAL
consulting engineers

Section 8

Analysis and Results



8. Analysis and Results

The analysis has been completed for two scenarios. The existing scenario represents existing pipes and properties currently connected to the sanitary sewer system. The future scenario represents servicing the entire City. All flows are based on the 100-year return period I&I rates and include 370 L/s of flow in the NWT from the City of Langford.

8.1 Existing Scenario

8.1.1 Capacity Limitations

The capacity analysis of the existing system indicates that for the existing populations, all of the City's sanitary sewers have adequate capacity with the exception of a short section of 450 mm sewer along Metchosin Road between Raynorwood Place and Terrahue Road. The depth of surcharge in this section of trunk sewer is minimal and upgrades are not necessary.

The CRD trunk also surcharges in a number of locations. These surcharge depths are acceptable in this trunk and will not result in needed upgrades.

These existing scenario hydraulic modelling results are illustrated on Figure 8-1.

The Hydraulic Levels of Service on this figure are defined as follows:

- **A** – flowing less than 0.7 full, velocity greater than 0.6 m/s, no surcharging;
- **B** - flowing less than 0.7 full, velocity less than 0.6 m/s, no surcharging;
- **C** – flow is less than 0.7 of the capacity of the pipe, surcharged as a result of the downstream system;
- **D** – peak flow is between 0.7 and 1.0 of the capacity of the pipe;
- **E** – peak flow is greater than the capacity of the pipe, and;
- **F** – peak flow is greater than the capacity of the pipe and surcharging above the ground elevation.

As shown on Figure 8-1 there are a few pipes that have a hydraulic Level of Service E, indicating some surcharge. The depths of these surcharge amounts do not result in any risk of flooding.

The existing scenario 100-year return period PWWF for the City of Colwood is 320 L/s, or 92 % of the City's allocation in the CRD's NWT of 347 L/s.

8.1.2 Pump Station Evaluation

The pump stations were evaluated for hydraulic capacity. This analysis is summarized in the following table.



Table 8-1: Pump Station Evaluation – Existing Scenario

Pump Station	Peak Inflow (L/s)	Pumping Capacity (L/s)
Pelican	6.0	24.4
Metchosin	34.5	44.9 / 128.4 ¹
Sewell	0.7	6.4
Ocean	11.7	87.8
Hatley	1.8	5.5
Portsmouth	3.0	22.0
Belmont	1.2	7.3
Wilfert	10.0	48.9
Note: 1. 128.4 L/s is the pumping capacity of the Metchosin Pump Station with 2 pumps in operation and the 300 mm forcemain (currently the 200 mm forcemain is in use). For all other pump stations the capacities given are for only 1 of the 2 pumps as these are duplex stations designed for 100% redundancy.		

As shown above, all pump stations have adequate capacity with only one pump in operation for the existing scenario.

8.2 Future Scenario

8.2.1 Capacity Limitations

The analysis of the future scenario indicates that there are some capacity limitation with the existing system. These capacity limitations are illustrated on Figure 8-2. This figure is used to determine the required upgrades to the existing system in order to accommodate the future flows. The Hydraulic Levels of Service on this figure are as described in the Existing Scenario section above.

The future scenario 100-year return period PWWF for the City of Colwood is 685 L/s, or roughly double the City's allocation in the CRD's NWT of 347 L/s.

8.2.2 Pump Station Evaluation

The existing pump stations were evaluated for hydraulic capacity for the future scenario. This analysis along with the pump rate for the proposed pump stations is summarized in the following table.



Table 8-2: Pump Station Evaluation – Future Scenario

Pump Station	Peak Inflow (L/s)	Pumping Capacity (L/s)
Pelican	17.6	24.4
Metchosin	160.7	44.9 / 128.4 ¹
Sewell	4.2	6.4
Ocean	28.1	87.8
Hatley	9.4	5.5
Portsmouth	8.0	22.0
Belmont	1.3	7.3
Wilfert	21.7	48.9
Note: 1. 128.4 L/s is the pumping capacity of the Metchosin Pump Station with 2 pumps in operation and the 300 mm forcemain (currently the 200 mm forcemain is in use). For all other pump stations the capacities given are for only 1 of the 2 pumps as these are duplex stations designed for 100% redundancy.		

