ENOCH CREE NATION LAND USE BYLAW NO. 2018-01

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PREAMBLE

WHEREAS the Enoch Cree Nation has inherent aboriginal and Treaty rights and authority to govern relations among its members and between the Enoch Cree Nation and other governments.

AND WHEREAS the Enoch Cree Nation people are the Maskêkosak nehiyowak, proud and avowing of our language, tradition and history, passed from ancestors, to those of today, for the benefit of Maskekosihk iyinowak oti nikanihk.

AND WHEREAS the aboriginal and Treaty right of the Enoch Cree Nation to govern itself was recognized and affirmed in Treaty No. 6 entered into on September 28, 1877 between Her Majesty the Queen and the Enoch Cree Nation and confirmed by section 35 of the *Constitution Act*, 1982.

AND WHEREAS in accordance with the September 13, 2007 UN Declaration on the Rights of Indigenous Peoples, Enoch Cree Nation members have the right to participate in decision–making in matters which would affect their rights, through representatives chosen by themselves in accordance with their procedures, as well as to maintain and develop their own decision making institutions.

AND WHEREAS in accordance with the September 13, 2007 UN Declaration on the Rights of Indigenous Peoples, Enoch Cree Nation members have the right to own, use, develop and control lands, territories and resources they possess by reason of traditionally ownership or use as well as those they have otherwise acquired.

AND WHEREAS the Enoch Cree Nation has historically managed its lands and resources according to traditional laws and its inherent right of self-government, which includes the right to designate, allocate and assign lands for different purposes and to regulate use of Enoch Cree Land.

AND WHEREAS the Enoch Cree Nation Council also has the power under section 81(1)(g) of the *Indian Act* to make bylaws not inconsistent with the *Indian Act* or with any regulation made by the Governor in Council or the Minister, for the dividing of Enoch Cree Land or a portion thereof into zones and the prohibition of the construction or maintenance of any class of buildings or the carrying on of any class of business, trade or calling in any zone.

AND WHEREAS the Enoch Cree Nation Council also has the power under section 81(1)(h) of the *Indian Act* to make bylaws not inconsistent with the *Indian Act* or with any regulation for the construction, repair and use of buildings whether owned by the Enoch Cree Nation or by individual members of the Enoch Cree Nation.

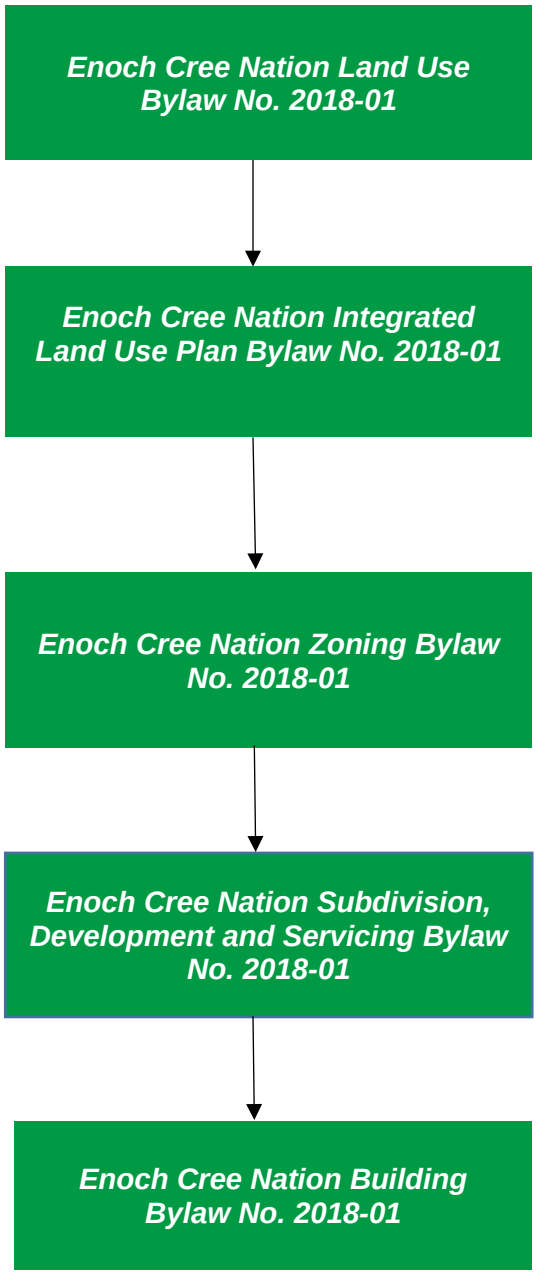
AND WHEREAS the Enoch Cree Council believes it is in the best interests of Enoch Cree to exercise its inherent right of self-government and its power under sections 81(1)(g)(h) of the *Indian Act* to enact this *Enoch Cree Nation Land Use Bylaw No. 2018-01*.

NOW THEREFORE we the Enoch Cree Council proclaim:

LAND USE PLANNING OVERVIEW

Planning involves the process of establishing a set of long term goals and agreement on the means to attain those goals. The Integrated Land Use Plan is a Council and community statement of that process. The goals and objectives with the Integrated Land Use Plan are statements of intent or purpose over the long term which are meant to direct development. Bylaws and Policies are day to day guidelines by which the community can evaluate land use activity and direct Enoch Cree Nation and private land usage and development.

The following flowchart outlines the hierarchy of Bylaws relating to Land Use:



PART I: DEFINITIONS AND INTERPRETATION

1. **TITLE**

1.1 This Bylaw may be cited as the *Enoch Cree Nation Land Use Bylaw 2018-01.*

2. **DEFINITIONS**

2.1 In this Bylaw, unless the context otherwise requires:

"**Affected Interest Holder**" means the holder of an allotment, leasehold, or subleasehold interest in the Enoch Lands or immediately adjacent to the Enoch Lands identified in the proposed amendment to the Integrated Land Use Plan Land Use Designation, Zoning Designation or application for Variance;

"**Area Structure Plan**" means a comprehensive plan for proposed land uses in a defined area of Enoch lands addressing but not limited to matters such as development vision, community needs and infrastructure requirements;

"**Area Structure Planning Area**" means an area identified on the Integrated Land Use Plan as an Area Structure Planning Area;

"**Board**" means Board of Variance established under this Bylaw;

"**Building Inspector**" means the person appointed by Council from time to time, or with whom Council has an agreement, to act as building inspector for the purpose of enforcing the provisions of the *Enoch Cree Nation Building Bylaw No. 2018-01* or successor thereto or other specified Enoch Bylaws and includes any delegate;

"**Council**" means the elected Chief and Council of the Enoch Cree Nation;

"**Development Permit**" means a development permit or equivalent authorization issued in accordance with the *Enoch Cree Nation Subdivision, Development and Servicing Bylaw No. 2018-01* or successor thereto;

"Enoch" means the Enoch Cree Nation previously known as the Stony Plain Indian Band traditionally known as the Maskêkosak iýiniwak;

"**Enoch Lands**" means all those lands located within Enoch Indian Reserves #135 and #135A previously known as the Stony Plain Indian Reserves #135 and #135A;

"**Enoch Cree Nation Planning Division**" means the Enoch Cree Nation Planning Division, as that department may be restructured or renamed from time to time;

Integrated Land Use Plan means *Enoch Cree Nation Integrated Land Use Plan Bylaw No. 2018-01*, or successor thereto

"**Land Use Designation**" means the land use designation as set out in the maps in the Integrated Land Use Plan;

"Master Serving Plan" means the servicing plans attached as Schedule "A" to this Bylaw setting out the current and long-term servicing and infrastructure plans for Enoch Lands which may be updated by Council from time to time by Resolution;

"**Member**" for the purposes of this Bylaw means a person listed on the membership list maintained by the Enoch Cree Nation who is eligible to vote in an election of the Enoch Cree Nation;

"**Special Members' Meeting**" means a meeting of the Members of the Enoch Cree Nation held for the purposes of voting on a matter herein.

"**Zoning Bylaw**" means the *Enoch Cree Nation Zoning Bylaw No. 2018-01* or successor thereto;

"**Zoning Designation**" means the zoning designation as set out in the zoning maps in the Zoning Bylaw.

PART II: GENERAL

3. GENERAL

3.1 Except as otherwise provided in this Bylaw all use of Enoch Lands must conform with the Integrated Land Use Plan and Zoning Bylaw.

3.2 Notwithstanding any provision in the Integrated Land Use Plan or Zoning Bylaw any Member who holds a Certificate of Possession in Enoch Lands shall be entitled to construct family residential dwellings on the parcel of land described in that Certificate of Possession for use by themselves and their family.

3.3 Council may by Resolution from time to time establish fees payable in respect of applications under this Bylaw. A copy of Resolutions setting out the current fees payable must be available for viewing free of charge at the administrative offices of Enoch and available for distribution at a nominal charge.

3.4 Nothing herein shall be construed as limiting Members from practising cultural and ceremonial traditions on Enoch Lands.

PART III: LAND USE PRINCIPLES

4. ADOPTION

4.1 The Enoch Cree Nation Land Use Principles set out in section 4.2 are hereby adopted as the principles that shall guide the interpretation of the Integrated Land Use Plan or Zoning Bylaw,

the consideration of applications for amendments to the Land Use Designation or Zoning Designation or for a variance under this Bylaw.

4.2 The Enoch Cree Nation Land Principles are as follows:

(a) Enoch shall work to promote a healthy and prosperous future to ensure the continued existence of Enoch as a strong political, social and cultural community;

(b) Enoch honours its connection to the land, resources and elements of the natural world that provide for its Members' physical and spiritual needs;

(c) Enoch recognizes its responsibility to protect the land and her resources for future generations;

(d) Enoch shall work to promote sustainable economic development and work to protect the value of Enoch Lands;

(e) Enoch in this Bylaw seeks to establish a clear plan for land use through the Integrated Land Use Plan and Zoning Bylaw to provide stability and predictability for the development of Enoch Lands; and

(f) Enoch in this Bylaw seeks to ensure a transparent, consistent and credible process for the development of Enoch Lands.

PART IV: INTEGRATED LAND USE PLAN

5. ADOPTION

5.1 The *Enoch Cree Nation Integrated Land Use Plan Bylaw* has been adopted as the Integrated Land Use Plan of Enoch Cree Nation;

5.2 Where the Area Structure Planning criteria and procedures set out in the Integrated Land Use Plan are not, in the estimation of Council, sufficiently comprehensive to guide the preparation of an Area Structure Plan for a particular Area Structure Planning Area or Area Structure Planning Areas, then Council may by Resolution establish additional criteria and procedures for the preparation of an Area Structure Plan for those areas.

6. AMENDMENT TO LAND USE DESIGNATION

6.1 Council or an interest holder in Enoch Lands may request an amendment to the Land Use Designation.

6.2 Where an Area Structure Plan is required, it shall be submitted and considered as an application for amendment to the Land Use Designation under sections 6.7 and 6.27.

6.3 Where Council or an interest holder in Enoch Lands requests an amendment to the Land Use Designation, they shall at the same time propose an amendment to the Zoning Designation consistent with the proposed amendment to the Land Use Designation, which,

notwithstanding Part V of this Bylaw, shall be considered and determined in the same manner and at the same time as the proposed amendment to the Land Use Designation.

6.4 Where an interest holder in Enoch Lands requests an amendment to the Land Use Designation and Zoning Designation they shall submit an application to the Enoch Cree Nation Planning Division in the form approved by Council.

6.5 The application under section 6.4 shall include the following:

(a) the completed application form;

(b) documentation of current ownership;

(c) a description of the proposed amendments;

(d) the reasons for requesting the proposed amendments; and

(e) a map showing the geographic boundary of the area affected by the proposed amendments, including adjacent properties.

6.6 Where Council requests an amendment to the Land Use Designation and Zoning Designation it shall:

(a) pass a resolution setting out:

(i) a description of the proposed amendments;

(ii) the reasons for requesting the proposed amendments; and

(iii) a map showing the geographic boundary of the area affected by the proposed amendments, including adjacent properties.

(b) provide to the Enoch Cree Nation Planning Division a copy of the Resolution passed under subsection (a).

6.7 Upon receipt of an application under section 6.4 or a Resolution passed under section 6.6 the Enoch Cree Nation Planning Division shall:

(a) review basic servicing and land use issues in relation to the application or Resolution;

(b) request additional information if required;

(c) prepared a preliminary report addressing the impact of the proposed amendments in light of the Land Use Principles and goals of the Integrated Land Use Plan including a recommendation as to whether or not the proposed amendments should proceed for further consideration; and

(d) provide a copy of the preliminary report to Council.

6.8 Upon receipt of the preliminary report prepared over section 6.7 the proposed amendments shall be considered at a duly scheduled Council meeting to determine whether they should proceed for further consideration.

6.9 In the case of an application by an interest holder for an amendment to the Land Use Designation and Zoning Designation:

(a) notice of the Council meeting held under section 6.8 shall be provided to the applicant and the applicant shall have an opportunity to address Council with respect to the application; and

(b) the preliminary report of the Enoch Cree Planning Division prepared under section 6.7 shall be provided to the applicant prior to the meeting where the application will be considered.

6.10 At the Council meeting held under section 6.8, Council shall review the preliminary report of the Enoch Cree Nation Planning Division and in the case of an application by an interest holder, if requested by an applicant, hear from the applicant and shall by Resolution decide whether the application should proceed for further consideration.

6.11 In the case of amendments proposed by an interest holder, the Enoch Cree Nation Planning Division shall give the applicant notice of the decision under section 6.10.

6.12 Council shall provide a copy of the Resolution decision under section 6.10 to the Enoch Cree Nation Planning Division and where Council decides that the proposed amendments should proceed for further consideration the Enoch Cree Nation Planning Division shall request comments from Affected Interest Holders and Members in relation to the proposed amendments.

6.13 Notice requesting comments under section 6.12 shall be given to the Affected Interest Holders and Members by:

(a) publication of a notice in the Enoch newsletter, mailed to Members or by separate written notice, delivered or mailed to Members;

(b) written notice, delivered or mailed to affected interest holders;

(c) posting of the notice in a public area of the Enoch administration building; and

(d) further notice may be provided by electronic means, including but not limited to website postings, emails or other social media as well as in accordance with Enoch communication strategies implemented from time to time by Council.

6.14 The notice shall:

(a) provide a summary of the application or Resolution seeking the amendments to the Land Use Designation and the Zoning Designation;

(b) request written comments from the Affected Interest Holders and Members on the proposed amendments; and

(c) specify a date that is at least twenty (20) days from the date of the notice for the Affected Interest Holders and Members to respond to the Enoch Cree Nation Planning Division.

6.15 Upon expiration of the time for submitting comments, the Enoch Cree Nation Planning Division shall:

(a) prepare a final report on the proposed amendments taking into consideration the comments received, the needs of the community and other relevant matters including recommendations on the proposed amendments; and

(b) provide a copy of the final report to Council.

6.16 Upon receipt of the final report prepared under section 6.15 the proposed amendments and final report shall be considered at a duly scheduled Council meeting.

6.17 Where the proposed amendments affect the Land Use Designation of any Enoch Lands, Council shall by resolution at the Council meeting held under section 6.16:

(a) reject the proposed amendments to the Land Use Designation and the Zoning Designation;

(b) request the Enoch Cree Nation Planning Division to provide additional information with respect to the proposed amendments; or

(c) refer the proposed amendments to a Special Members' Meeting for approval by Members.

6.18 Where Council requests additional information under section 6.17(b) the Enoch Cree Nation Planning Division shall prepare a revised final report and provide a copy of the revised final report to Council to be considered at a duly scheduled Council meeting where the procedure under sections 6.19 through 6.26 shall be followed.

6.19 A copy of the Resolution under section 6.17 shall be:

(a) mailed to the applicant, if applicable;

(b) mailed to Affected Interest Holders;

(c) posted in a public area of the Enoch administration building; and

(d) further notice may be provided by electronic means, including but not limited to website postings, emails or other social media as well as in accordance with Enoch Communication Strategies implemented from time to time by Council.

6.20 Where Council decides to refer the proposed amendments to the Land Use Designation and Zoning Designation to Members, Council shall schedule a Special Members' Meeting for approval, it shall provide notice to the Members at least twenty (20) days before the date of the Special Members' Meeting.

6.21 Notice shall be provided to the Members by:

(e) publication in the Enoch newsletter mailed to Members, or by separate written notice delivered or mailed to Members; and

(f) posting of the notice in a public area of the Enoch administration building; and

(g) further notice may be provided by electronic means, including but not limited to website postings, emails or other social media as well as in accordance with Enoch communication strategies implemented from time to time by Council.

6.22 Notice of the Special Members' Meeting where the proposed amendments to the Land Use Designation and the Zoning Designation will be provided to the Members in accordance with section 6.21 and shall include:

(a) a summary of the proposed amendments;

(b) a summary of the final report of the Enoch Cree Nation Planning Division on the proposed amendments;

(c) a statement that there will be a vote by secret ballot of the Members present at the Special Members' Meeting to vote on the proposed amendments;

(d) a statement that the report of the Enoch Cree Nation Planning Division on the proposed amendments is available for inspect at the Enoch administration building; and

(e) the date, time and place of the Special Members' Meeting also specifying the time period during which such voting will take place.

6.23 At the Special Members' Meeting copies of the final report of the Enoch Cree Nation Planning Division shall be made available to Members in attendance.

6.24 At the Special Members' Meeting called to vote on the proposed amendments, the purpose and provisions of the proposed amendments shall be explained to the Members present at the Meeting, and Members shall be entitled to ask questions and provide comments.

6.25 Upon completion of discussion, the Members, including Council present, shall vote by secret ballot on the proposed amendments to the Land Use Designation and the Zoning Designation.

6.26 The proposed amendments shall be deemed approved if a majority of the Members voting at the Special Members' Meeting vote in favour of the proposed amendments to the Land Use Designation and the Zoning Designation.

6.27 The amendments to the Land Use Designation and the Zoning Designation shall be effective as of the date of the Special Members' Meeting where Members approved the proposed amendments.

PART V: ZONING

7. ADOPTION

7.1 The *Enoch Cree Nation Zoning Bylaw* has been adopted as the zoning bylaw for Enoch Lands.

7.2 Except where an amendment to the Zoning Designation is proposed as part of a proposed amendment to the Land Use Designation, all amendments to the Zoning Designation shall be made under section 8 of this Bylaw.

8. AMENDMENT TO ZONING BYLAW

8.1 Council or an interest holder in Enoch Lands may request an amendment to the Zoning Designation provided that the proposed amendment is consistent with the Integrated Land Use Plan.

8.2 Where an interest holder in Enoch Lands requests an amendment to the Zoning Designation they shall submit an application to the Enoch Cree Nation Planning Division in the form approved by Council.

8.3 Where a proposed amendment to the Zoning Designation is within an area of land identified as an Area Structure Plan Area the application shall not proceed until an Area Structure Plan has been approved as an amendment to the Land Use Designation.

8.4 The application under section 8.2 shall include the following:

(a) the completed application form;

(b) documentation of current ownership;

(c) a description of the proposed amendment to the Zoning Bylaw;

(d) the reasons for requesting the proposed amendment to the Zoning Bylaw; and

(e) a map showing the geographic boundary of the area affected by the proposed amendment including adjacent properties.

8.5 Where Council requests an amendment to the Zoning Designation it shall:

(a) pass a Resolution setting out:

(i) a description of the proposed amendment to the Zoning Bylaw;

(ii) the reasons for requesting the proposed amendment to the Zoning Bylaw; and

(iii) a map showing the geographic boundary of the area affected by the proposed amendment, including adjacent properties.

(b) provide to the Enoch Cree Nation Planning Division a copy of the Resolution passed subsection (a).

8.6 Upon receipt of an application under section 8.2 or a Resolution passed under section 8.5 the Enoch Cree Nation Planning Division shall:

(a) review basic servicing and land use issues in relation to the application or Resolution;

(b) request additional information if required; and

(c) prepare a preliminary report addressing the impact of the proposed amendment to the Zoning Designation in light of the Land Use Principles and goals of the Zoning Bylaw including a recommendation as to whether or not the proposed amendment should proceed for further consideration; and

(d) provide a copy of the preliminary report to Council.

8.7 Upon receipt of the preliminary report prepared under section 8.6 the proposed amendment to the Zoning Designation shall be considered at a duly scheduled Council meeting to determine whether it should proceed for further consideration.

8.8 In the case of an application by an interest holder for an amendment to the Zoning Designation:

(a) notice of the Council meeting under section 8.7 shall be provided to the applicant and the applicant shall have an opportunity to address Council with respect to the application for amendment to the Zoning Designation; and

(b) the preliminary report of the Enoch Cree Nation Planning Division prepared under section 8.6 shall be provided to the applicant prior to the meeting where the application will be considered.

8.9 At the Council meeting held under section 8.7, Council shall review the preliminary report of the Enoch Cree Nation Planning Division and in the case of an application by an interest holder, if requested by an applicant, hear from the applicant and shall by Resolution decide whether the application for amendment to the Zoning Designation should proceed for further consideration.

8.10 In the case of an amendment to the Zoning Designation proposed by an interest holder Enoch Cree Nation Planning Division shall give the applicant notice of the decision under section 8.9.

8.11 Council shall provide a copy of the Resolution under section 8.9 to the Enoch Cree Nation Planning Division and where Council decides that the proposed amendment to the Zoning Designation should proceed for further consideration the Enoch Cree Nation Planning Division shall request comments from Affected Interest Holders and Members in relation to the proposed amendment to the Zoning Designation.

8.12 Notice requesting comments under section 8.11 shall be given to the Affected Interest Holders and Members by:

(a) publication of a notice in the Enoch newsletter mailed to Members or by separate written notice, delivered or mailed to Members;

(b) written notice, delivered or mailed to Affected Interest Holders;

(c) posting of the notice in a public area of the Enoch administration building; and

(d) further notice may be provided by electronic means, including but not limited to website postings, emails or other social media as well as in accordance with Enoch communication strategies implemented from time to time by Council.

8.13 The notice shall:

(a) provide a summary of the application or Resolution seeking an amendment to the Zoning Designation;

(b) request written and oral comments from the Affected Interest Holders and Members on the proposed amendments to the Zoning Designation; and

(c) specify a date that is at least twenty (20) days from the date of the notice for the Affected Interest Holders and Members to respond to the Enoch Cree Nation Planning Division.

8.14 Upon expiration of the time for submitting comments, the Enoch Cree Nation Planning Division shall:

(a) prepare a final report on the proposed amendment to the Zoning Designation taking into consideration the comments received, the needs of the community and other relevant matters; and

(b) provide a copy of the final report to Council.

8.15 Upon receipt of the final report prepared under section 8.14 the proposed amendment to the Zoning Designation and final report shall be considered at a duly scheduled Council meeting where Council shall by Resolution:

(a) reject the proposed amendment to the Zoning Designation;

(b) request the Enoch Cree Planning Division to provide additional information with respect to the proposed amendment to the Zoning Designation; or

(c) approve the proposed amendment to the Zoning Designation.

8.16 Where Council requests additional information under section 8.15(b) the Enoch Cree Nation Planning Division shall prepare a revised final report and provide a copy of the revised final report to Council to be considered at a duly scheduled Council meeting where the procedure under section 8.15 shall be followed.

8.17 A copy of the Resolution under section 8.15 or section 8.16 shall be:

(a) mailed to the applicant, if applicable;

(b) mailed to affected interest holders;

(c) posted in a public area of the Enoch administration building; and

(d) further notice may be provided by electronic means, including but not limited to website postings, emails or other social media as well as in accordance with Enoch Communication Strategies implemented from time to time by Council.

8.18 The amendment to the Zoning Designation shall be effective as of the date of the Resolution approving the proposed amendment to the Zoning Designation.

PART VI: MASTER SERVICING PLAN

9. SERVICING MAPS

9.1 The Master Servicing Plan attached hereto as Schedule “A” are adopted as the servicing maps for Enoch Lands.

9.2 Council may by Resolution make amendments to the Master Servicing Plan.

PART VII: VARIANCE

10. VARIANCE

10.1 A person may apply to the Board for a variance in accordance with this Part.

11. ESTABLISHMENT OF BOARD

11.1 The Board is hereby established to:

(a) evaluate and make decisions on applications for a variance;

(b) establish policies and procedures for operation of the Board and the carrying out of its duties that are not inconsistent with this Bylaw; and

(c) carry out such other duties and responsibilities as may be assigned to the Board under Enoch Bylaw.

12. COMPOSITION OF BOARD

12.1 The Board shall be composed of three persons as follows:

(a) a member of Council, appointed by Resolution of Council;

(b) the Chief Operating Officer;

(c) the Executive Director of the Enoch Cree Nation Planning Division.

13. CHAIRPERSON

13.1 The Chief Operating Officer shall be the Chairperson of the Board provided that in the absence of Chief Operating Officer, the Council member on the Board will act as Chairperson.

13.2 The Chairperson shall be responsible for organizing, calling and presiding at all meetings of the Board shall perform such other duties as may be assigned to the Chairperson by the Board.

14. APPLICATION FOR VARIANCE

14.1 A person may apply to the Board for a variance if the person alleges that compliance with any of the following provisions in an Enoch Bylaw would cause the person hardship:

(a) the siting, dimensions, site coverage, or size of a building or structure; and

(b) the prohibition of a structural alternation, addition or replacement of or to a building or other structure permitted as a non-conforming use.

14.2 The application under section 14.1 shall include the following:

(a) the completed application form;

(b) documentation of current ownership;

(c) a description of the variance requested;

(d) the reasons for requesting the proposed variance; and

(e) a map showing the geographic boundary of the area affected by the proposed variance including adjacent properties.

15. GRANTING OF A VARIANCE

15.1 On an application under this Part, the Board may order that a minor variance be permitted from the requirements of an Enoch Bylaw, if the Board finds that undue hardship would be caused to the applicant if required to comply with Enoch Bylaw, and is of the opinion that the variance does not:

(a) result in inappropriate development of the site;

(b) adversely affect the natural environment, heritage sites or culturally sensitive areas;

(c) substantially affect the use and enjoyment of adjacent land;

(d) vary permitted uses or densities under the Zoning Bylaw or the Integrated Land Use Plan; or

(e) defeat the intent of the Zoning Bylaw or the Integrated Land Use Plan.

15.2 The granting of a variance by the Board under this Bylaw will not relieve the applicant from also complying with the provisions of any Federal Act or regulation, or Provincial Act or regulation, or other Enoch Bylaw requirement, or any legally binding agreement to which the applicant is a party.

16. NOTICE OF APPLICATION

16.1 Where the Board receives an application under section 14.1, the Board must notify all Affected Interest Holders.

16.2 The notice under section 16.1 must state the subject matter of the application, the time within which the recipient may send written comments on the application to the Board and the place where the comments shall be sent.

16.3 The obligation to give notice under section 16.1 will be satisfied if the Board made reasonable effort to mail or otherwise deliver the notice.

16.4 A copy of the comments received by the Board shall be provided to the person applying for a variance on or before the hearing of the application.

16.5 No application for a variance shall be heard by the Board, unless the Board complied with this section.

17. NOTICE TO THE APPLICANT

17.1 The Board shall give notice to the applicant at least five (5) business days before the date of a meeting, specifying the place, day and hour where the application shall be heard.

17.2 Notice shall be given to the applicant by ordinary mail or delivery at the address provided on the application.

18. MEETINGS

18.1 The Board shall meet as required to carry out its duties this Bylaw.

18.2 The Board shall meet on Enoch Lands.

18.3 The Chairperson shall give notice to Board members at least five (5) business days before the date of a meeting specifying the place, day and hour of the meeting.

18.4 Notice of the meeting may be given to a Board member either personally, by telephone, facsimile or e-mail at the telephone number or e-mail address provided by the Board Member.

18.5 Board meetings shall be closed to all persons except Board members, the applicant and invited Enoch Cree Nation employees or representatives provided that the Board may by vote invite such other persons as may be required to provide information to assist the Board in considering the application.

18.6 Persons attending Board meetings may only address the meeting if their matter is on the agenda or if they receive permission from the Chairperson.

18.7 Enoch shall appoint a person who is not a member of the Board to act as secretary to the Board, and the secretary shall:

(a) take attendance of Board members present at meetings;

(b) record decisions and votes at meetings; and

(c) perform such other duties, consistent with this Bylaw, as may be assigned to the secretary by the Board.

18.8 The secretary to the Board shall, in a timely manner and by ordinary mail or delivery to the address provided on the application, provide copies of records of decisions to an applicant and to Council.

18.9 All records of decisions of the Board shall be retained by the Board at the Enoch administration building and copies may be obtained upon payment of any applicable copying fee.

18.10 The Board may, subject to this Bylaw, establish rules for its procedure at meetings and no rule made by the Board invalidates a prior act of the Board that would have been valid if that rule had not been made.

19. QUORUM

19.1 Quorum for a meeting of the Board shall be two Board members provide that where a quorum cannot be established because of conflict of interest provisions in this Bylaw, the matter shall be adjourned to the next meeting or such future meeting where a quorum can be established.

19.2 The Chairperson shall be included in counting quorum.

19.3 If a quorum can never be established because of conflict of interest provisions in this Bylaw, the application shall be referred to Council for a decision.

20. VOTING

20.1 All matters before the Board for decision shall be decided by a majority vote of Board members participating in the vote.

20.2 The Chairperson shall be entitled to vote.

20.3 Unless a secret vote is requested and approved by the Board, all voting shall be by a show of hands indicating a “Yes” vote or a “No” vote. No abstentions are permitted on a vote.

20.4 The results of a vote shall be recorded in the minutes of the meeting.

21. CONFLICT OF INTEREST

21.1 A conflict of interest arises in any situation where a member or a person in their immediate family has a personal or business interest in the matter under consideration.

21.2 A Board member who has a conflict of interest will, as soon as possible, disclose the nature and extent of their conflict to the Chairperson who shall report the conflict to the remaining Board members.

21.3 Where a conflict of interest exists, the Board member affected shall leave the meeting where the matter is being considered and will not be counted in determining quorum nor participate in discussion nor vote on the matter under consideration.

22. CONFIDENTIALITY

22.1 Board members shall not release information received by them in their work with the Board or information relating to the deliberations proceedings or other matters of the Board unless:

(a) the information is public under Enoch Bylaw or other applicable Bylaws; or

(b) the information is information that the Board, by vote of Board members at a meeting, decides to release.

23. APPEALS

23.1 A decision of the Board under this Part is final.

PART VIII: NON-CONFORMING USES

24. NON-CONFORMING USES

24.1 If at the time this Bylaw comes into force:

(a) a land or building or other structure, is lawfully used; and

(b) the use does not conform to the uses permitted under this Bylaw, the Zoning Bylaw or Integrated Land Use Plan,

the use may be continued as a non-confirming use but if the non-conforming use is discontinued for a continuous period of six months any subsequent use of the land, building or other structure becomes subject to this Bylaw.

24.2 The use of land, a building or other structure, for seasonal uses or for agricultural purposes is not discontinued as a result of normal seasonal or agricultural practices, including:

(a) seasonal, market or production cycles;

(b) the control of disease or pests; or

(c) the repair, replacement or installation of equipment to meet standards for the health or safety of people or animals.

24.3 Where a Development Permit has been issued for a building or other structure at the time this Bylaw comes into force, any building or structure subsequently built in accordance with that Development Permit is deemed, for the purpose of this Part:

(a) to be a building or other structure existing at that time; and

(b) to be then in use for its intended purpose as determined from the building permit authorizing its construction.

24.4 If sections 24.1 and 24.2 authorize a non-conforming use of part of a building or other structure to continue, the whole of that building or other structure may be used for that non-conforming use.

24.5 A structural alteration or addition, except one that is required under Enoch Bylaw or permitted by the Board, must not be made in or to a building or other structure while the non-conforming use is continued.

24.6 Nothing in this Part authorizes the non-conforming use to be continued on a scale or to an extent or degree greater than that at the time this Bylaw comes into force.

24.7 For the purposes of this part, a change of owners, tenants or occupants of any land, or of a building or other structure, does not, by reason any of the change, affect the use of the land or building or other structure.

24.8 If a building or other structure, the use of which does not conform to the provisions of this Bylaw is damaged or destroyed to the extent of less than 75% of its value above its foundations, as determined by the Building Inspector, it can be repaired or reconstructed to continue the non-conforming use permitted under this Bylaw.

24.9 Unless as permitted by the Board, if a building or other structure, the use of which does not conform to the provisions of this Bylaw is damaged or destroyed to the extent of 75% or more of its value above its foundations as determined by the Building Inspector, must not be repaired or reconstructed except as a conforming use under this Bylaw.

PART IX: INTERPRETATION

25. APPLICATION OF BYLAW

25.1 Where any federal Act or regulation or provincial Act or regulation or any other Enoch Bylaw may apply to any matter covered by this Bylaw and Integrated Land Use Plan adopted by this Bylaw, compliance with this Bylaw and Integrated Land Use Plan will not relieve the person from also complying with the provisions of the other applicable Act, regulation or bylaw.

25.2 If any statement, section, sub-section, clause, sub-clause or phrase of this Bylaw, including its appendixes, is for any reason held to be invalid by a decision of a court of competent jurisdiction, the decision shall not affect the validity of the remaining portions of the Bylaw and its appendixes.

25.3 The headings given to the sections and paragraphs in this Bylaw are for convenience of reference only. They do not form part of this Bylaw and will not be used in the interpretation of this Bylaw.

PART X: IMMUNITY

26.1 No action or damages lies or may be instituted against present or past Council, Enoch Cree Nation Bylaw Enforcement Officer, Fire Chief, Officer or fire fighter, or members, employees, servants or agents of either Enoch or Council:

(a) for anything said or done or omitted to be said or done by that person in the performance or intended performance of the person's duty or the exercise of the person's authority; or

(b) for any alleged neglect or default in the performance or intended performance of the person's duty or the exercise of the person's authority.

26.2 Section 26.1 does not provide a defence if:

(a) Council, Enoch Cree Nation Bylaw Enforcement Officer, Fire Chief, Officer or fire fighter, or members, employees, servants or agents have, in relation to the conduct that is the subject matter of the action, been guilty of dishonesty, gross negligence or malicious or wilful misconduct; or

(b) the cause of action is libel or slander.

26.3 Enoch, present or past Council, or members, employees, servants or agents of any of Enoch or Council is not liable for any damages or other loss, including economic loss, sustained by any person, or to the property of any person, as a result of neglect or failure, for any reason, to discover or detect any contravention of this Bylaw or any other Enoch Bylaw, or from the neglect or failure, for any reason or in any manner, to enforce this Bylaw or any other Enoch Bylaw.

26.4 All actions against Enoch for the unlawful doing of anything that:

(a) is purported to have been done by Enoch under the powers conferred by this Bylaw or any Enoch Bylaw; and

(b) might have been lawfully done by Enoch if acting in the manner established by law,

must be commenced within six (6) months after the cause of action first arose, or within a further period designated by Council in a particular case, but not afterwards.

26.5 Enoch is in no case liable for damages unless notice in writing, setting out the time, place and manner in which the damage has been sustained, is delivered to Enoch, within two (2) months from the date on which the damage was sustained. In case of the death of a person injured, the failure to give notice required by this section is not a bar to the maintenance of the action. Failure to give the notice or its insufficiency is not a bar to the maintenance of an action if the court before whom it is tried, or, in case of appeal, the Court of Appeal, believes:

(a) there was reasonable excuse; and

(b) Enoch has not been prejudiced in its defence by the failure or insufficiency.

PART XI: PENALTY

27. PENALTY

27.1 Every person who violates any provisions of this Bylaw or who suffers or permits any act or thing to be done in contravention of this Bylaw, or who refuses, omits, or neglects to fulfill, observe, carry out, or perform any duty or obligation imposed by the Bylaw is liable upon summary conviction, to a fine and penalty not to exceed $1,000, or imprisonment for a term not exceeding 30 days, or both.

27.2 In the event any person fails or refuses to comply with this Bylaw, Enoch Cree Nation shall be entitled to the granting of equitable relief (including without limitation injunctive relief & specific performance) from any Court of competent jurisdiction concerning any threatened or actual breach of the provisions of this Bylaw.

PART XII: AMENDMENTS

28. Historical amendments to this Bylaw:

Date Of Amendment:	Section to Be Amended:	Amendment:

THIS BYLAW IS HEREBY enacted at a duly convened meeting of the Council of the Enoch Cree Nation this 26th day of April, 2018.

Signed by the following members of Council:

Chief William Morin

(Councilor)
Kelly Morin

(Councilor)
Shane Morin

(Councilor)
Lyle Morin

(Councilor)
Lorna Morin

(Councilor)
Nola Wanuch

(Councilor)
Michelle Wilsdon

(Councilor)
John Thomas

(Councilor)
Shane Peacock

(Councilor)
Amanda Morin

being the majority of those members of the Council of the Enoch Cree Nation present at a duly called meeting of the Council.