As shown above there are two pump stations that do not have adequate capacity for the future scenario, Metchosin and Hatley.

The required pumping rates for the four proposed pump stations have also been determined and are provided in the following table.

Table 8-3: Future Pump Stations

Pump Station	Peak Inflow / Required Pumping Rate (L/s)	Notes
Future 1 (Allandale Road)	38.9	Temporary pump station, replaced by a permanent pump station in the lower, north portion of the Allandale Pit in the future
Future 2 (Sunridge Valley Drive)	9.9	
Future 3 (Kelly Road)	15.1	
Future 4 (Painter Road)	12.9	Temporary pump station, could flow by gravity to the Metchosin Pump Station when Royal Bay site is developed
Future 5 (Cotlow Road)	< 5.0	This pump station could be eliminated, and flow by gravity to the Metchosin Pump Station if a right-of-way to the south is obtained

8.3 Neighbourhood Summaries

For the purpose of describing the capacity limitations and proposed servicing in detail, we have divided the City into seven neighbourhoods. These neighbourhoods are as follows:

- Metchosin/Latoria;
- Triangle Mountain;
- Lagoon/Dunsmuir;



- Central;
- Kelly;
- DND / Royal Roads; and
- Colwood Corners.

These seven neighbourhoods are illustrated on Figure 8-3.

8.3.1 Metchosin/Latoria (Figure 7-1 – Sheets 6, 7 and 8)

General

The Metchosin/Latoria area is defined as the catchment to the Metchosin Lift Station near the Metchosin Road and Latoria Road intersection. This area contains the Olympic View Golf Course and the Royal Bay development properties.

Gravity Mains

The majority of the developed properties within this area are serviced by the existing municipal sewer system. Future servicing within this area, as shown on Figure 7-1, is not extensive, as much of the future sewer routes will be determined by future developments (primarily the Royal Bay development).

The future modelling scenario indicates that a section of the gravity main along Latoria Road near Metchosin Road does not have adequate capacity. Upon review of this section of sewer the surcharge depth is less than 0.3 m. Upgrades to these sections of sewer are therefore not necessary.

Pump Stations and Forcemains

There are two existing pump stations within this area and no future pump stations are indicated. The Pelican Pump station pumps via a forcemain along Metchosin Road which then flows by gravity to the Metchosin Pump Station. The Metchosin Pump Station forcemain discharges to the gravity main along Metchosin Road near Dunsmuir School.

The future modelling scenario indicates that the Metchosin Pump Station does not have adequate capacity for the future scenario with two of the three pumps in operation and using both the existing 200 mm and 300 mm diameter forcemains. The peak flow to this station in the future scenario is 161 L/s. The existing Hatley Pump Station and future pump station at Painter Road could be eliminated when the Royal bay development proceeds and flows to both of these stations could also contribute to the Metchosin Pump Station. This would bring the total peak flow to the Metchosin Pump Station up to 183 L/s. Analyzing the existing 200 mm and 300 mm forcemains indicates that if both forcemains were used for this flow, the velocities would be 1.5 m/s and 1.9 m/s, respectively. These velocities are acceptable and therefore the existing forcemains would likely not have to be upgraded.

The Metchosin Pump Station currently has excess capacity and upgrade will not be required until the majority of the contributing catchment (Royal Bay and Olympic View) is completed.

8.3.2 Triangle Mountain (Figure 7-1 – Sheets 4 and 6)

General

The Triangle Mountain area is defined as the area west of Veterans Memorial Parkway and south of Sooke Road (excluding the Latoria Road area). This area, for the most part, is built out with single family residential properties.



Gravity Mains

Less than half of the properties in the Triangle Mountain area are serviced by the existing municipal sewer system. Future servicing within this area includes the use of existing right of ways which are needed to avoid additional pump stations or low pressure sewer systems.