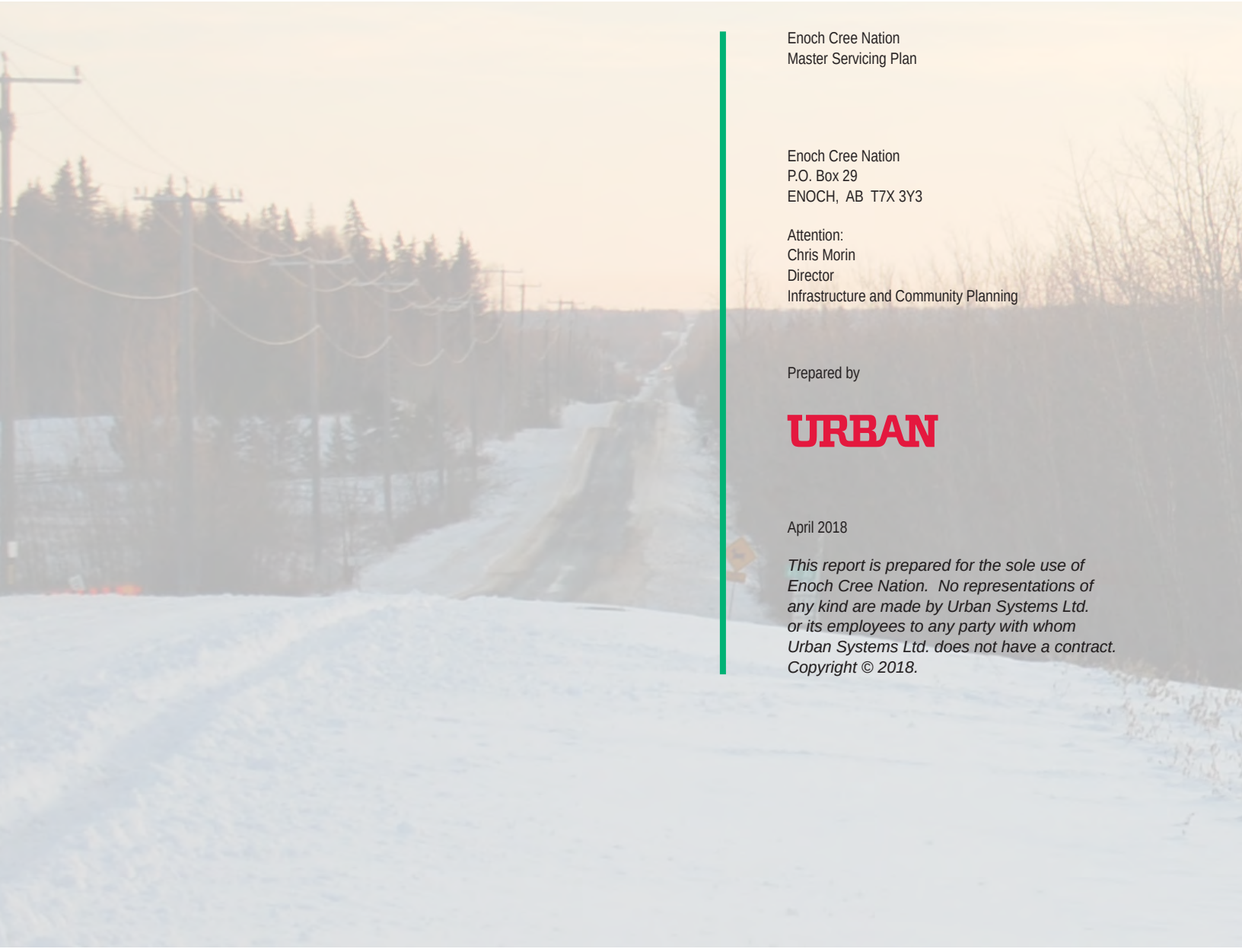
Master Servicing Plan
Schedule “A”

MASTER SERVICING PLAN

ENOCH CREE NATION

ENOCH CREE NATION

URBAN systems



Enoch Cree Nation
Master Servicing Plan

Enoch Cree Nation
P.O. Box 29
ENOCH, AB T7X 3Y3

Attention:
Chris Morin
Director
Infrastructure and Community Planning

Prepared by

URBAN

April 2018

Contents

Figures

1. Master Servicing Plan Introduction

1.1 Introduction

1.1.1 WHAT IS THE MASTER SERVICING PLAN?

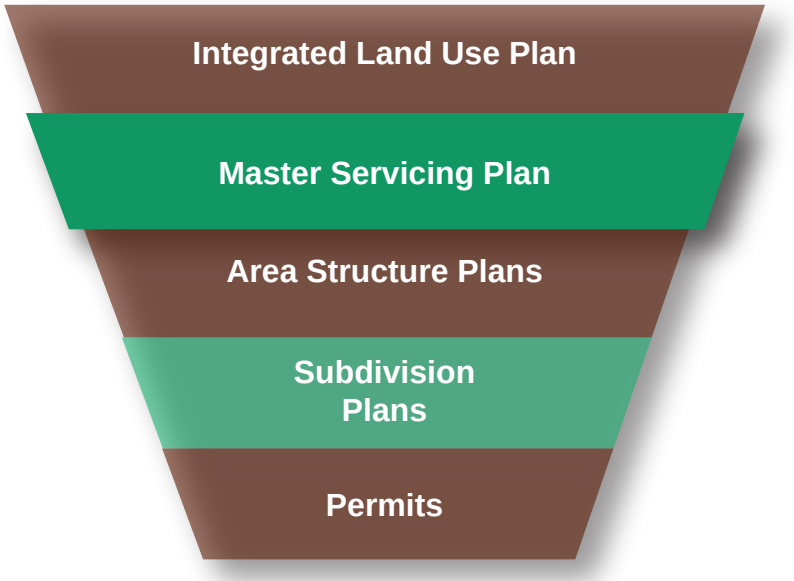
To plan and accommodate for the future growth of ECN, it is necessary to evaluate current and future infrastructure servicing needs from a cost, timing and political perspective. The master servicing plan evaluates servicing strategies for the water distribution, sanitary sewer collection, stormwater conveyance and transportation networks.

Key outcomes of this plan are expressed through the servicing vision, target levels of service, definitions of sustainability and resilience and servicing goals. Within these goals, short-term priorities and long-term goals have been identified.

1.1.2 ALIGNING WITH ENOCH'S OTHER STRATEGIC PLANS

At the time of preparation of this document, an Integrated Land Use Plan was also being developed for ECN. While this plan includes a high-level understanding of current and future servicing needs, the Master Servicing Plan explores these needs in further detail. It summarizes the ability of current infrastructure to meet those needs. The information in both the ILUP and Master Servicing Plan helps inform land use decisions for the Area Structure Plans (ASPs) for the North-East Development Area (NEDA) and the Village. These decisions will be informed by the existing capacity and upgrading requirements of existing infrastructure, and concurrently these plans will help inform short and medium-term decisions for infrastructure needs on the basis of enabling economic and population growth.

In addition to coordinating the internal strategic plans, these plans also inform the collaborative work of the ECN in pursuing potential agreements with the City of Edmonton, EPCOR, Alberta Capital Region Wastewater Commission, Capital Region Parkland Water Services Commission and/or the West Inter Lake District (WILD) Regional Water Transmission Pipeline for servicing connections.



1.2 ECN Vision, Mission and Values

Enoch Cree Nation's current strategic priorities help set direction and align efforts as the Nation works towards achieving its goals. These priorities include land use and infrastructure planning, creating partnerships, and improving operations. The Nation also currently has the following vision, mission and values:

Vision - We strive to be a self-sufficient, unified and prosperous Nation

Mission - We, the Enoch Cree Nation, proud member of Treaty 6, actively seek to preserve and promote our culture, language, history, and spirituality while advancing our economic, education, health, and social well-being of our people.

Values

- Honesty – ka kwayasksihcikêwinik or kwayask itâtisiwin
- Respect – kihcêyihtowin or manâcihtowin
- Balance – mîyo pimâtisiwin
- Integrity – kwayaskâtisîwin
- Fairness – peyakwan êsi kanawâpamat ayisîynîw
- Transparency – ê kanawapatêhiwêhk
- Growth – ê akamêmototamihk
- Commitment – asotâmawin
- Mutual Support – sîtoskâtowin
- Empowerment – mâmawi wîcihitôwin

The Vision, Mission and Values guide the Integrated Land Use Plan and all associated processes.

1.3 Sustainability and Resilience

1.3.1 WHAT IS SUSTAINABILITY?

The Office of Sustainability through the University of Alberta defines sustainability as:

"Meeting our own needs without compromising the ability of future generations to meet their own needs."

The Office of Sustainability also notes that environmentalism is not the only pillar of sustainability, rather social equity, economic development and environmentalism form the pillars of a sustainable community. The following definitions are provided.

1.3.1.1 Environmental Sustainability

"Ecological integrity is maintained, all of earth's environmental systems are kept in balance while natural resources within them are consumed by humans at a rate where they are able to replenish themselves."

1.3.1.2 Economic Sustainability

"Human communities across the globe are able to maintain their independence and have access to the resources that they require, financial and other, to meet their needs. Economic systems are intact and activities are available to everyone, such as secure sources of livelihood."

1.3.1.3 Social Sustainability

"Universal human rights and basic necessities are attainable by all people, who have access to enough resources in order to keep their families and communities healthy and secure. Healthy communities have just leaders who ensure personal, labour and cultural rights are respected and all people are protected from discrimination."

Using the above definitions, the City of Edmonton provided principles of sustainable living in their Environmental Strategic Plan "The Way We Green". Of these, the following principles are also applicable to the Master Servicing Plan for ECN.

- **Biodiversity** – recognizing the value of biodiversity and working to protect and restore natural ecosystems.
- **Renewable and non-renewable resources** – ensuring that renewable resources are consumed at a rate less than or equal to the rate of replenishment. Ensuring that the use of non-renewable resources slows at a rate of decline equal to or greater than the rate of resource depletion.
- **Future generations** – the actions of today benefit seven generations into the future.

1.3.2 WHAT IS RESILIENCE?

The Way We Green provides a definition of resilience that has been adapted with minor revisions, as follows.

"The capacity of a system to withstand and bounce back intact from environmental disturbances."

Building on this, the ResilientCity.org network provided the following definition, which ties in the social, economic and infrastructure aspects of resiliency.

"A Resilient City is one that has developed capacities to help absorb future shocks and stresses to its social, economic, and technical systems and infrastructures so as to still be able to maintain essentially the same functions, structures, systems, and identity."

Both the City of Edmonton and ResilientCity.org network provided principles of resilience and of these, the following principles are applicable to the Master Servicing Plan for ECN.

- Density, diversity, and mixed-use –maximizing the active-use (i.e. avoiding long periods of underutilization) of the land while also offsetting the need for new infrastructure.
- Alternate modes of transportation – prioritizing pedestrians, reducing car dependency and promoting active transportation is both sustainable and improves quality of life.
- Transit supportive planning – access to transit is the next step in the progression away from car dependent transportation.
- Place making – conserving, enhancing and creating strong, vibrant places creates a sense of identity and can aid in the preservation of culture and tradition.
- Complete communities – the needs of daily living are provided within walking distance, and walking routes are connected, enjoyable and operate at a fine scale.
- Integrated natural systems – conserving and enhancing natural systems and reducing our impact through how we choose to live and develop land.
- Engaged communities – active participation from all community members is required to both plan the community and to then carry out activities reflective of that plan in their day-to-day routine (e.g. using reusable grocery bags).
- Redundant and durable life safety and crucial infrastructure systems – ensuring proper levels of redundancy and durability are planned for and implemented in critical infrastructure systems.
- Resilient operations – buildings and urban form are designed to have a reduced environmental footprint and require reduced servicing costs (e.g. urban sprawl has a large footprint and is expensive to service and maintain).

1.4 Servicing

1.4.1 WHAT WE HEARD FROM MEMBERS

Through the development of the ILUP, the community was comprehensively engaged, and the feedback received relating to servicing informs the servicing vision.

Priorities for members included green space preservation and reforestation, paved roads, installation of traffic lights, infrastructure upgrades, and wetland health. Members like that other communities have amenities within walking distance, proper services and implement sustainable development.

Development opportunities were identified to be facilities such as recreation, cultural, and health care centres, all of which will need to be considered when assessing future infrastructure capacity.

ECN values a focus on sustainability wherever possible, whle also understanding that short-term infrastructure needs must be addressed first. As these are addressed it is important to lay the foundation for sustainability to be achieved through the long-term goals.

1.4.2 SERVICING VISION

Though ECN is focused on independence and self-reliance, it is sensible to utilize nearby resources that can immediately address short-term needs. Where ECN can focus on reducing its dependence on nearby systems is through reduced water consumption, water conservation and where practical, re-use and reducing storm and sanitary discharges.

1.4.2.1 Water Distribution

A reliable and clean water source is available to all Nation members. Water is conserved and most efficiently used, with source quality meeting the needs of the end use.

1.4.2.2 Sanitary Collection

All members are using a collection system that meets the needs of the Nation while preserving the natural environment.

1.4.2.3 Stormwater Management

The stormwater management system respects and enhances the natural environment with a focus on naturalized systems first and engineered systems where needed, while providing flood protection and minimizing risks to the community.

1.4.2.4 Transportation

A network that connects Enoch internally and externally to the surrounding region. Transportation corridors are designed to be safe for all modes of transportation, facilitating vehicles, transit, bikes and pedestrians.

1.5 Land Use & Population Growth

The residential, commercial, and institutional growth in the 20-year design horizon is expected to be largely contained within the NEDA and Village ASP areas, with some highway commercial and light industrial growth immediately west and north of the Village core. The expected development required to support this growth is illustrated in **Figure 1.5.1**.

Through the development of the Integrated Land Use Plan (ILUP) an Annual Average Growth Rate of 2% has been selected as the most appropriate means of calculating the Nation's population and land needs over the next 100 years. ECN reported an on-reserve 2016 total population of 1,674 people. The 2% Average Annual Growth Rate projects this population to reach an estimated 11,894 people by 2115. As such, a significant amount of additional land will be needed to meet this increased demand for housing, employment, goods, services, and amenities. The ILUP includes recommendations for the dedication of additional residential, industrial, commercial, and institutional land over and above the amount needed to support the 2% population growth. This is included in the ILUP to ensure flexibility for the development of the Nation over the long term, but has not been included in the Master Servicing Plan analysis as this would result in largely over-designed infrastructure recommendations.

Currently, the Nation has 400 housing units on Reserve located on approximately 5,308 hectares of land. This results in a per unit density of 0.075 units per hectare. Moving forward, ECN has identified the need to shift away from this existing development model toward an approach that incorporates increased residential density.

Due to this anticipated shift in on-reserve residential development, the residential land needs calculation will focus solely on the land needed to accommodate the additional on-Reserve population expected by 2115. It is assumed that ECN's existing housing, which currently accommodates 1,674 residents, will remain in its current form and gradually redevelop over the next 100 years.

For the purpose of the calculating residential land needs for the anticipated on-reserve population, it has been assumed that future housing will consist of 50% rural detached housing and 50% urban residential including detached, semi-detached, and apartment dwellings, which will be located primarily within the Village and NEDA ASP areas (70/30 split between the Village and NEDA respectively). ECN is targeting an average of 4 persons per unit at Enoch by 2115. This is based on the current Enoch household size of approximately 4.2 persons per dwelling unit. An additional 20% of the land required for rural detached and urban residential housing is allocated for roads, stormwater management, lift stations and other above-ground servicing and an additional 10% of the land required for housing will be allocated for parks and open space above and beyond protected environmentally and culturally significant areas.

Commercial and Industrial land is essential to provide revenue and employment for the Nation and its members. Currently, the Nation does not have designated industrial land, and with an expected increase in population, the Nation will need to expand its industrial land base. It is important to note, however, that industrial and commercial growth is not necessarily tied to population growth, but rather local market conditions, which are often difficult to estimate as they depend on micro and macro-economic factors. That said, initial estimates of commercial and industrial growth for the short- medium- and long-term in the Nation were estimated to the best of our knowledge. It is expected that 90% of commercial and industrial growth will occur in NEDA.

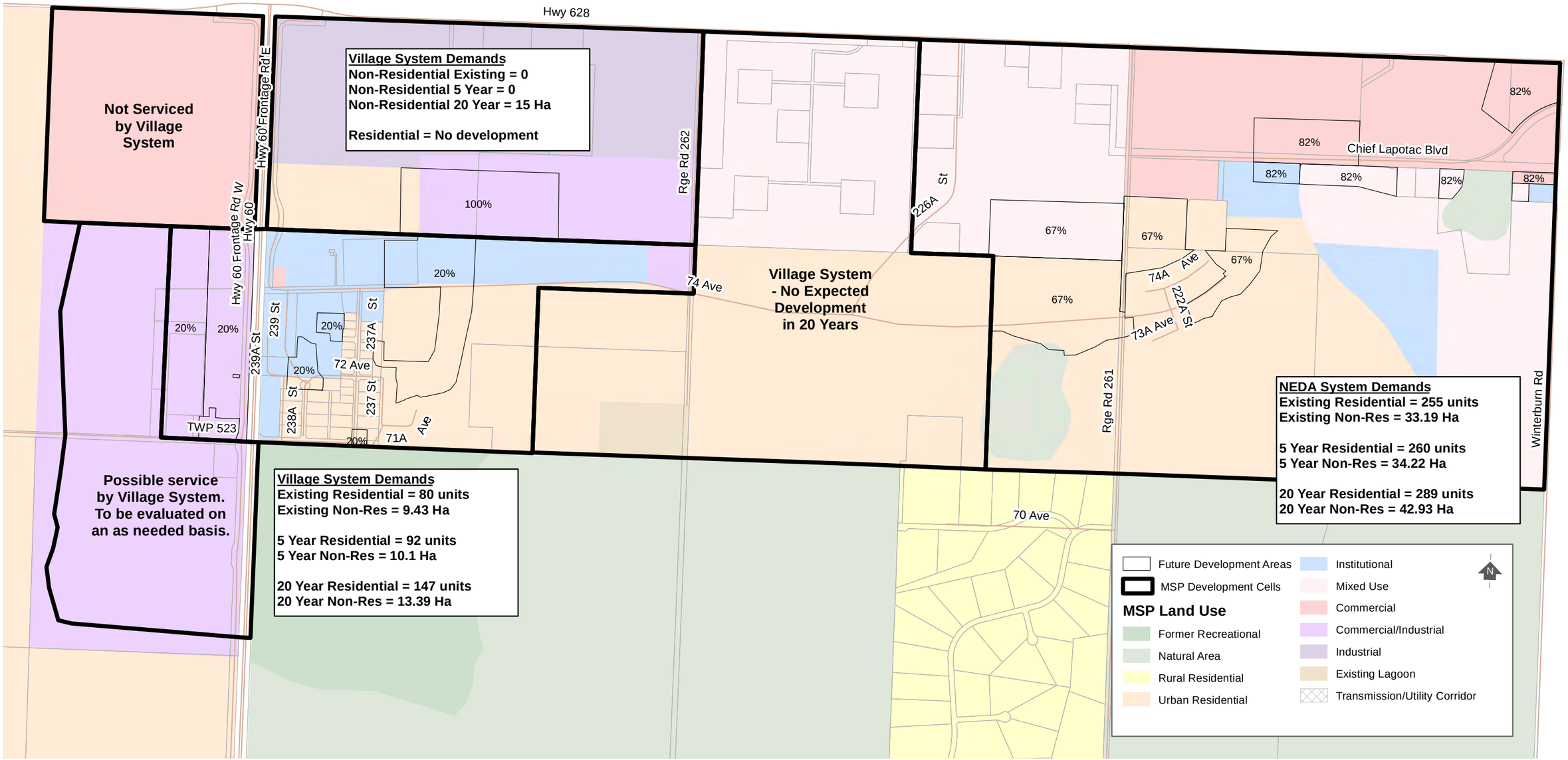
The need for institutional land use is directly tied to population growth in the Nation. It was assumed that 12 new acres of institutional land will be required for every 100 additional people in Enoch. It was also assumed that 80% of this land will be located within the Village ASP area, as this area is expected to have the highest concentration of Urban Residential development.