The future modelling scenario indicates that there are no capacity issues with the existing gravity mains

Pump Stations and Forcemains

There is one existing pump stations (Sewell Pump Station) within this area and no future pump stations are shown. The Sewell Pump Station has adequate capacity for the future scenario.

Low Pressure Sewer Systems

Due to the steep and undulating topography in this area, it is not practical to service a number of areas with a gravity sewer system. As a result a number of low pressure sewer systems are shown.

Servicing Alternatives

We have identified several servicing alternatives in this area. These include alternate routes if sanitary sewer right of ways can be obtained, or connections can be made to the City of Langford's sewer system. These alternatives are described in detail in Appendix B and are as follows:

- Servicing Alternative 1: South End of Fulton;
- Servicing Alternative 2: Sunheights at the Langford Boundary;
- Servicing Alternative 3: Townview;
- Servicing Alternative 6: East End of Drummond;
- Servicing Alternative 11: Haida Drive; and
- Servicing Alternative 15: Karger Terrace.

8.3.3 Lagoon/Dunsmuir (Figure 7-1 – Sheets 5 and 7)

General

The Lagoon/Dunsmuir area is loosely defined as the area east of Wishart Road and south the Royal Roads lands. Much of this area is built out with single family residential properties, except for the northeast portion of this area along Esquimalt Lagoon where multifamily developments are proposed.

Gravity Mains

The majority of properties in this catchment east of Metchosin Road are currently serviced by the existing municipal sewer system, while the properties west of Metchosin Road generally are not.

The future modelling scenario indicates that all of the pipes have adequate capacity except for the 450 mm and 525 mm trunk on Metchosin Road. We completed an analysis of this section of the trunk sewer and determined that surcharge depth for a less conservative Manning's roughness coefficient of 0.011 results in a maximum surcharge depth of 0.2 m in the 525 mm section. This trunk sewer is up to 5 m deep and we do not anticipate that this surcharge depth would result in any negative impacts. Therefore, upgrading the 525 mm diameter section of the trunk sewer is not necessary.

The surcharge depth in the 450 mm diameter section of the trunk sewer is not acceptable. Rather than upgrading the 450 mm main, we propose extending the existing forcemain to the upstream end of the 525 mm section (at Raynorwood Place). This would be significantly less expensive than upsizing the



deep gravity sewer main, and this additional forcemain length could be included in the hydraulic calculations for the required upgrades to the Metchosin Pump Station (described above).

Pump Stations and Forcemains

There are three existing pump stations (Hatley, Ocean and Portsmouth) within this area and one future pump station is shown (Painter Road). The forcemains from the existing Ocean and Pelican pump stations both discharge to gravity mains on Metchosin Road. We understand that the Pelican Pump Station was designed as a temporary pump station which could be removed once the Royal Bay development proceeds. At that time the flows to this station could flow by gravity down to the Metchosin Pump Station. The proposed pump at Painter Road could also be eliminated once the Royal Bay development proceeds.

Another option to eliminate the Hatley Pump Station would be to divert the flow currently to this station towards the north and into the existing sewer along Anchorage Avenue and down to the Ocean Pump Station. This option would require a right-of-way to be obtained, likely between 3480 and 3496 Perimeter Place.

The future modelling scenario indicates that Hatley Pump Station does not have adequate capacity. This emphasizes the need for the City to work with the Royal Bay developer to provide a gravity connection for the Hatley Pump Station catchment (down to the Metchosin Pump Station) or to divert the flow to this station to the north and down to the Ocean Pump Station.

Servicing Alternatives

We have identified two servicing alternatives in this area. Both of these alternatives involve gravity flow through the Royal Bay development down to the Metchosin Pump Station. These alternatives are described in detail in Appendix C and are as follows:

- Servicing Alternative 9: Gravity Main at Cotlow / Joyce; and
- Servicing Alternative 10: Temporary Pump Station at Painter.

8.3.4 Central (Figure 7-1 – Sheets 4 and 6)

General

The Central area is loosely defined as the area east of Sooke Road and Veterans Memorial Parkway, west Wishart Road and north of the Metchosin/Latoria area. This area contains single family residential properties and the inactive gravel pit in the Allandale Road area.

Gravity Mains

This area contains the existing trunk sewer along Wishart Road which services south Colwood, however the majority of properties within this area are not connected to the municipal sanitary sewer system.

The future modelling scenario indicates that the gravity main on Wishart Road has inadequate capacity for the future sanitary sewer flows. The section of sewer between Dressler Road and Metchosin Road does not have adequate capacity due to future servicing to the west and this capacity problem is made worse by inflow from the future pump station at Painter Road. As described above, it is likely that this pump station will be temporary until the Royal bay development proceeds and flows to this station can flow by gravity to the Metchosin Pump Station. This would reduce the level of capacity deficiency, however not enough to eliminate the deficiency.



The existing sewer on Wishart Road north of Metchosin Road is under capacity for the future modelling scenario and the hydraulic grade line for this section is above the road elevation. This existing gravity main requires upgrading from 600 mm to 750 mm.

Pump Stations and Forcemains

There are no existing pump stations within this area and one future pump station (Allandale Road) is shown. We understand that this pump station is currently being designed as a temporary pump station. This pump station could be replaced by a permanent pump station within the Allandale Pit, likely to the north where the existing ground is lower, once development of this area proceeds.

Servicing Alternatives

We have identified two servicing alternatives in this area. These alternatives are described in detail in Appendix C and are as follows:

- Servicing Alternative 7: Maryanne; and
- Servicing Alternative 8: North End of Galloway.

8.3.5 Kelly (Figure 7-1 – Sheets 2 and 4)

General

The Kelly area is defined as the area west and north of Sooke Road, and south of Goldstream Avenue. This area contains predominantly single family residential properties with some commercial properties along Sooke Road.

Gravity Mains

Other than the gravity main up Sooke Road and the CRD trunk to Langford, there is very little sanitary sewer infrastructure in this area.

The future modelling scenario indicates that the sewer along Sooke Road has adequate capacity for the future modelling scenario. Previous model runs had the Kelly Road Pump Station contribute to the Sooke Road sewer system (as opposed to the current scenario where these flows go to the north) and these scenarios indicated capacity deficiencies along Sooke Road. To alleviate some of these capacity problems we have held discussions with the CRD regarding having a portion of the Kelly Road area tie into the CRD's Northwest Trunk near to the Langford municipal boundary. The information sent to the CRD and their response is included in Appendix D.

A connection to the CRD's Northwest Trunk would also eliminate the need for a pump station in the David Cameron School area. Furthermore the properties in the vicinity of Aldeane Avenue and Leila Place could connect to the Northwest Trunk by gravity rather than a LPS system out to Sooke Road.

These connections would require that the existing Langford flow meter, located on Aldeane Avenue adjacent to the golf course pond, be moved upstream of the new Colwood connections to the Northwest Trunk. This would provide the secondary benefit of eliminating the current issue where the Colwood Golf Course is counted as part of the Langford flows as it is upstream of Langford's meter.

As noted in Appendix D, surcharging of the CRD's NWT downstream of this connection should be acceptable to the CRD.



As part of the connection to the CRD's Northwest Trunk, the City has contact the School District 62 and David Cameron School regarding a gravity main through the school property. This letter including the response from the school district is included in Appendix E.

Pump Stations and Forcemains

There are no existing pump stations within this area and two future pump stations at Sunridge Valley Drive and at Kelly Road are shown. As discussed above, these future pump stations are shown to pump towards the CRD trunk in order to alleviate capacity concerns along Sooke Road.

Servicing Alternatives

We have identified two servicing alternatives in this area. These alternatives are described in detail in Appendix C and are as follows:

- Servicing Alternative 4: Kelly Road Pump Station; and
- Servicing Alternative 5: Sunridge Pump Station.

8.3.6 DND / Royal Roads (Figure 7-1 – Sheet 3)

General

The DND Royal Roads area includes the DND lands, Royal Roads University, the Juan de Fuca Recreation Centre and the municipal lands along Rosebank Road and Belmont Road. The majority of the sanitary sewer infrastructure within this area is privately owned (and not included in our analysis). The City owns and operates the sanitary infrastructure on Rosebank Road and on Belmont Road as far east as house address 380.