Based on the above assumptions, the following table summarizes additional land requirements for rural residential, urban residential, industrial, commercial and institutional land uses for the 5, 10 and 20-year growth projections of the Nation.

Table 1.5.1: Enoch Cree Nation Existing and Proposed Land Use

	5-year		10-year		20-year	
Land Use	NEDA (ha)	Village (ha)	NEDA (ha)	Village (ha)	NEDA (ha)	Village (ha)
Rural Residential	n/a	n/a	n/a	n/a	n/a	n/a
Urban Residential	0.26	0.60	0.61	1.43	1.43	3.34
Industrial	n/a	n/a	n/a	3	n/a	15
Commercial	0.9	0.1	4.5	0.5	9	1
Institutional	0.13	0.54	0.32	1.26	0.74	2.96
Additional on Reserve Population (ppl)	**138**		**326**		**764**	

Figure 1.5.1 *MSP Land Use and Expected 20-year Growth*



2. Transportation Master Plan

2.1 Introduction

2.1.1 PURPOSE OF TRANSPORTATION MASTER PLAN

The purpose of a Transportation Master Plan (TMP) is to prepare a long-term plan to guide the development of transportation infrastructure to support the goals and objectives of Enoch Cree Nation (ECN), principally the growth of the community. The TMP documents and analyzes current travel conditions, forecasts future travel conditions, and develops appropriate long-term transportation strategies for the community to consider.

The TMP is used as a basis for adopting safe, innovative, sustainable approaches to all modes of transportation, as a guide to future development, as a basis for partnership discussions with other agencies, and as a basis for preparing long-term Capital Plans for funding and construction of the recommended improvements. These recommendations will support the Nation in applying for funding, and in negotiating development conditions with the private sector. The TMP also forms the basis for the Nation to develop work programs and budgets and consider maintenance expenditures and how they relate to the life-cycle of the infrastructure.

2.1.2 LEVELS OF SERVICE

2.1.2.1 Typical Transportation Level of Service

The ideal transportation network is sized to accommodate all travel modes (including passenger and commercial vehicles, transit, pedestrians, and cyclists) efficiently and safely. A roadway hierarchy includes local roadways that serve as access to residential and commercial properties with low speeds and low volumes, arterial roadways that handle a large volume of traffic and are primarily tasked with movement of traffic, and collectors that funnel traffic between locals and arterials. Level of service in a transportation network is typically measured on a scale from A to F, with a LOS of E considered the maximum capacity of the infrastructure. LOS can be predicted and measured for vehicle, transit, pedestrian, and cycling infrastructure and a balance of facilities is necessary to accommodate all modes and make the most efficient use of the network. LOS is a measure of the capacity of a roadway and is indicative of the stability of the traffic flow, vehicle spacing, and travel speed. LOS does not reflect the condition of the infrastructure and LOS assumes that there is a service in place that can be used.

Levels of service are a defined set of standards and services that a community adopts as performance expectations from its infrastructure systems. These levels of service inform how infrastructure is designed, operated, maintained, repaired and upgraded or replaced.

2.1.2.2 Currently Achieved Transportation Level of Service in Enoch

The existing internal transportation network consists of Chief Lapotac Boulevard which provides access to the NEDA area, a small grid of paved roadways within the Village constructed to various standards and cross sections, as well as a series of rural roadways providing connectivity throughout the Nation and access to rural properties. The Nation lands are primarily accessed from 215 Street (Winterburn Road) to the East and Highway 60, which bisects the Nation lands. Service roads parallel Highway 60 and provide access to residential and commercial properties as well as to the Village.

In 2016, ECN upgraded a section of Chief Lapotac Boulevard between the River Cree Resort and Range Road 261, which will help to provide connectivity between the NEDA and the Village. Arena Road serves as the main connection from Range Road 261 to the Village core and is constructed to a two-lane rural gravel standard. **Figure 2.1.1** illustrates the existing road network within and surrounding the Enoch Cree Nation lands.

The existing road network has ample capacity for motorized vehicles based on existing traffic volumes (the roadway network operates at an LOS of A) but, in general, are not built to adequate construction standards (road structure and geometric characteristics). Infrastructure to support multi-modal transportation opportunities is almost non-existent. The Nation constructed a gravel pathway adjacent to a portion of Chief Lapotac Boulevard in 2016 in order to facilitate a safe connection for pedestrians and cyclists in one of the most heavily trafficked areas of the Nation, to provide a connection between the 108 unit apartment building and the River Cree Resort. Monolithic concrete sidewalks exist along 237 A Street within the Village as well as informal dirt paths (desire lines) throughout the Village. There is currently no existing transit service within ECN.

2.1.2.3 Desired Transportation Level of Service

Through the development of the Master Servicing Plan Visioning Document, the Nation defined the desired level of service for the transportation network as:

> "A network that connects Enoch internally and externally to the surrounding region. Transportation corridors are designed to be safe for all modes of transportation, facilitating vehicles, transit, bikes and pedestrians."

Figure 2.1.1 *Existing Regional Road Network*

U:\Projects_EDM\3234\0009\01\D-Drafting-Design-Analysis\GIS\Projects\MXD\Current\MSP Figures\Existing Road Network.mxd Last updated by squalie on Monday, May 29, 2017 at 9:17:40 AM

2.1.3 PRIORITIES AND GOALS

The guiding principles in the integrated land use plan define the overall vision that ECN members have for their land and community in the long term. These guiding principles were arrived at through consultation and conversation with Chief and Council, elders, students, and other community members. The transportation master plan is informed and shaped by these guiding principles.

ILUP Guiding Principles:

- Protect natural and cultural areas for member use and enjoyment
- Balance community growth and economic development
- Support job creation and business development on reserve
- Maintain and strengthen Enoch's unique culture and identity
- Develop cultural and recreational facilities
- Provide a variety of housing options according to members needs

Through development of the master services plan visioning document the following short-term priorities and long-term goals emerged:

Short-term Priorities

A network that connects Enoch both internally and externally to the surrounding region.

- **Upgrading Chief Lapotac Boulevard to provide connectivity between NEDA and Village.** *Chief Lapotac Boulevard was constructed between the River Cree Resort and Range Road 261 in 2016 to a two-lane paved standard. This completes the connection between NEDA and the Village, though Arena Road is gravel and will require upgrading as traffic increases.*
- **Establishing road network plan and road standards to guide infrastructure investments.** *The TMP establishes a long term road network plan based on the anticipated population growth in Enoch. It also provides recommended infrastructure improvements at the short, medium, and long-term horizons to guide investment in transportation infrastructure.*
- **Plan and construct safe pedestrian facilities within the Village and between NEDA and the Village.** *A gravel multi-use trail was constructed adjacent to Chief Lapotac Boulevard in 2016 in order to connect the 108 unit apartment building to the River Cree Resort. This was identified as a key pedestrian corridor that was crucial to ensure safe separation of pedestrians from vehicular traffic. The trail currently terminates at the West end of the River Cree Resort parking lot and at the 108 unit apartment building and will require expansion in the future to truly serve as a connection between NEDA and the Village.*
- **Signalization of Chief Lapotac Boulevard / 215 Street Intersection and re-timing of signals at Costco access to improve safety for those entering/exiting the NEDA area.** *This was completed in 2016 and appears to be alleviating traffic concerns for people entering and exiting the Nation from 215 Street at these two access points.*

Long-term Goals

Streets are designed to be safe for all modes of transportation, facilitating automobiles, transit, bikes and pedestrians.

- Explore potential impacts of emerging autonomous vehicle technology and opportunities for development within ECN.
- Establish a network of transportation infrastructure that safely and efficiently accommodates all modes of travel.
- Explore options for development of a transit network, which may include a community transit system, extension of service from the City of Edmonton, a regional transit initiative, or another model.

The Nation has already made progress on addressing the short-term priorities since the visioning document was developed. The TMP serves as a framework to continue to address these priorities and set the Nation up to realize its long-term goals. This document explores the steps that the Nation can take in the short, medium, and long term to build a transportation network that is safe and sustainable for all modes of travel.

2.1.4 HISTORICAL INFORMATION

This Transportation Master Plan is informed by the following historical reports and documents:

- Area Structure Plan (Urban Systems, 2017)
- Integrated Land Use Plan (Urban Systems, 2016)
- Enoch Master Servicing Plan – Visioning Document (Urban Systems, 2016)
- Enoch Environmental Overview (Urban Systems, 2015)
- Master Servicing Agreement (City of Edmonton)
- City of Edmonton Design and Construction Standards

2.2 Existing Transportation Network

2.2.1 EXISTING ROAD NETWORK

Enoch is bordered by Highway 628 (Whitemud Drive) to the north, Highway 627 to the south, Range Road 265 in Parkland County to the west, and 215 Street (Winterburn Road) in Edmonton to the east. Highway 60 runs north-south and bisects the Enoch lands. **Figure 2.2.1** illustrates the existing road network in the Village core and NEDA areas.

Highway 628 has an AADT of approximately 6,500 vehicles per day in the vicinity of the Enoch lands. It is currently an unimproved two-lane roadway with a cold mix surface between 215 Street and Highway 60 and a gravel surface west of Highway 60. This section of Highway 628 has a posted speed of 80 km/h. The intersection with Winterburn Road is signalized as is the intersection with Highway 60. The intersection with Range Road 265 is currently stop controlled. There are a number of private accesses directly onto Highway 628.

Highway 628 between Anthony Henday Drive and Highway 60 is planned for upgrading to a six-lane freeway cross section, with a posted speed of 100 km/h and interchanges at the 231 Street and Highway 60 intersections. Alberta Transportation mandates full access control on freeways, prohibiting at grade intersections. Local access to freeways is restricted within 3km of an existing or future interchange and prohibited within 1.6km of a freeway interchange. Development access is typically permitted greater than 1.6km away from an existing or future interchange provided the development is served by one-way highway exit and entrance ramps. These developments may also be serviced by a two-way service road providing the service road access is off an adjacent roadway, not off the highway. From Highway 60, west to Stony Plain, Highway 628 will be upgraded to a four-lane expressway standard. Development access is generally limited to right-in right-out access off of an expressway. All directional access is restricted to the minor roadway. Highway access will be removed at Range Road 262 (Pinchbeck Road) with the old alignment of Highway 628 kept as a service road to provide access to the Enoch lands.

Planning has been completed for the portion of Highway 628 between Anthony Henday Drive and Highway 60, but the construction is currently outside of AT's three-year construction program. Planning of the first stage of upgrade from Highway 60 west to Highway 779 has been completed and includes widening, realignment, and access relocation / consolidation. Design and land purchase for this section is currently underway but the construction is currently outside of AT's three-year construction program. The City of Edmonton's long-term traffic model indicates that the construction of the interchange at 231 Street will not be warranted until after the year 2020. Development adjacent to Highway 628 (whether by Enoch, Edmonton, Parkland County, or a developer) will require an assessment of the traffic volumes expected to be generated and whether improvements will be triggered by these developments. Through the servicing agreement dated August 6, 2009, Enoch has committed to contribute towards the total cost of future construction of one lane of Highway 628 (Whitemud Drive) between 215 Street and 231 Street, estimated at $3,900,000.

Highway 60 has an AADT of approximately 11,000 vehicles per day. Alberta Transportation had previously identified Highway 60 as a possible location for the future Edmonton Regional Ring Road. In recent conversations with AT, it has been indicated that this is no longer the case, and that the future Ring Road will be located further west, outside of Enoch's lands, pending further review by the Province. The relocation of the Regional Ring Road generally means that traffic volumes on Highway 60 will remain lower over the long term, resulting in a lower standard of roadway and less stringent access management requirements imposed by AT. Given this information, it has been assumed that Highway 60 will remain a major arterial standard roadway in the short and medium term, with existing at-grade intersections remaining at the current locations. Additional at-grade intersections would be at the discretion of AT on a case-by-case basis. The parcels of land adjacent to Highway 60 will continue to be serviced by the existing accesses and service roads.

Highway 627 (Garden Valley Road) has an AADT of approximately 6,200 vehicles per day. It is a two lane undivided paved highway with a posted speed of 100km/h and signals at the intersection of Highway 60. The intersection of 215 Street is stop controlled in the northbound/southbound directions and the Highway turns into 23 Avenue within Edmonton City limits, east of 215 Street. 23 Avenue provides a connection to the Cameron Heights neighbourhood in the City of Edmonton and Anthony Henday Drive.

215 Street (Winterburn Road) is a two lane undivided paved arterial roadway with a posted speed of 60km/h. It primarily provides access to the residential neighbourhoods in the City of Edmonton bordering the Enoch lands, as well as to the River Cree Resort and the Costco development and future commercial development to the west. Existing accesses onto 215 Street include Chief Lapotac Boulevard, the Costco access, 62 Avenue and 45 Avenue, with future accesses at 69 Avenue and Lessard Road, which are currently being planned and constructed. 62 Avenue provides an important connection from Enoch at 215 Street to the Anthony Henday and Callingwood Road/west Edmonton. Another key connection to Enoch Cree Nation is Lessard Road which is an Anthony Henday Interchange and connects into west Edmonton. Future arterial access to Enoch is identified at 62 Avenue and 35 Avenue. The land between these accesses is the Sand Hills area which has been identified as an area of cultural and environmental significance. ECN members and leadership have stressed the importance of protecting this area by restricting development and access, now and in the long term. The City of Edmonton has future plans to upgrade 215 Street in the vicinity of Enoch to a six-lane arterial standard, with two of those lanes designated for Enoch generated traffic.

The Master Servicing Agreement between Enoch and the City of Edmonton, outlines triggers for the construction of upgrades to 215 Street and Whitemud Drive and the responsibility of Enoch for contributing a proportionate share of the cost of the capital improvements associated with the development. Specifically, the agreement states that Enoch will bear the cost of a traffic study by an independent consultant when peak hour two-way development traffic volumes exceed 1,000 vehicles/hour on Whitemud Drive or 215 Street. The agreement also states that the cost for installation of traffic signals at the Chief Lapotac Boulevard / 215 Street intersection will be shared proportionately when peak traffic volumes reach 1,300 vehicles/hour. The installation of signals was completed in 2016 to address difficulty for vehicles exiting Chief Lapotac Boulevard due to high volumes of traffic on 215 Street. The signals at the Costco access were also re-timed in order to improve traffic flow in the area. As per the agreement, additional capital improvements will be required (and cost shared) once peak traffic volumes reach 1,971 vehicles per hour. A Traffic Impact Assessment was conducted in March 2014 for the Northeast Development Area, to quantify the traffic impacts of expected development adjacent to the 215 Street / Whitemud Drive intersection by Enoch and adjacent developers. The study estimated that the Enoch commercial development would include a bank, office buildings, a fast food restaurant, a gas bar with convenience store, retail centres, 231 apartment units, and 46 residential lots. Additionally, the Granville development to the east and the Rosenthal development to the north, within the City of Edmonton are expected to be completed, with approximately 1,560 residential units and 6.5 ha of commercial development. This TIA will be updated as the NEDA ASP is completed, as changes to the assumed land use for the area are anticipated.

In 2016, Enoch constructed Chief Lapotac Boulevard between the River Cree Resort and Range Road 261 to a two-lane paved standard to enhance access to the apartment units in the area as well as provide a connection between the NEDA area and the Village. This also serves as a secondary emergency access. It is anticipated that Chief Lapotac Boulevard will eventually be upgraded to a four-lane paved arterial standard and will serve as a major east-west connector within the Enoch lands.

In general, there is significant development ongoing and expected within Enoch and the surrounding municipalities. Some responsibility for the pressures placed on the existing roadway network and the cost of future upgrades can be attributed to each neighbouring development. As development in the area occurs, the affected road authority will require a TIA or similar traffic study to quantify the effects of the increased traffic generated by the development on the surrounding road network. A cost sharing framework should be developed to determine each municipalities / developers share of the financial responsibility for funding upgrades to the offsite roadway infrastructure.

Figure 2.2.1 *Existing Road Network*

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2.2.2 TRAVEL BEHAVIOUR

Transportation modal share is a measurement of the percentage of trips taken using different modes of transportation (walking, cycling, transit, and driving) and is an indicator of the sustainability of the transportation network within a city or region. A shift to more sustainable modes of transportation (walking, cycling, or transit) over driving can have a significant impact on public health and quality of life, while also reducing impacts to the natural environment and easing the pressure and cost of building and maintaining transportation infrastructure. People are enticed to shift modes when alternate modes of transportation are efficient, accessible, and comfortable.

Existing modal share data is typically collected through a household travel survey, which has not been conducted for Enoch specifically. As there is no existing transit service in Enoch and few pedestrian and cycling facilities, it can be assumed that most trips are made by private vehicle, particularly outside of the Village core. As Enoch plans to develop more commercial, institutional, and residential land use there is an opportunity to incorporate transportation facilities that encourage a healthy and sustainable modal share, including sidewalks and multi-use paths, separated bicycle facilities, and eventually a transit service when potential ridership grows enough to warrant it. A mix of land use, including neighbourhood commercial and institutional development within the Village provides services to Enoch residents within walking or cycling distance, as opposed to having to leave the Village or the Nation to obtain these services.

2.3 Future Transportation Network

2.3.1 FUTURE LAND USE AND POPULATION GROWTH

The residential, commercial, and institutional growth in the 20-year design horizon is expected to be largely contained within the NEDA and Village ASP areas, with some highway commercial and light industrial growth immediately west and north of the Village core.

An Annual Average Growth Rate of 2% has been selected as the most appropriate means of calculating the Nation's population and land needs over the next 100 years. ECN reported a 2015 total population of 2,518 people. The 2% Average Annual Growth Rate projects this population to reach an estimated 18,242 people by 2115.

It is proposed that, over the long term, approximately 70% of Enoch's total population will live on reserve. This would result in an on-Reserve population of 12,769 people in 2115, an increase of 11,096 people from 2015. As such, a significant amount of additional land will be needed to meet this increased demand for housing, employment, goods, services, and amenities.

The proposed area (by land use) that is required to support this growth is outlined in the *Master Servicing Plan Introduction*.