Gravity Mains

The municipal properties in this area are connected to the municipal sewer system which connects to the CRD Trunk along the Galloping Goose Trail. The municipal gravity mains have adequate capacity for the future modelling scenario.

Pump Stations and Forcemains

There is one existing pump stations within this area (Belmont) and no future pump stations are shown. There are also pump stations owned and operated by Royal Roads University, DND (3 pump stations in total) and Juan de Fuca Recreation.

The future modelling scenario indicates that the existing Belmont Pump Station has adequate capacity for the future model scenario.

8.3.1 Colwood Corners Area (Figure 7-1 – Sheets 1, 2 and 3)

General

The Colwood Corners area is described as the areas around the Goldstream Avenue to Sooke Road intersection and north to the Town of View Royal municipal boundary. This area contains a number of commercial properties and some residential properties.



Gravity Mains

The majority of the properties in this area are already connected to the sanitary sewer system. These connections are either to the Colwood municipal sewer which is then connected to the CRD trunk, or in some cases directly connected to the CRD trunk.

The future modelling scenario indicates that portions of the CRD main are under capacity. This is as expected considering the Northwest Trunk was originally designed to handle the combined the allocation from Colwood of 348 L/s plus the allocation from Langford of 370 L/s. The peak future modelling scenario flow from Colwood alone is 690 L/s.

Pump Stations and Forcemains

There is one existing pump stations within this area (Wilfert) and no future pump stations are shown.

The future modelling scenario indicates that the existing Wilfert Pump Station has adequate capacity for the future model scenario.

8.4 Upgraded Modelling

The upgrades described above have been included in the InfoSewer proposed modelling scenario. The model results for the future scenario with the proposed upgrades are illustrated on Figure 8-4.

**City of Colwood
Sewer Master Plan**


Legend

 Sanitary Pump Station

 Forcemains

Hydraulic Level of Service

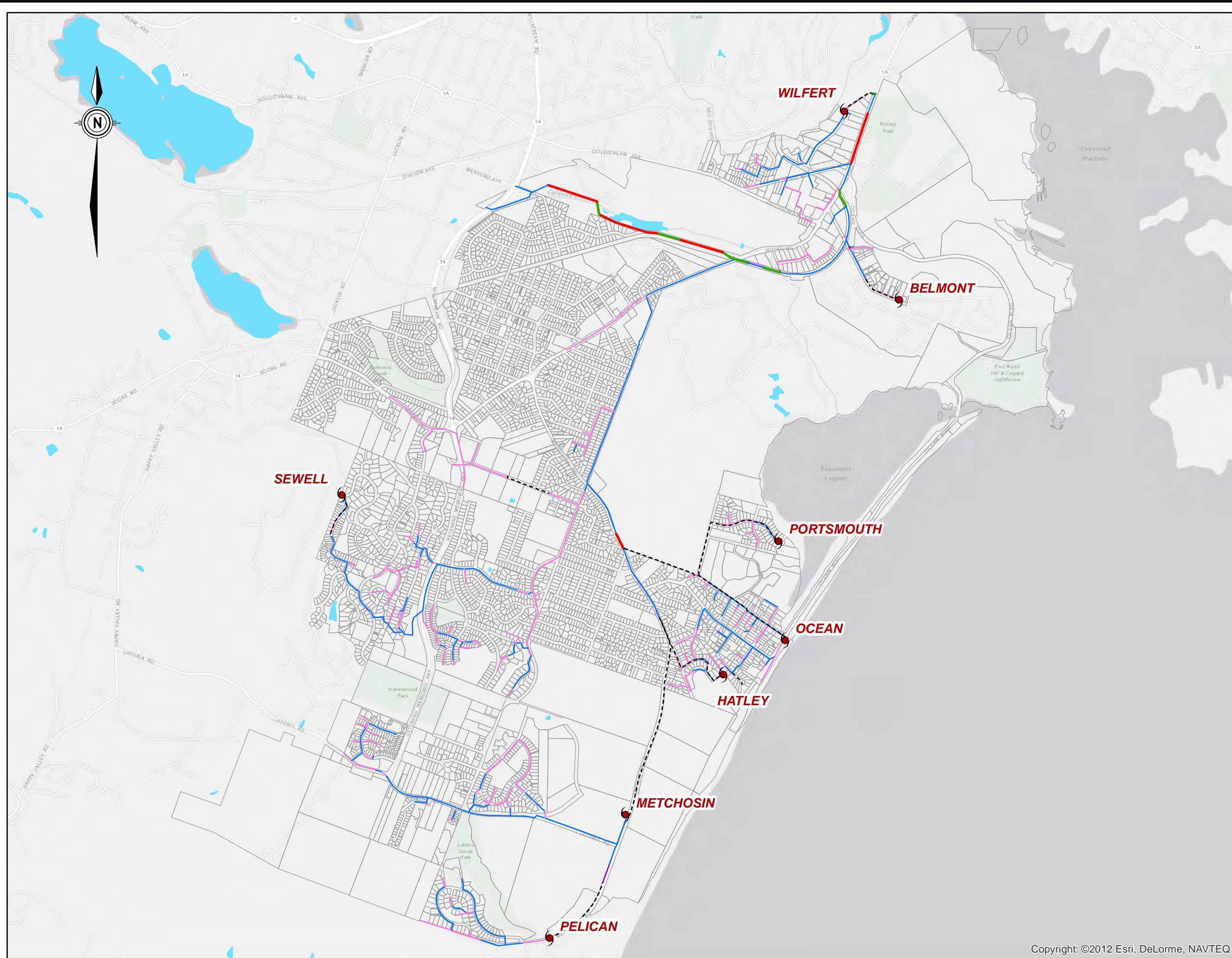
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 B Adequate Capacity, Low Velocity may Indicate Potential Sedimentation

 C Adequate Capacity, Downstream Condition Causing Backwater

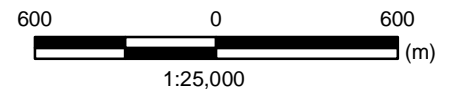
 D Marginal Capacity

 E Capacity Exceeded



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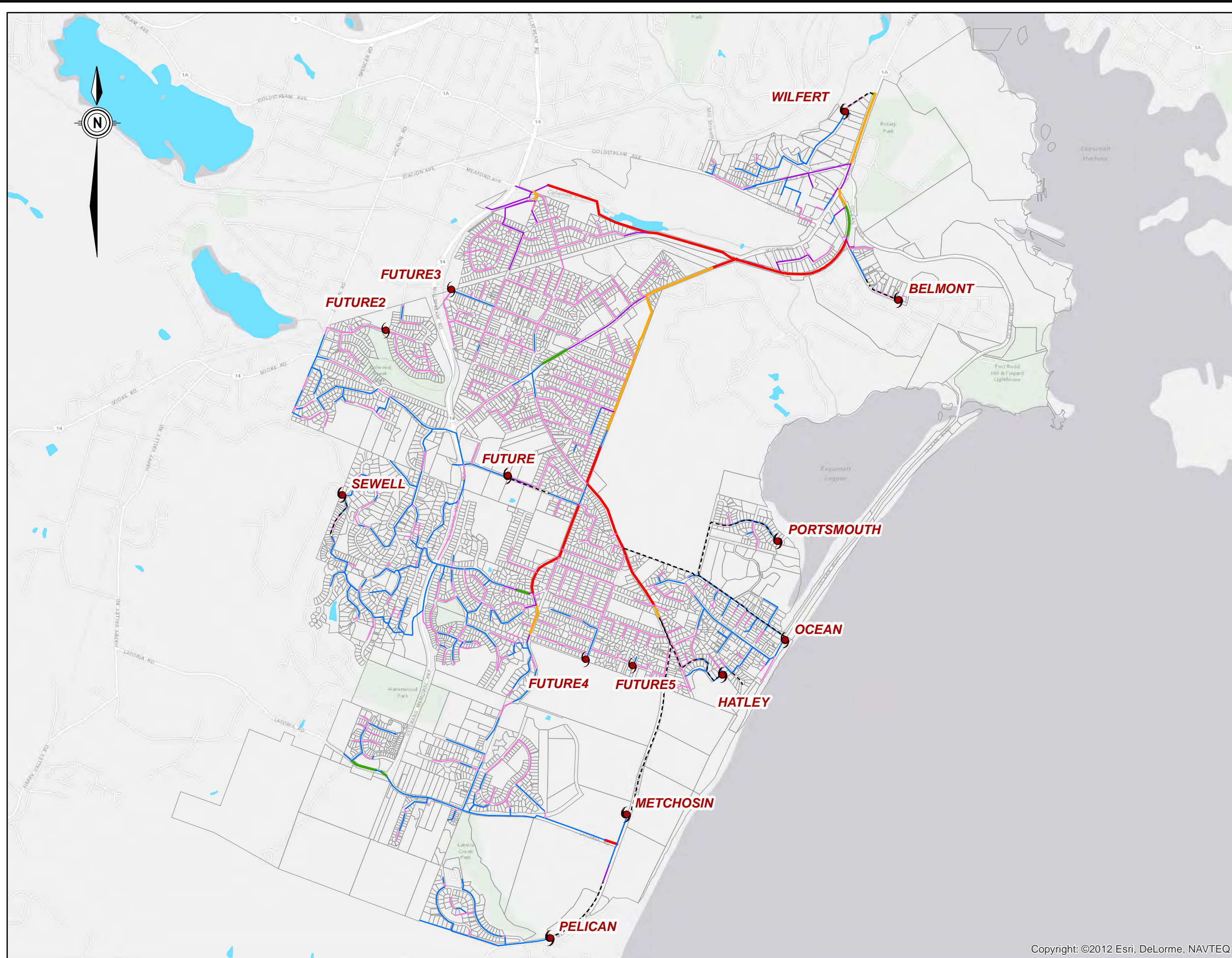
Project No.
2417-003

Date
May 2013

**2011 PWWF - 100 Yr I&I
Hydraulic Model
Results**



Figure 8-1

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**City of Colwood
Sewer Master Plan**

Legend

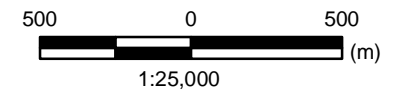
-  Sanitary Pump Station
-  Force mains

Hydraulic Level of Service

-  A Pipe Performing as Designed
-  B Adequate Capacity, Low Velocity may Indicate Potential Sedimentation
-  C Adequate Capacity, Downstream Condition Causing Backwater
-  D Marginal Capacity
-  E Capacity Exceeded
-  F Capacity Exceeded and Overflow Likely