2.4 Implementation

2.4.1 SHORT TERM (5 YEARS)

Development is not expected to increase sufficiently to warrant intersection upgrades (turning lanes, signalization, or other improvements) or road widening in the short term (by the year 2022), based on estimated trip generation and calculated LOS. Transportation infrastructure upgrades in the short term should focus on upgrading of substandard roadways, development of a maintenance program to guide maintenance expenditures and prolong the lifespan of existing infrastructure, and constructing multi-modal linkages in areas where the demand exists.

Arena Road is the main connection between the Village core and Range Road 261 / Chief Lapotac Boulevard that provides connection to the River Cree Resort and the rest of the NEDA. Arena Road is constructed to a poorly-graded gravel standard and currently services approximately 1,300 vehicles/day. This is expected to increase to 8,400 vehicles/day within twenty years. Reconstruction of Arena Road between Range Road 261 and the Village core to a paved collector road standard (refer to *Section 2.5.3* for typical road cross-sections) is warranted within five years to support the expected growth and to provide a driving surface that is safe and passable for all modes of transportation in all weather conditions.

The development of a maintenance program in the short term will give ECN a framework for making decisions related to the expenditure of maintenance dollars, ensuring that the time and money spent on maintenance efforts delivers the greatest impact possible. Maintenance treatments and applications have a direct impact on the design life of a paved or gravel roadway and are an essential component of good management practice. The amount of maintenance required to keep a roadway at a planned serviceability level can be a measure of the effectiveness of programming, design, maintenance treatments, and/or construction quality. In turn, maintenance activities and expenditures provide feedback for programming, design, future maintenance and construction. For this reason, maintenance should be carefully planned, systematically implemented and well documented. Doing so can enable road managers to easily retrieve information, and accurately assess material costs, methods, and their effectiveness.

In general, there is a lack of pedestrian infrastructure throughout ECN. The Nation constructed a gravel pathway adjacent to a portion of Chief Lapotac Boulevard in 2016 to provide a safe connection on one of the most heavily used pedestrian routes (between the 108 unit apartment building and the River Cree Resort) and to keep pedestrian traffic off of the newly built roadway. Further pedestrian linkages should be built in key areas over the next five years. These areas include the Village core, NEDA, and the connection between the two, as these areas service the highest number of residents and the most traffic and provide the connections between home and other key destinations (school, work, shopping, etc). As Arena Road is upgraded to a collector standard, separated multi-use trails should be constructed adjacent to the road to provide a safe connection for pedestrians and cyclists. This pedestrian connection should be extended up Range Road 261 to make a connection to the existing Chief Lapotac Boulevard pathway system. This will complete the pedestrian connection between the Village and the NEDA. As roadways are upgraded or constructed throughout the Nation, they should include appropriate pedestrian and cycling infrastructure to support multi-modal connections as outlined further in *Sections 2.5.3* and *2.6.1.* **Figure 2.4.1** illustrates the ultimate pedestrian connectivity network for the Village and NEDA areas. It should be noted that this figure shows the main arterial and collector connections as well as multi-use trail connections intended to provide access to natural and culturally significant areas. All roadways should include the construction of appropriate pedestrian facilities as constructed to facilitate connection to these major routes.

2.4.2 MEDIUM TERM (20 YEARS)

A transportation impact assessment (TIA) was completed for the 20-year growth horizon to determine the impact of the forecasted growth on the existing road network and recommend improvements to support the growth and development of the Nation. A TIA is a planning tool for determining a proposed development's specific impact on the regional road network and the necessary timing, phasing, and extent required to support development. The TIA is intended to be a living document that will be referred back to and updated as the Enoch lands develop and the population grows. The detailed analysis is included in **Appendix A**.

The transportation analysis was conducted on the regional and internal road networks with the proposed 20-year land use based on the forecasted growth concentrated in the Village Core and NEDA site.

At the 20-year growth horizon, the Village Core and NEDA sites are expected to contain approximately 785 units with a mix of single-family, multi-family, school, and commercial developments. It is expected that approximately 2,200 vehicle trips will be generated in the peak morning period with 2,300 trips in the afternoon. It is assumed that as the lands approach full build out, trips would internalize to capture synergies between land uses within the community. Areas of mixed development (residential, commercial, and institutional) encourage trips to be made within the community as opposed to the majority of trips made to destinations outside of the community. This development also results in shorter trips which makes active transportation modes (walking or cycling) more efficient and inviting.

Traffic volumes for the study intersections were extracted from the Alberta Transportation web portal and used for the TIA. Trip distribution was assigned based on the Alberta Transportation data on Highway 60 at Highway 16A.

Traffic generated by the anticipated 20-year horizon build out was combined with the existing background traffic volumes to determine transportation upgrade triggers for the various transportation facilities throughout the staged development. The timing for improvements in the TIA is listed below.

The only warranted improvement noted in the traffic analysis is that the intersection of Highway 60 / Arena Road will require signalization by the 2037 horizon. It should be noted that this intersection is expected to fail under background traffic conditions (based on regional traffic growth, without accounting for Enoch development growth). This means that the north-south regional traffic on Highway 60 is expected to increase to a point where it will be nearly impossible to enter or exit the highway at this location without signalization.

2.4.3 LONG TERM (100 YEARS)

Figure 2.4.2 illustrates the anticipated ultimate roadway network and applicable classifications, based on the expected growth of ECN over the next 100 years. while **Figure 2.4.3** illustrates the ultimate roadway network specific to the Village core and NEDA area The proposed network is designed to support residential, institutional, and commercial growth which is expected to be centered in the Village core and NEDA in the short term and then the area between these areas in the longer term. The roadway network is designed to provide connection between these key areas in the short term, while eventually providing an arterial connection (Township Road 523) between 215 Street and Highway 60 and taking any through traffic away from the Village and developed areas. A balance of appropriately sized roads provide safe access to residential areas and amenity spaces and moves traffic safely and efficiently. Multi-modal facilities will be developed and expanded as new roadways are built and older roadways are rehabilitated, providing safe and efficient connections for all transportation modes.

Figure 2.4.1 *Pedestrian Connectivity Network*

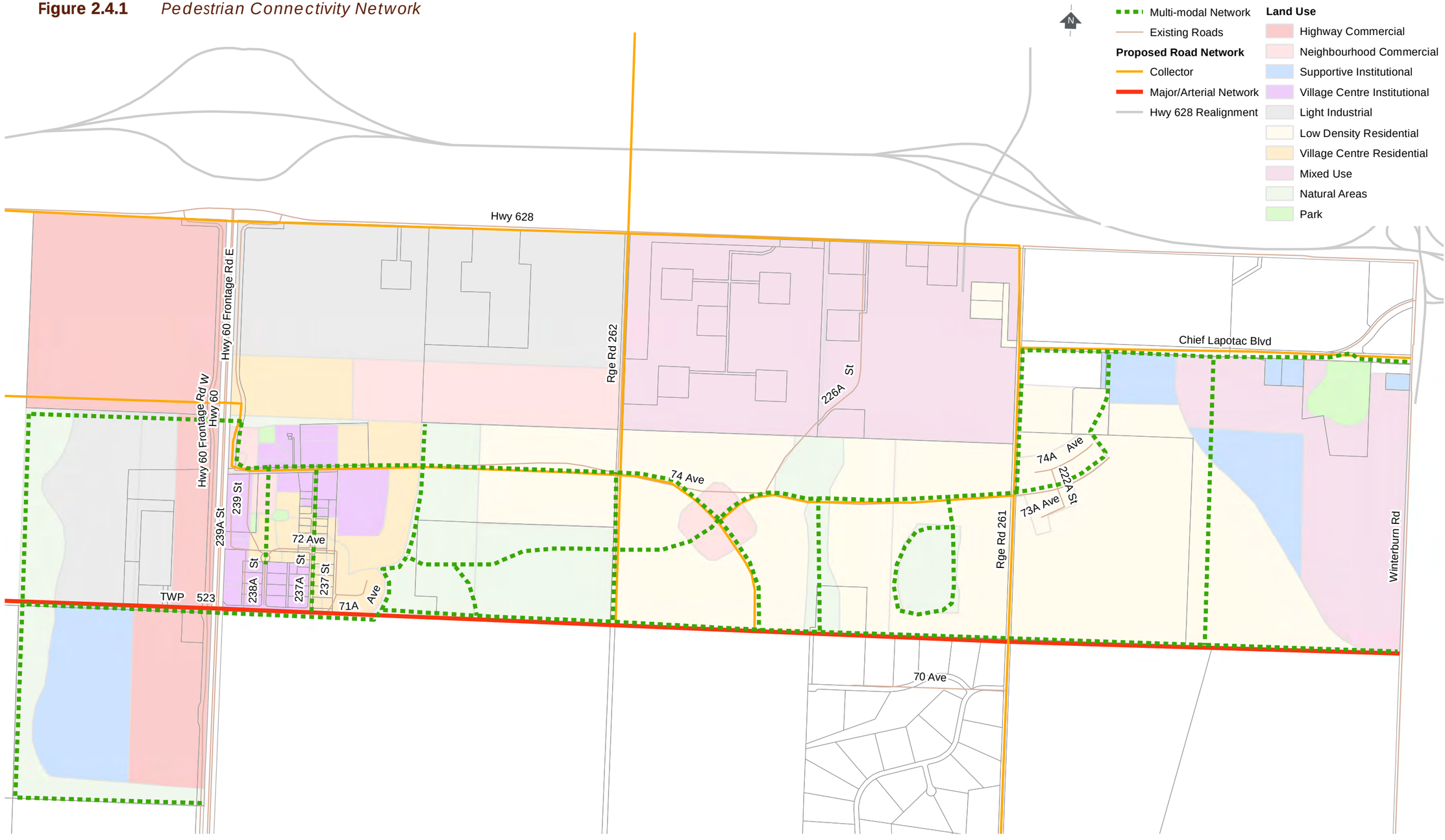

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Figure 2.4.2 *Proposed Ultimate Roadway Network*

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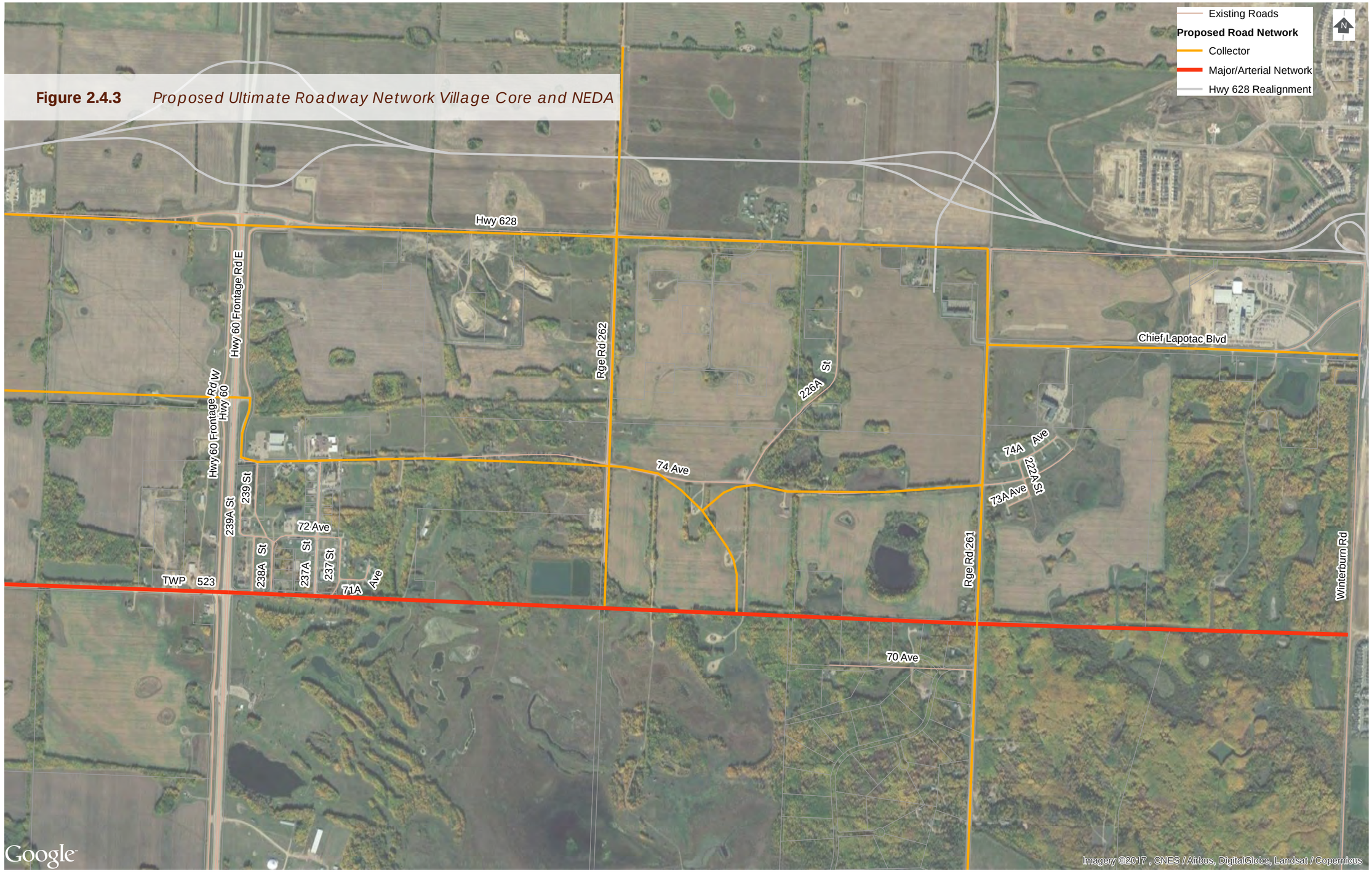
Figure 2.4.3 *Proposed Ultimate Roadway Network Village Core and NEDA*



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2.5 Road Standards

2.5.1 TRANSPORTATION HIERARCHY

The classification and designation of a roadway dictates the appropriate cross section and design criteria to be applied. A transportation hierarchy defines the design of the street based on the intended use, balancing the movement of people and goods with access to adjacent parcels of land. The classification of a roadway dictates the applicable road standards and cross section elements as well as the posted and design speeds.

ECN's transportation hierarchy includes arterial, collector, and local roadways as well as specialty cross sections specific to specialized areas.

The arterial roadway network typically services upwards of 5,000 vehicles per day and provides direct connections between communities or major destinations with traffic movement as the primary function. **Figure 2.5.1** illustrates the arterial roadway standard cross section.

The collector road network balances movement of traffic between arterial and local roadways and access to adjacent land uses. The collector road concept is designed to control vehicular traffic speeds, provide pedestrian and bicycle network connectivity, and preserve and enhance the natural features of the Nation (see **Figure 2.5.2** Collector Cross-section Concept).

The primary function of local roads is to provide access to adjacent land uses for automobiles, bicycles as well as pedestrians (see **Figures 2.5.3** and **2.5.4** Local Cross-section Concept). The urban cross-section is applicable to the areas within the Village core, with concrete curbs and sidewalks separated from the roadway by a treed and landscaped boulevard space. The rural cross-section option is applied to the residential areas east of the main Village core. This cross-section accommodates overland flow of drainage and maintenance of the natural features of the nation while also providing a separate space for pedestrians. These roadways are characterized by low traffic volumes and low speeds and form safer access for local residents. Treed boulevards, separate sidewalks, pedestrian scale lighting, and appropriately sized roadway widths encourage low speed traffic and increase safety and comfort for all traffic modes.

Complete Streets are safe, comfortable, and convenient for travel for everyone, regardless of age or ability – motorists, pedestrians, bicyclists, and public transportation riders. (*www.completestreets.org*)

Complete Streets are streets that are built for people. They reflect the surrounding area, are safe and welcoming to users of all ages and abilities traveling by all modes of transportation, and are important for the quality of life and growth of a community. ECN's road standards reflect the desire to implement Complete Streets principles on all new and rehabilitated roadway projects. Complete Streets are intended to:

- Provide travel options for all users and trip purposes in a safe, accessible, context sensitive manner in all seasons;
- Form a network of streets that together accommodate all users and allow for efficient and high quality travel experiences;
- Be adaptable by accommodating the needs of the present and future through effective space allocation for the many functions of the street;
- Contribute to the environmental sustainability and resiliency of the Nation; and
- Be vibrant and attractive people places in all seasons that contribute to an improved quality of life.

2.5.2 MINIMUM ROAD STANDARDS

ECN does not currently have infrastructure design and construction standards and has traditionally referred to standards from the City of Edmonton and other surrounding municipalities as well as relying on best engineering practices. It is recommended that a standards document be developed for ECN that is reflective of the unique cultural and environmental features of the Enoch lands and the desire to build infrastructure that best highlights and preserves these important features. A standards document ensures that any development (whether completed by the Nation or a third party developer) follows the same set of rules, ensuring consistency not only in the look and feel of infrastructure throughout the Nation but also ensuring that infrastructure is built to suitable standards and will last for as long as possible with minimum maintenance costs.

This section is not intended to be a comprehensive design standards document. It is only intended to highlight best practices that should be considered as transportation infrastructure is designed and constructed.

Roadway subgrade and pavement structures shall be based on results of a geotechnical investigation. A report shall be submitted specifying the required structure and all design factors including design traffic loading and the pavement design life. Roadways must be designed to meet or exceed these standards in accordance with good engineering practices and specific site conditions.

ECN completed a road signage standardization project in 2016 to select and install appropriate identifying road signage and building numbers. All future sign installation should comply with this new standard.

2.5.3 ALTERNATIVE / SPECIALTY ROAD CROSS SECTIONS

Specialty road cross sections have been developed to apply to specific areas, as identified through the development of the Village Area Structure Plan. The Main Street cross section (**Figure 2.5.5**) is applicable to 237 A Street and reflects a roadway with street oriented commercial development. It includes a separated bicycle facility as well as a wide pedestrian zone, curb extensions at intersections and mid-block crossings, and opportunity for parklets. This cross section is intended to encourage a balance of all modes of transportation and create a safe destination for people to shop, eat, and be entertained.

The pedestrian priority cross section (**Figure 2.5.6**) is applicable to Pedestrian Priority Overlay area. This cross section intertwines the pedestrian and vehicular zones, by using low-profile rolled curbs and textured pavement applications. The street is designed to encourage low speeds and comfortable movement of all roadway users.

2.5.4 MAINTENANCE CONSIDERATIONS

As previously outlined, development of a road maintenance program is recommended to ensure that the dollars invested in the construction and maintenance of roadway infrastructure is best utilized to extend the life cycle of the Nation's paved and gravel roadway infrastructure. A properly prepared maintenance program can also make the case for sufficient funding allocation.

Paved and gravel roadways serve different types and volumes of traffic and their use is applicable in different situations. An Average Annual Daily Traffic (AADT) volume of 200 vehicles/day is generally the minimum cost effective value considered for paving a roadway in Alberta. If traffic is less than this average (which is typical of rural roadways in the Nation that service a handful of residential properties) it is most cost effective to maintain them as a gravel surface and complete the necessary maintenance. Gravel surface maintenance includes grading, dust abatement, snow and ice control, regular inspections, and spot repair of pulling shoulders, drainage issues, and deep structure failures. Paved surfaces require less ongoing maintenance but repairs are generally more costly and if not properly maintained can result in more serious issues. Pavement distresses that require treatment include pot holes, subgrade failures, settlements, rutting, cracking, spalling, and raveling. A maintenance program ensures that all roadways are inspected regularly for these issues and recommends the appropriate (most cost effective) maintenance application to fix the issue and extend the life of the pavement.

Maintenance can be reactive (damage repair) or proactive (damage prevention). Development of a maintenance program ensures that maintenance dollars are appropriated effectively and roadways are maintained to a standard that is safe for all users.

Figure 2.5.1 *Arterial Cross Cross Section*

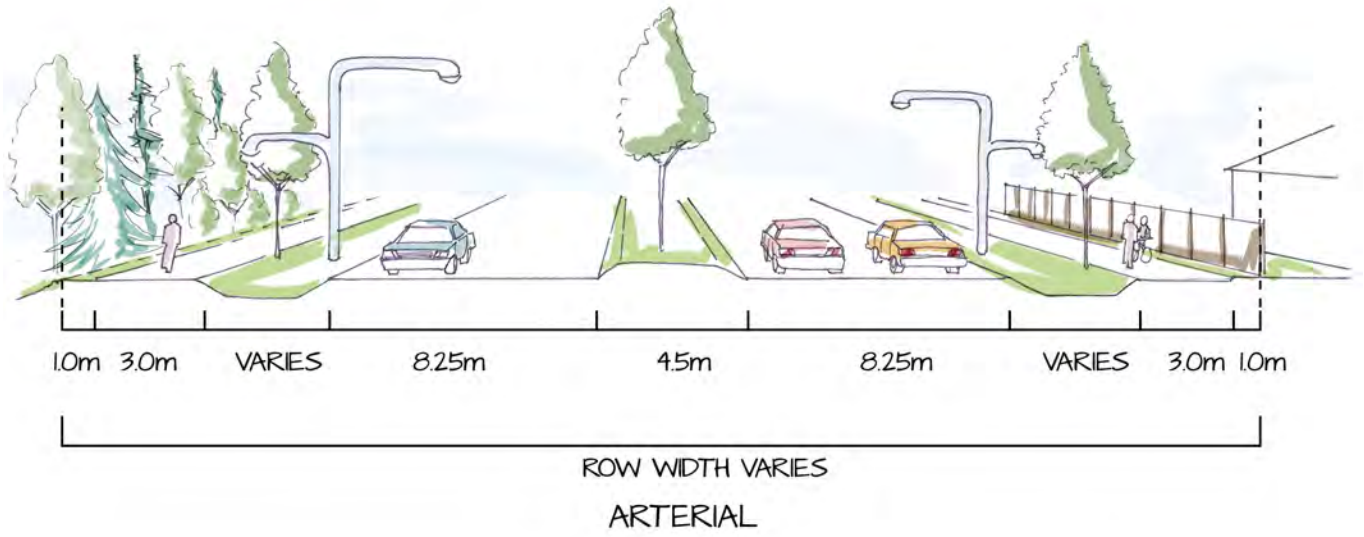


Figure 2.5.2 *Collector Cross Section*

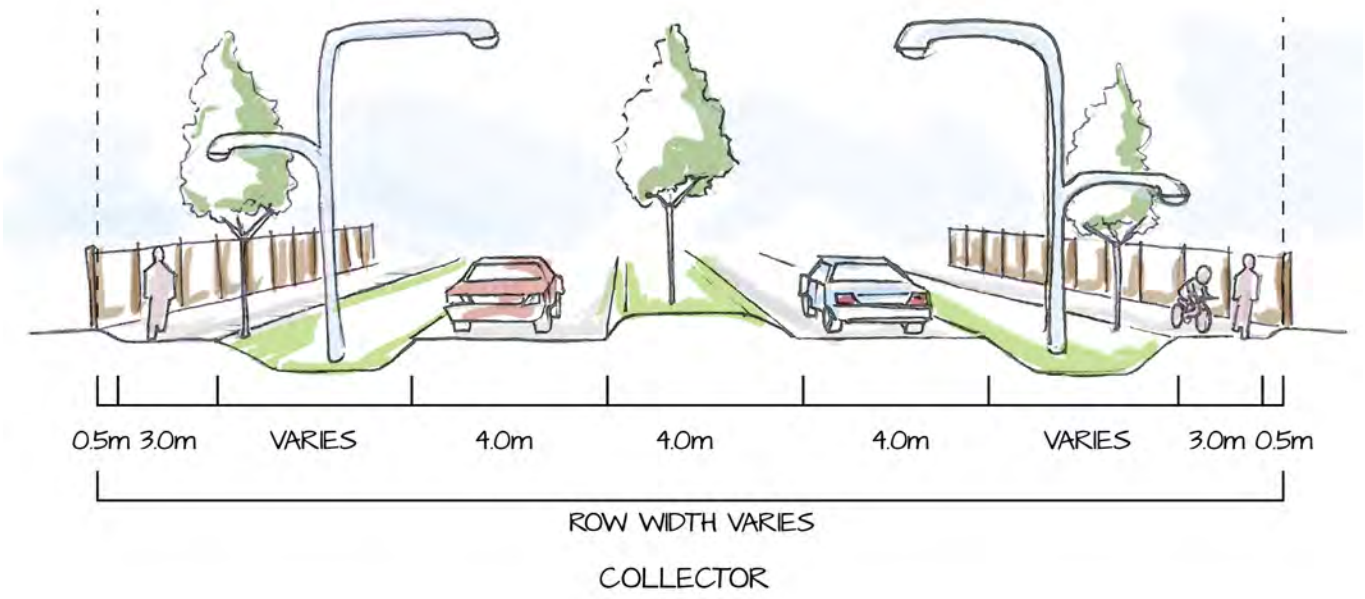


Figure 2.5.3 *Local Urban Cross Section*

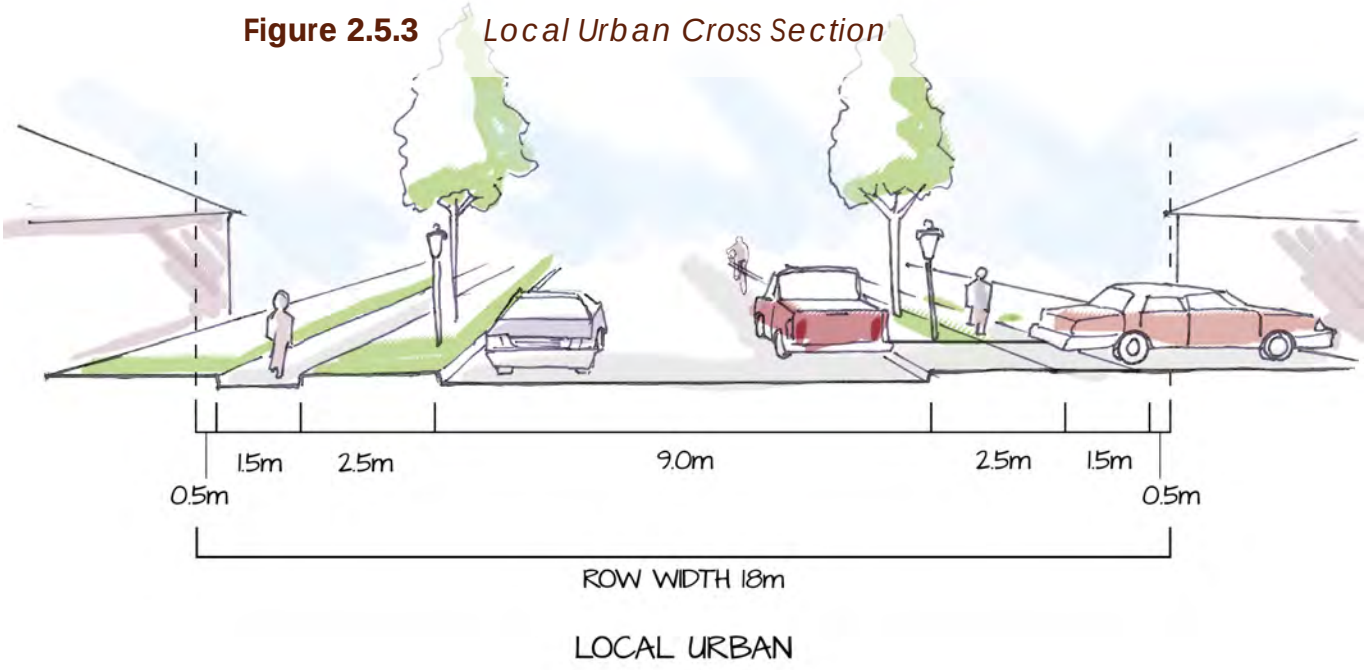


Figure 2.5.4 *Local Urban Rural Cross Section*

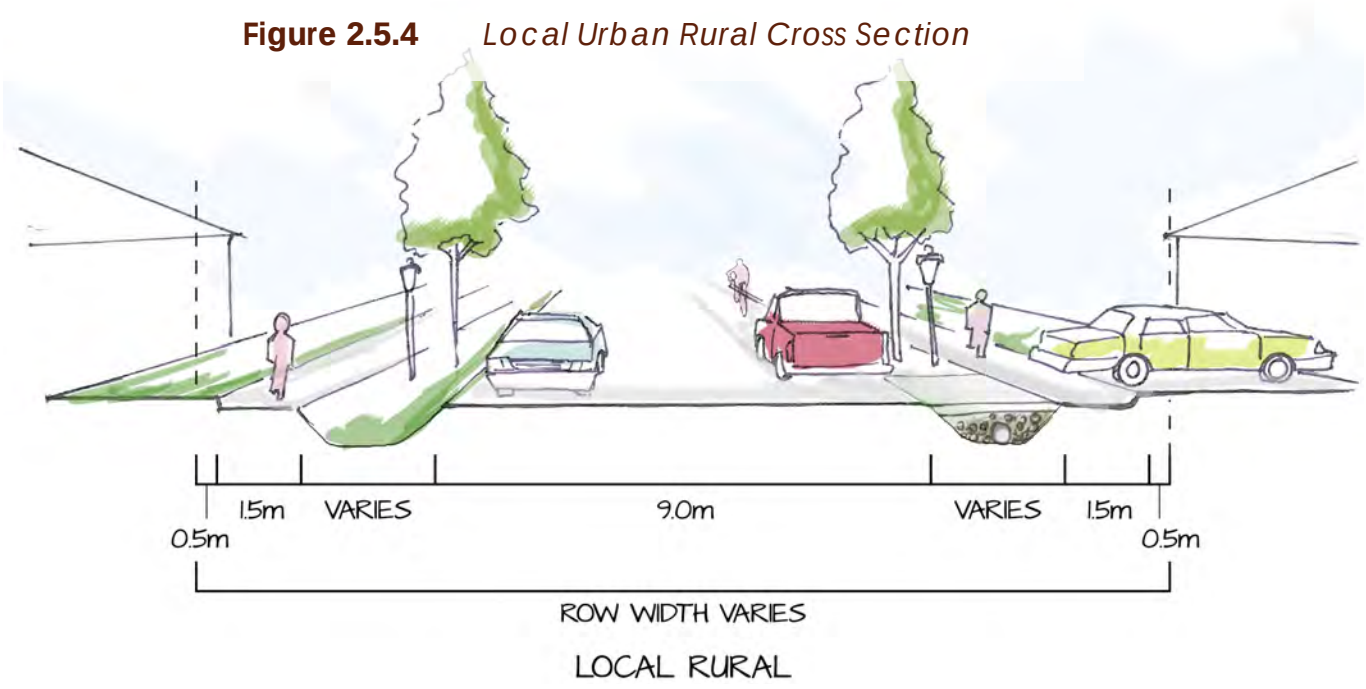


Figure 2.5.5 *Main Street Cross Section*

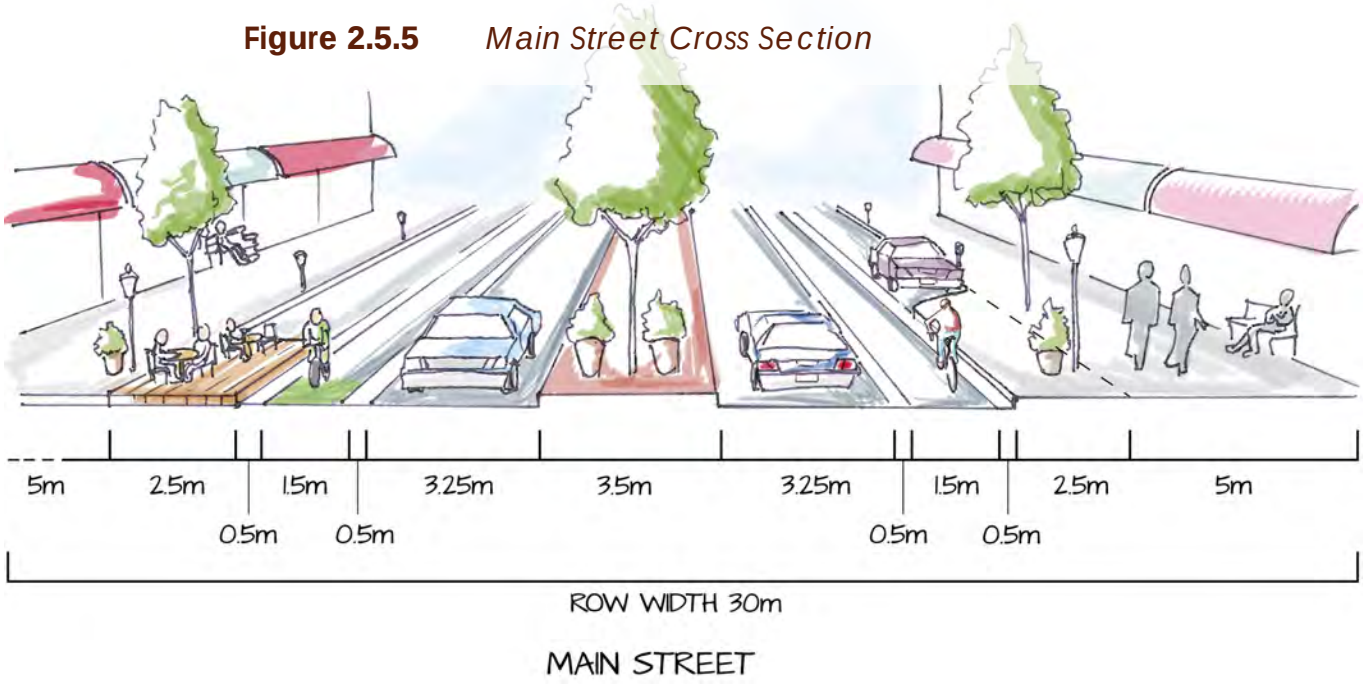
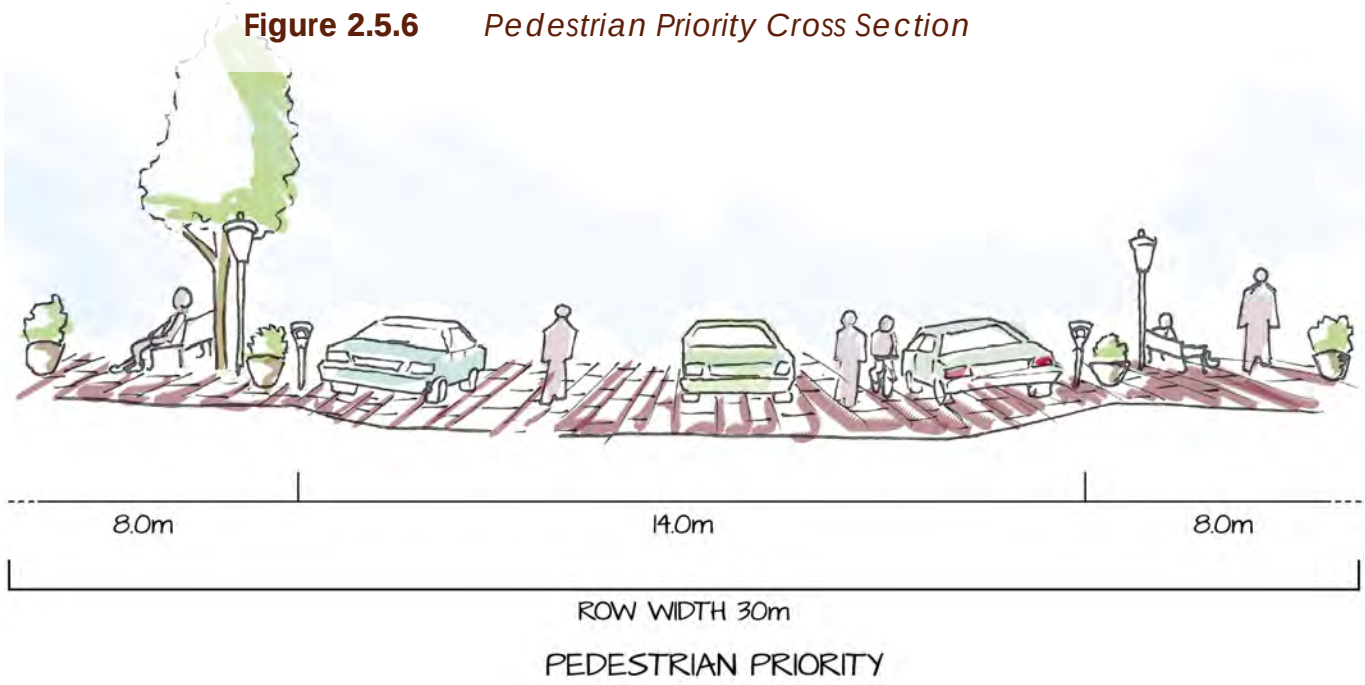


Figure 2.5.6 *Pedestrian Priority Cross Section*



2.6 Alternate Transportation Modes

"Numerous studies from Canada and around the world demonstrate a relationship between the physical design and layout of cities and towns – also known as "the built environment" – and the health of people living in them. Community form is associated with varying levels of physical activity, diet, safety and injury rates, and how easily people can access work, shops, services and schools. According to a 2009 report from the Canadian Senate, some 10% of population health outcomes can be attributable to our physical or built environment, with an additional 50% being related to social and economic determinants, many of which are deeply interconnected with environments. Hence, creating physical environments that facilitate healthy living is a critical component of supporting individuals in making better choices for their health."

Physical activity is among the most significant modifiable behaviours that can influence a person's likelihood of developing chronic diseases, such as diabetes, heart disease, stroke or cancer. Active transportation mode choice can provide a means for all community members to reach the recommended levels of daily physical activity that has been proven to be critical in the prevention of these chronic diseases. Recent Canadian research has associated the built environment, including active transportation and physical activity infrastructure, with more physically active lifestyles.