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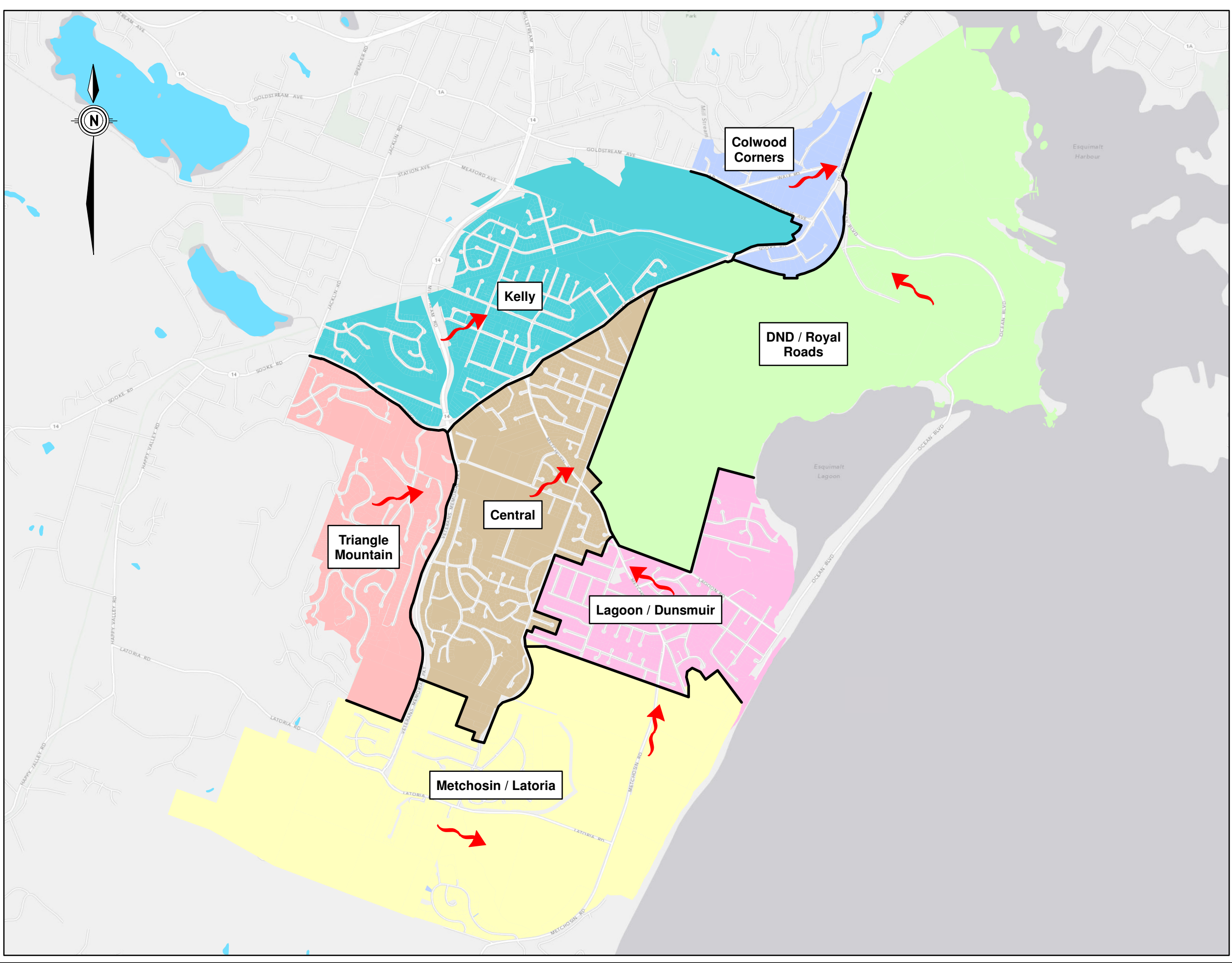


Project No. 2417-003	Date May 2013
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**Future PWWF - 100 Yr I&I
Hydraulic Model
Results**

Figure 8-2

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**City of Colwood
 Sanitary Sewer
 Master Plan**

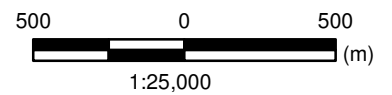
Legend

Neighbourhood Boundaries

-  Central
-  Colwood Corners
-  DND Belmont / Royal Roads
-  Kelly
-  Lagoon / Dunsmuir
-  Metchosin / Latoria
-  Triangle Mountain
-  General Flow Direction



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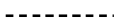
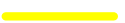
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**Neighbourhood
 Boundaries**







Figure 8-3

City of Colwood
Sewer Master Plan

Legend

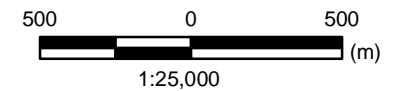
-  Sanitary Pump Station
-  Force mains
-  Pipe Requiring Upgrade

Hydraulic Level of Service

-  A Pipe Performing as Designed
-  B Adequate Capacity, Low Velocity may Indicate Potential Sedimentation
-  C Adequate Capacity, Downstream Condition Causing Backwater
-  D Marginal Capacity
-  E Capacity Exceeded
-  F Capacity Exceeded and Overflow Likely



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**Future PWWF - 100 Yr I&I
Proposed Upgrades with
Hydraulic Model Results**

Figure 8-4