Healthy community design has been demonstrated to support health objectives, including facilitating physical activity, reducing injury risks for pedestrians and cyclists, and improving public safety and perceptions of safety. Community design alone may not make more active living the most prevalent choice for individuals. Changes to the built environment might need to be supported by communications and education programs to help shift the societal values that are associated with the daily choices people make about where to live, how to get around, and personal health.

Safe and pleasant routes for cyclists and pedestrians are key attractors for increasing active transportation mode share, and in turn increasing healthy outcomes for a community.

2.6.1 PEDESTRIAN CONNECTIVITY

A connected pedestrian system includes a continuous network of sidewalks or multi-use trails, separated from motorized traffic. Wherever possible, sidewalks should be included on both sides of the street and should be separated from traffic by a landscaped boulevard, furnishing zone, or other means of separation. Separation from vehicular traffic serves to increase safety for pedestrians as well as increase the level of comfort for pedestrians, in turn increasing the use of the pedestrian facilities.

As the roadway network in Enoch is constructed, rehabilitated, or otherwise enhanced, pedestrian facilities should be constructed as outlined in the applicable cross sections. Sidewalk connections should be added where there are missing links and handicap ramps should be installed at all crosswalk locations to facilitate safe crossing of roadways for pedestrians of all ages and abilities. Local roadways are to have a minimum 1.5 metre wide concrete sidewalk on each side of the road, separated from the roadway by a landscaped boulevard. Collector and arterial roadways are to include a 3.0 metre wide multi-use trail on each side of the road separated by a landscaped boulevard space.

Figure 2.4.1 illustrates the future multi-modal connectivity network, comprised of sidewalks and multi-use trails adjacent to roadways as well as a path system that provides access to culturally and environmentally significant features.

Curb extensions extend the line of the curb into the roadway, reducing the width of the street crossing for pedestrians and increasing the visibility of pedestrians to motorists. Curb extensions provide room for on-street parallel parking as well as opportunities for mid-block crossings or parklets where warranted.

2.6.2 CYCLING

A cycling network that is connected and comfortable for users of all ages and skill levels is critical to encourage use of the network. Bicycle facility type should be selected based on street classification, traffic volume, speed, and vehicle mix, topography, and adjacent land use. As motorized traffic speed and volumes increase, there is a significant impact on the comfort level of cyclists and it becomes increasingly important that a buffer or other means of physical separation between motor vehicles and cyclists is provided.

As the roadway network is constructed and/or rehabilitated a multi-use trail network should be constructed adjacent to the roadway to facilitate connections between the Village and the NEDA as well as to connect other areas as they develop and provide access to culturally or environmentally significant areas that the Nation intends to preserve. Continuous connection of cycling facilities, whether they are low volume streets, multi-use trails, or dedicated separated cycling facilities, provides a safe and comfortable transportation option for cyclist of all ages and abilities. Cycling mode share has been shown to increase dramatically when suitable cycling facilities are made available.

The completion of the connection between the Village and NEDA, via the upgrade of Arena Road, Range Road 261, and connection to the existing Chief Lapotac Boulevard, should be a priority connection as it has the potential to service the largest number of trips. Other connections can be added as development warrants.

2.6.3 TRANSIT

The current population of ECN is not yet large enough to warrant or support a dedicated transit service. It is however, important to consider other transit systems currently providing service in the vicinity of Enoch as well as the plans of adjacent municipalities and governing bodies when it comes to the development of regional transit service. Many small to medium sized municipalities struggle to provide a transit service that is cost effective as ridership as well as the density of development in these areas tends to be low. This results in more transit vehicle kilometers traveled to service fewer riders. It is also difficult to build ridership when trip distances are short, parking is free and abundant, and there is no traffic congestion, which is typical of smaller municipalities and the case in Enoch. A typical planning-level estimate of the average cost of operating a transit system in small to medium sized communities is $61 per transit service hour, compared to $96 per transit service hour in larger cities. Most of these systems are however heavily subsidized, with an average of 39% of operating costs recovered.

Transit offers independence and mobility to people who do not have other means of transportation, either by choice or necessity – seniors, children, students, persons with disabilities, and low income individuals and families, among others.

The Capital Region Board's Capital Region Intermunicipal Transit Network Plan, published in 2009, outlines a framework for the development and implementation of a public transit network for the Capital Region. The stated plan vision reads "The Region's transit network enables the Capital Region to achieve its economic, social, and environmental objectives by making transit a convenient and competitive mode of transportation". An intermunicipal bus route between Edmonton and Stony Plain along Highway 628 is identified in the plans long term network, as is a potential LRT connection to the west boundary of the City of Edmonton and a Park and Ride Lot near Anthony Henday Drive and Whitemud Drive. The Edmonton Transit System (ETS) operates transit service to the Edmonton neighborhoods adjacent to Enoch, including Rosenthal and Suder Greens north of Whitemud Drive and Glastonbury east of 215 Street. There is an existing

transit centre and park and ride lot at Lewis Farms, on Webber Green drive west of Anthony Henday Drive. There is not currently a transit route along 215 Street adjacent to the Enoch lands but there is an opportunity to discuss shared services with ETS if development occurs along 215 Street and the potential ridership demand warrants this service. ETS currently provides regional transit service to Fort Saskatchewan, Edmonton Garrison, and Spruce Grove, while St. Albert, Strathcona County, and Leduc operate their own local bus services with commuter bus service to and from Edmonton. Opportunities should be explored to collaborate with the Capital Region Board and the City of Edmonton to leverage their existing and planned transit networks.

These networks provide access to the communities surrounding ECN but do not address any demand for transit within ECN. It is projected that the on-reserve population of ECN will surpass 2,500 people by the 20 year study horizon (2037). It is recommended that a transit study be conducted at this stage to understand whether or not there is sufficient demand for a pilot transit project. A small scale shuttle service between the Village and NEDA area that also provides access to adjacent transit hubs (park and ride lots supporting Edmonton Transit and LRT service) during peak hours may be warranted at this stage and may help to provide mobility to those residents that do not drive or cannot make use of active transportation opportunities.

2.6.4 AUTONOMOUS VEHICLE TECHNOLOGY

The scale of technological innovation can radically reshape the way we live and move about communities. Like the three urban transportation revolutions that preceded it (the introduction of the urban streetcar, popularization of the motorcar, and construction of freeways, a new AV reality will both broaden possibilities and present new threats to the established order.

Amongst other implications, autonomous vehicles extend the freedom of personal mobility to those who cannot or are unwilling to drive such as the visually impaired and youth under the age of 16; additionally, AVs could provide new mobility options for those without access to an automobile. As 90% of vehicle collisions are a result of human error, research suggests that autonomous vehicles can significantly reduce the 112,000 fatal and personal injury collisions that occur across Canada each year.[1] Further, autonomous vehicles are projected to significantly improve roadway operations. As an example, by allowing for a significant reduction in vehicle following distance, research suggests that full AV operations can theoretically increase freeway lane capacities by 80%.[2]

Perhaps the most far-reaching implication, however, is how the technology will enable people to reclaim their time. Instead of driving, travellers could spend their travel time increasing their productivity during their journey. While this may be a benefit on a personal level, collectively this may result in reduced distance friction and significantly add greater pressures on roadways as individuals rethink whether it's necessary to live within or near urban cores.

While the specifics of Enoch's transportation system and population growth in 100 years is ambiguous, what is eminently clear is that the way people will get around in 25 to 100 years will be very different from the way people are getting around today. These changed realities will have significant impacts on land use patterns, vehicle ownership, travel demand, and public transit systems, all of which have implications for long range infrastructural decisions being made today.

1 Transport Canada: Canadian Motor Vehicle Traffic Collision Statistics (2014).
2 Preparing a Nation for Autonomous Vehicles. Fagnant and Kockelman (2015).

Depending on municipal, regional, and provincial policies, the introduction of AVs may result in significantly increased pressures on the roadway network, extensive exurban sprawl, and the hollowing out of urban transit services or conversely, a widescale reduction of total vehicles in the network and strong support for regional transit. As an example, theoretical studies in the US and Europe have noted that the same levels of mobility being provided today by personal vehicles could be provided by shared autonomous vehicles with only 10 to 15% of the total vehicle fleet.[3] The implications of this shift on right-of-way reutilization (re-allocation of on-street parking lanes), home design (garages not required), re-use of land dedicated to parking (development or sale of parking lots), and sustainability are enormous for any community.

As with all communities, Enoch has a choice at this juncture: it can plan proactively or wait and react when the facts on the ground have already changed. Planning proactively means gaining a broader understanding of the trends as they present themselves and scoping out wide-ranging policies that are in line with the Community's core strategic objectives. Recognizing that there is much to gain or lose, strong direction should be established to capitalize on opportunities and mitigate challenges.

3 Urban Mobility System Upgrade: How shared self-driving cars could change city traffic (OECD, 2015)

2.7 Summary & Recommendations

The following capital projects and infrastructure management strategies are recommended in the short, medium, and long term to ensure that the transportation network will continue to handle the expected population growth.

Short Term (5 Years):

- Upgrade Arena Road to a paved collector standard suitable to handle the existing traffic volumes.
- Develop a comprehensive maintenance program to ensure that maintenance efforts/dollars are used appropriately and to extend the longevity of existing and future roadways.
- Complete a multi-modal connection between the Village and NEDA areas and continue to expand the multi-modal network as roadways are constructed or rehabilitated.
- Develop a design and construction standards document to ensure that all future infrastructure is built to a suitable and consistent standard that will ensure the longevity of the infrastructure with minimal maintenance costs.

Medium Term (20 Years):

- The intersection of Highway 60 / Arena Road will require signalization by the 20 Year design horizon based solely on background traffic growth.
- Conduct a comprehensive transit feasibility study to explore the opportunities for a small-scale transit pilot project and/or connections to regional transit initiatives.
- Explore opportunities to become leaders in autonomous vehicle innovation. Recognize that autonomous vehicle technology is poised to have a profound impact on how people think about transportation and how we build roadway infrastructure to suit. Consider ways to integrate autonomous vehicle technology with mass transit or shuttle service operations to reduce the reliance on vehicle ownership.

Long Term (100 Years):

- Develop a network of appropriately sized local, collector, and arterial roadways as outlined in the ultimate road network plan, and further detailed in the Village and NEDA area structure plans that supports the growth of the Nation and allows for safe and efficient multi-modal travel for people of all ages and abilities.

3. Water Master Plan

3.1 Introduction

As the Enoch Cree Nation (ECN) community grows, its needs for a reliable water distribution system become apparent. In recent years, the community has been struggling to provide its members with a reliable source of potable water, particularly in the Village, where Health Canada Drinking Water Quality standards are currently not being met.

The Water Master Plan is intended as a short- to long-term plan to guide the development of water distribution infrastructure to support the goals and objectives of Enoch Cree Nation (ECN), specifically the growth and development of the community. This plan takes a look at existing infrastructure and its condition, projected water needs, and develops options for the Nation to consider.

3.1.1 PURPOSE OF WATER MASTER PLAN

The main objectives of the Water Master Plan include:

- To establish service delivery goals that result in system performance standards based on achieving community-wide sustainability goals.
- To establish short- and long-term priorities to guide the Nation through capital investment requirements to maintain an adequate potable water system.
- To analyze the performance of existing infrastructure and the requirements for future servicing relative to meeting service delivery goals.
- To provide recommendations for utility management and infrastructure planning strategies to address and achieve the proposed service delivery goals.

3.1.2 LEVELS OF SERVICE

3.1.2.1 Typical Level of Service (for surrounding municipalities)

A typical level of service for municipalities surrounding ECN consist of a piped potable water system which provides water that meets the quality guidelines set out in the Health Canada “Guidelines for Canadian Drinking Water Quality”. The system has sufficient quantity and pressure to meet community demands both for domestic and fire protection requirements. Efficient water use is encouraged through metering, rate structures and education.

Levels of service are a defined set of standards and services that a community adopts as performance expectations from its infrastructure systems. These levels of service inform how infrastructure is designed, operated, maintained, repaired and upgraded or replaced.

3.1.2.2 Currently Achieved Water Level of Service in Enoch

ECN currently provides a piped water service to members in the Village and NEDA areas, and a trucked delivery service to rural members. Water servicein NEDA is connected to EPCOR through a City of Edmonton connection and currently meets typical levels of service of surrounding municipalities. The Villagehas a separate piped water system supplied by five shallow aquifer wells and treated on-site at a water treatment plant. the Village is not meeting the above levels of service on several fronts. The raw water supply is suspected to be vulnerable to direct influence of surface water and the current treatment plant processes do not account for this. Health Canada water sampling results show elevated levels of arsenic, iron, manganese, and turbidity that exceed the Canadian Guidelines for Drinking Water Quality. Additionally, the reservoir currently does not meet fire and domestic storage requirements nor does it provide sufficient contact time for disinfection. At the time of preparation of this report, ECN was in the process of extending their NEDA water system to supply water to the Village, in order to improve the level of service and allow for the abandonment of the current wells. This is discussed in detail in further sections.

3.1.3 SERVICE DELIVERY GOALS

Achieving service delivery goals for the Nation's water service requires a combination of utility operational and infrastructure development strategies. Establishing service delivery goals for the water service will help focus and prioritize the efforts and investments both in the on-going operation and maintenance of the systems and the capital investments in infrastructure improvements.

The focus of this Master Plan is to develop a plan for infrastructure renewal and development that is based on achieving the service delivery goals of the utilities. Although not comprehensively addressed in this study, utility management and operational strategies that are required to achieve the service delivery goals of the water system are also identified.

3.1.3.1 Water Quality

ECN's goal in terms of water quality level of service is to exceed regulatory requirements and ensure that the aesthetics and quality of the water meets or exceeds the Canadian Drinking Water Guidelines 100% of the time. This translates into receiving less than two (2) complaints per year regarding the quality of the water provided, and ensuring that there are zero test results that would indicate that regulatory requirements are not being met.

In order to reach the goals of water quality, a number of utility management and infrastructure strategies are put in place. These include:

1. Employ trained and certified staff for the operation and maintenance of potable water infrastructure.
2. Use state of the art technology and monitoring the operation of the system continuously.
3. Maintain proactive education and communication with new and existing customers to build and preserve confidence.
4. Maintain adequate control over cross-connections and preventing back-flow.
5. Ensure there are no negative pressures in the system.
6. Minimize system breaks by maintaining adequate pressures through the network and ensuring aged or damaged infrastructure is replaced promptly.
7. Monitor system storage and chlorine residual levels.
8. Ensure a permanent connection to EPCOR water for short- and long-term growth of the Nation.

3.1.3.2 Water Quantity

Water conservation is a key issue for ECN, when establishing service delivery goals. The Nation is encouraged to implement water conservation initiatives including being a fully metered community, considering a tiered water rate system (meaning the more you use, the more you pay), toilet rebate programs, the use of conservation officers, time of day watering restrictions, and naturescape requirements for commercial and industrial landscaping.

Based on the above, the Nation's service delivery goal with respect to water quantity is to provide approximately 380 L/c/d of maximum daily residential water usage, giving priority to fulfilling indoor domestic water needs 100% of the time.

In order to reach the goals of water quantity, a number of utility management and infrastructure strategies can be put in place. These include:

1. Implement water conservation initiatives, which include a tiered utility rate structure, toilet rebate programs, conservation communication and education programs, and Level 1 water-use restrictions.
2. Undertake an audit to identify the main causes of losses within the system and ensure all these losses are accounted for.
3. Minimize losses and leaks within the system, and continuously monitor and keep records of system performance (pumping and pipe breaks).
4. Once installed, provide adequate maintenance to water meters to ensure proper functionality.
5. Explore grey water re-use options as additional means for conservation.
6. Conduct risk assessments that include risks of failure and consequence ranking.
7. Ensure reservoirs in the system have enough capacity to provide both peak hour storage and emergency storage.
8. Explore effluent re-use options as an additional means of conservation.
9. Explore stormwater re-use options as an additional means of conservation.

3.1.3.3 Water Pressure

From discussions with Nation members and key stakeholders, it was determined that the system should be designed and operated based on City of Edmonton's (EPCOR) Design and Construction Standards. As a result, the service delivery goal established in terms of water pressure is to provide minimum operating pressures for all new developments of 280 kPa (40 psi) under peak hourly demand conditions and a maximum operating pressure of 550 kPa (80psi) under average daily demand conditions.

Even when system pressure is provided to customers within the City of Edmonton standard, there can still be some concerns expressed from customers regarding water pressure. These concerns can result from pressures declining over time in development areas as more users increase the water demand in the system and reduce the system delivery pressure. Also, some issues can arise from the differences in pressure experiences in different areas of the community. The following utility infrastructure management strategies include approaches to reducing these concerns.

1. Educate and communicate with residents and developers on the eventual decline in system pressures in new development areas and the difference in pressures for different areas of the Nation.
2. Avoid providing higher system pressure on early phases of new developments simply because the system has the capacity to provide the additional pressure.
3. Monitor operating pressures throughout the system.
4. Establish minimum operating pressures as per City of Edmonton Standards and adopt as part of the Nation's design and construction standards for new development.

3.1.3.4 Fire Protection

Appropriate emphasis need to be placed upon the Nation's ability to provide adequate water to control fires on a reliable basis via sufficient and suitable hydrants. The Nation's ultimate goal is to adopt a criterion for fire flow requirements and hydrant spacing as outlined in the Fire Underwriters Survey (FUS), which summarizes the most significant recommendations with respect to fire protection requirements in municipal water works system design. Fire flow requirements are determined based on building area, construction type and usage. Minimum fire flow requirements are detailed in subsequent sections.

The FUS also specifies that hydrants should be located at intersections, in the middle of long blocks and at the end of dead-end streets. The maximum recommended spacing between hydrants in commercial, industrial, institutional and multi-family residential areas is 90 meters. In single-family residential areas, 180 meters is recommended.

In order to achieve the goal of adopting the FUS recommendations for fire protection throughout the entire system, the Nation should adopt the following utility management and infrastructure planning strategies:

1. Conduct passive upgrades of the water distribution system to meet fire flow requirements within existing developments.
2. Review operational strategies that may lead to a maximization of fire flows within the network.
3. Provide adequate fire flow storage in all system reservoirs.
4. Ensure hydrant spacing meets the minimum requirements within existing and future developments.
5. Conduct fire flow risk assessments or ranking based on how close the Town is currently meeting the specified targets, develop back-up strategies and determine possible consequences.

3.1.3.5 Service Reliability

The Nation's water distribution system must be reliable. This means that service should be available when desired, and that the users have uninterrupted service that meets their expectations on pressure and flow availability. The service reliability goal for the Nation is defined by the following level of service statements:

1. Keep pipe breaks to a minimum on secondary, small diameter, or looped pipes that can be isolated. No breaks should be acceptable on larger diameter pipes, or mains that cannot be shut down.
2. In the event of interruptions, regardless of their cause, the Nation should restore service within 8 hours, or otherwise a temporary supply is to be provided.
3. For planned outages, the Nation should notify users 48 hours in advance, and the services should not be interrupted for more than 8 hours. Temporary supply should be provided for planned outages lasting longer than 8 hours.
4. When prioritizing system upgrades and operations to ensure system reliability, high priority service customers should be considered. These include schools, institutions and commercial businesses that require water to provide service.

In order to achieve the above service reliability goals, the Nation should adopt the following utility management and infrastructure planning strategies:

1. Contractors should be required to establish temporary services during construction when outages will last longer than 8 hours.
2. Risk of failure assessments and prioritization of required upgrades should be conducted for mains within the system. This analysis is performed as part of this study.
3. Risk of failure assessments and prioritization should also be conducted for pumps within the system. Develop facility management plans to determine infrastructure renewal needs for the various components for water facilities. Review system redundancy to ensure pumping systems will meet design flows when largest pump is out of service.

3.1.3.6 Capacity for Growth

Distribution system upgrades will need to be identified to ensure that the water utility can provide the necessary capacity for growth. In order to achieve this goal, planning for growth should be done based on the Nation's long-term growth plan. Additionally, responsible growth management demands that the Nation make every effort to meet the needs of the growing population, using its land base and existing infrastructure systems efficiently. Growth needs to be managed in a way that enables the Nation to provide and maintain adequate public services.

Regular infrastructure planning exercises are essential to maintain up to date knowledge of upgrade requirements for existing infrastructure to meet the current growth plans and patterns of development. Infrastructure planning strategies should be developed and regularly updated for all components of the water system, including reservoirs, pump stations and the distribution network. It is also key to have a good understanding of the timing of development and upgrade requirements.

In order to achieve the above service delivery goal to provide capacity for growth, the Nation should adopt the following utility management and infrastructure planning strategies:

1. Undertake regular updates to master servicing plans to ensure the water system will meet the needs of growth and development patterns.
2. Prepare prioritized capital upgrade plans that will ensure infrastructure upgrades that are necessary to accommodate growth are planned along with a financial strategy to fund the capital costs of the projects.
3. Ensure water demand strategies are integrated into development standards to ensure that water is used efficiently.
4. Identify necessary oversizing to be undertaken by development to ensure infrastructure capacity provided for overall growth of the Nation.
5. Investigate possible water re-use strategies that will reduce the demand for water supply and distribution capacity.

3.1.3.7 Environmental Impact

The Nation should be committed to responsible management of its natural resources and economical assets. Part of ECN's vision is to be a community that protects its water resources through effective conservation policies and practices, has effective water management policies and uses renewable energies to reduce its dependence on fossil fuels. It is also within the Nation's goals to encourage low-impact non-polluting industries and ensure environmental stewardship in all aspects of utility management and infrastructure planning.

To achieve this goal, utility management and infrastructure planning strategies include:

1. Undertaking energy audits to identify possible areas for energy efficiency improvements.
2. Evaluating infrastructure improvement needs on a triple bottom line basis including financial, system performance and impacts to the environment.
3. Implementing a comprehensive approach to water conservation and demand management.
4. Enforcing best management practices such as the removal of chlorine residuals prior to discharging to a stream and appropriate residuals handling in future designs.
5. Including in risk analysis of infrastructure failure the potential impact to the environment that could result from failure.
6. Developing standards for design and construction of infrastructure that minimize energy usage, consider renewable energy options, minimize impacts and risk of impacts to the environment, consider water re-use and water reduction options, and investigate options for waste reduction.

3.1.3.8 Financial Effectiveness

Understanding the full costs associated with providing potable water to the community is key in strategic decision-making, and to ensure the system remains sustainable for existing and future development. It also provides the foundation for a healthy, prosperous and resilient financial status. The Nation's goal is to implement principles of full cost recovery through appropriate methods of cost allocation and funding.

In order to achieve the goal of financial effectiveness, the Nation should adopt the following utility management and infrastructure planning strategies:

1. Conduct long-term planning that incorporates forecasting construction, operation and maintenance costs, prioritizing and staging of upgrades and identifying funding mechanisms to support the upgrade plans.
2. Improve the operational efficiency of the system.
3. Minimize water losses and leakage within the system.
4. Ensure proper operation, maintenance and replacement of water meters (when installed).
5. Consider life-cycle costs of infrastructure when determining infrastructure design standards and strategies.
6. Educate customers on costs of water service.

3.1.4 WATER SERVICE SHORT- AND LONG-TERM PRIORITIES

To achieve the aforementioned service delivery goals, the following short- and long-term priorities have been identified. These were derived from visioning sessions, discussions and workshops with the Nation. It is with these priorities in mind that the following short- and long-term recommendations for the water infrastructure were made.

3.1.4.1 Short-Term Priorities

A reliable and clean water source is available to all Nation members

- Establish water management plans in conjunction with the NEDA and Village ASPs.
- Amend the Master Servicing Agreement with the City of Edmonton to allow for service to the Village.
- Connect the rest of the Nation to the City of Edmonton water system through the extension of a distribution line from the NEDA to the Village area.
- Provide an acceptable level of service (operating pressures and fire flow availability) to all urban members.
- Establish a truck fill station in the Village area to service rural members and reduce truck haul trips.

3.1.4.2 Long-Term Priorities

Water is conserved and most efficiently used, with source quality meeting the needs of the end user

- Meter all water uses and conduct annual audits of water use so that water system inefficiencies can be minimized.
- Explore an additional potable water connection, either to the CRPWSC or West Inter Lake District (WILD) regional water transmission pipelines, for redundancy as growth dictates.
- Educate members in water conservation and actively strive to reduce consumption.
- Implement development and housing regulations that require low-flow water fixtures and toilets for all new developments.
- Implement landscaping techniques that are water efficient (e.g. xeriscaping) and water absorbent (e.g. low impact development).
- Explore water reuse for activities such as toilet flushing and irrigation to reduce potable water consumption from EPCOR.

3.2 Water System

Analysis & Assessments

This section describes performance analyses results for the Nation's existing water distribution system, and servicing requirements for future developments, in the context of the service delivery goals established in previous sections. This includes a description of analysis criteria, storage, pumping and distribution capacity assessments, and medium- and long-term system requirements.

3.2.1 ANALYSIS CRITERIA AND ASSUMPTIONS

3.2.1.1 Computer Modeling

Modeling of the existing and future distribution network was performed in WaterCAD Version 8i. The software simulates flow and pressure in a pipe network using information such as:

- Pipe material, length, nominal size;
- Pump performance data;
- Reservoir dimensions and elevations;
- Contour data;
- Demand Information;
- Fire flow requirements;
- Spatial coordinates.

The information was obtained from a variety of sources including as-constructed drawings and operation data. The model requires accurate information to provide a reliable estimate of performance, thus, data collection was a critical part of the modeling process.

Typically, the simulated network does not match the complexity of the real-world situation. Model systems are typically simplified simulations of the actual situation and the results are approximations of actual system pressures and flows. The real-world situation is reduced to a smaller subset of pipes that still represents the major system elements and produces reliable albeit approximate results. For example, building service connections are not included in the model, as the demand from individual users is too small to impact the overall calculated results. Individual user demands are combined to produce a larger aggregate total which is input into the model. Only distribution mains need to be represented at this level of analysis.

The model is used to analyze the performance of the existing distribution network, in the context of the service delivery goals established in previous sections. The model is also used to analyze the future impact of new development on the existing distribution network, and to predict future requirements.

3.2.1.2 Design Criteria and Assumptions

Based on the service delivery goals established in previous sections, the following criteria and assumptions were made in order to evaluate existing system performance and determine water infrastructure needs for the projected growth of the Nation:

Table 3.2.1 – Water Demands and Pressure Requirements

Category	Value	Units
Residential ADD	225	L/cap/day
Comm., Inst., Ind. ADD	15	m3/ha/day
MDD/ADD Ratio	1.7	
PHD/ADD Ratio	3	
MDD + Fire Flow (minimum pressure)	140 (20)	kPa (psi)
Minimum pressure under Peak Hour Demand	280 (40)	kPa (psi)
Maximum Pressure under Average Day Demand	550 (80)	kPa (psi)

Determining required fire flows for various structures requires information on building construction materials, building utilization and size information that is, in most cases not inventoried by the Nation. Assumed fire flows for building types were used in the model in lieu of specific building ratings. The fire flows used and the recommended fire flow ranges were obtained from the 1991 Fire Underwriters Survey (FUS) for public fire protection. The FUS defines fire flows and their required duration as the amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings, which comprise essentially the same fire area by virtue of immediate exposure. Recommended fire flow ranges as obtained from the FUS are as follows:

Table 3.2.2 – Fire Flow Requirements (FUS)

Category	Value (L/s)	Duration (hours)
Residential, Single Detached	75	1.75
Residential, Multi-Family	180*	2.00
Schools, Institutional Building	180	3.00
Commercial/Light Industrial	230	3.00

*Certain types of multi-family may require higher fire flows depending on type of construction

3.2.2 EXISTING WATER DISTRIBUTION SYSTEM

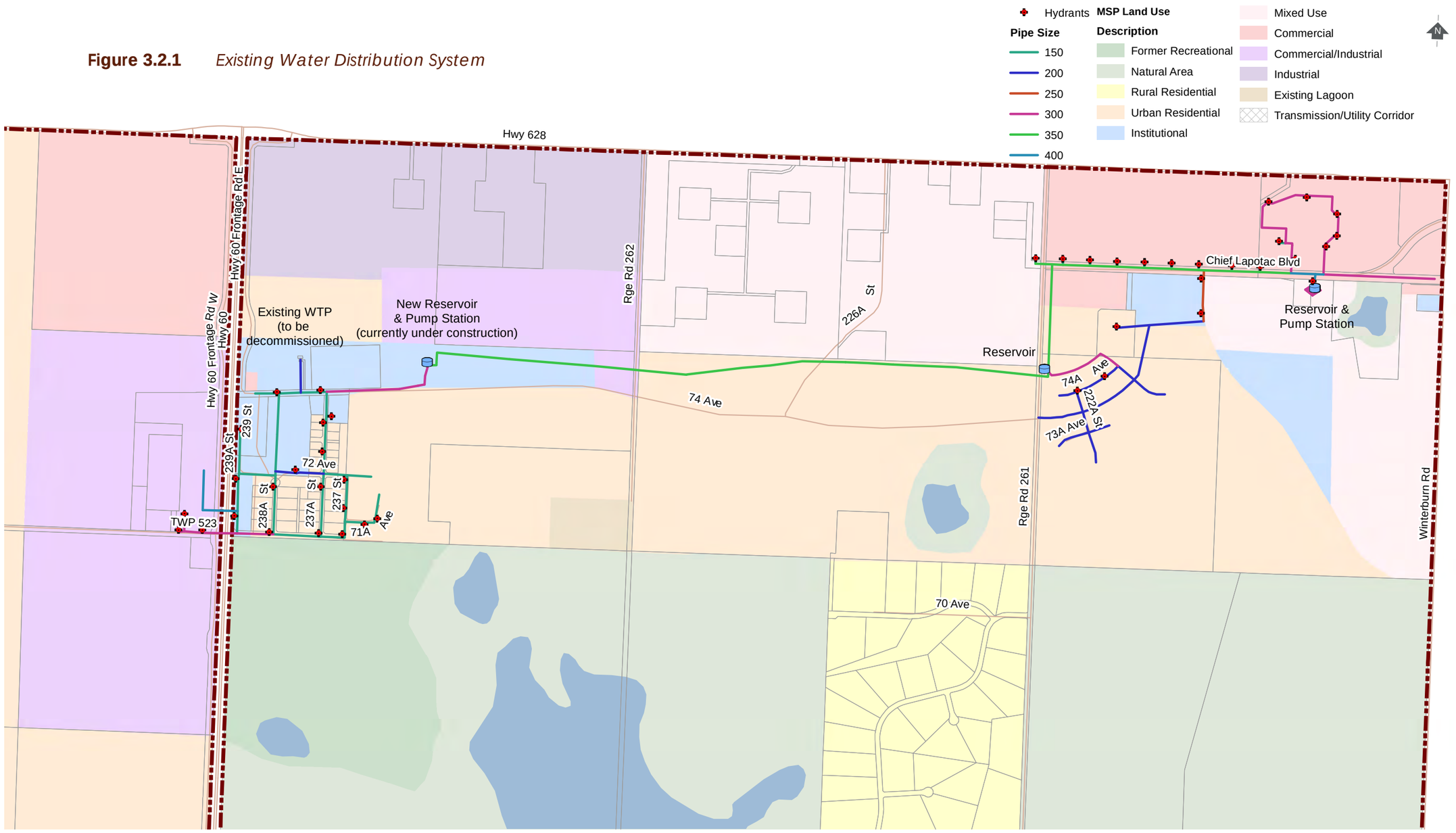
The water distribution system in Enoch currently exists as two separate systems, namely the NEDA and the Village systems. Each system currently operates independently; however, as mentioned previously, a connection is currently being constructed from NEDA to feed into a new reservoir and pump station for in the Village. For the purposes of this Master Plan, this connection has been assumed to be a part of the existing system.

Figure 3.2.1 shows the existing water distribution system, incorporating the new connection, reservoir and pump station. Other features such as hydrant locations and pipe sizes are also shown.

3.2.2.1 Northeast Development Area (NEDA)

NEDA is serviced via a 300mm watermain which connects to EPCOR's 750mm supply main in the Lewis Estates development area in West Edmonton. The 300mm watermain fills an existing reservoir located south of the River Cree Resort & Casino and water is pumped from the reservoir to service both the Casino and other developments in the immediate surroundings, including the 108 and 123 unit multi-family buildings and the single family homes in the Millennium Neighborhood

Figure 3.2.1 *Existing Water Distribution System*



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EPCOR FEED

In July 2006, the ECDC, with the consent of EPCOR, assigned the water supply agreement to the Casino's Enoch/Paragon Limited Partnership (EPLP). The agreement is for the provision of servicing to the Resort/Casino complex, Millennium subdivision and the 108/123 apartments. There is a maximum supply limit from EPCOR to the Casino in the Master Servicing Agreement at 12.27 L/s (AECOM 2011) corresponding to an established annual quantity of 215 ML/yr in the year 2010.

RESERVOIR AND PUMP STATION

The NEDA reservoir and pump station is located south of the River Cree Resort/Casino, on the south side of Chief Lapotac Road. There are currently two reservoirs at this location, each one with a capacity of 3,000 m^3. The pump house above the reservoir has four (4) distribution pumps running and one in standby, and currently designed to provide 84 L/s at a total dynamic head of 56 m (three pumps only). The pumphouse also includes two (2) fire pumps, each rated for 126 L/s at a total dynamic head of 74.2 m. The following table summarizes available pumping capacity in the NEDA pump station:

Table 3.2.3 – Existing NEDA Reservoir – Pumping Capacity

Pump	Design Flow (L/s)	TDH (m)
Jockey Pump	9	56
Duty Pump #1	25	56
Duty Pump #2	25	56
Duty Pump #3	25	56
Fire Pump #1	126	74.2
Fire Pump #2	126	74.2

DISTRIBUTION SYSTEM

The distribution system is fed by the existing reservoir located south of the River Cree Casino & Resort. The pipes directly feeding from the reservoir are 400mm in diameter. The system around the River Cree Casino & Resort, including new developments to the east are serviced by 300mm pipes. Extending to the west from the River Cree Casino & Resort, the watermain along Chief Lapotac Road is sized at 350mm, all the way towards the existing 123-unit apartment complex, and south towards the connection to the new transmission line to the Village. The Millennium neighborhood is fed from this 350mm main by a combination of 250mm and 200mm pipes. This neighborhood is also connected to the Village extension by a 300mm line. It is worth noting that no hydrants exist within the Millennium neighborhood.

3.2.2.2 Village

Currently, the Enoch Village is serviced by a separate system to that of NEDA. The raw water supply for the Village consists of five shallow (production zone greater than 15m below ground surface) aquifer wells. Raw water is pumped from wells and held in a raw water tank before it is treated at the on-site water treatment plant. When the NEDA connection main is complete and connected to the new Village reservoir the Nation will have an opportunity to decide on what to do with the existing wells, treatment plant, and reservoir. There have been intentions in preliminary design reports that these structures would be planned for decommissioning (AECOM 2009). Due to the quality of water drawn from the wells, it is recommended that they be decommissioned, as it will be difficult to find a publicly safe use of the non-potable water, unless it can be justified to not affect people of the Nation.

WATER TREATMENT PLANT

The water treatment plant located near the Village Centre draws water from raw water tank wells and treats it. After the water is treated, it is stored in an underground reservoir until it enters the local distribution system. The current water treatment plant is not suited to treat the contaminants found in the raw water source, posing a risk to health to the community. The new 350mm transmission line from NEDA to the Village, including a new reservoir and pumphouse, will now provide treated, potable water to the residents of the Village, and will no longer be dependent on this water treatment plant.

NEW RESERVOIR AND PUMP STATION

Plans for the new reservoir and pump station include 3,400 m^3 of storage capacity, two duty pumps rated with a total capacity of 60 L/s at 50 m of total dynamic head, and two fire pumps with a total capacity of 376 L/s at a total dynamic head of 50 m. The following table summarizes pump capacity at the new Village reservoir and pump station:

Table 3.2.4 – New Village Reservoir – Pumping Capacity

Pump	Design Flow (L/s)	TDH (m)
Duty Pump #1	30	50
Duty Pump #2	30	50
Fire Pump #1	188	50
Fire Pump #2	188	50

DISTRIBUTION SYSTEM

The transmission line currently being built from NEDA feeding into the new Village reservoir is sized at 350mm. The water is then pumped into the existing Village water distribution system via a 300mm pipe, and the Village itself is serviced by a mix of 150mm and 200mm pipes.

3.2.2.3 Rural Areas

Rural areas are not currently connected to the any of the distribution systems. Potable water servicing for these areas is done via private cisterns within each individual home, filled by two ECN public works water trucks. It was originally intended that the Village reservoir would serve as a source for rural areas in addition to the Village. However, due to the inadequacies of the existing water treatment plant, the water trucks are currently filled at the Acheson Reservoir in Parkland County. This will be transitioned to a truck haul site at the new Village reservoir.

3.2.3 SYSTEM PERFORMANCE

3.2.3.1 Storage Capacity

Storage requirements for each reservoir were determined based on Alberta Environment Guidelines, which state that potable water storage may be calculated using the following formula:

$$S=A+B+C$$

Where:

S=Total Storage requirement (m^3)

A=Fire Storage (m^3)

B=Equalization storage (approximately 25% of projected MDD)(m^3)

C=Emergency storage (minimum 15% of projected ADD)(m^3)

The following table summarizes reservoir storage requirements compared to existing reservoir capacities, to service the current population in the Nation. Note that the Village reservoir information included corresponds to the new facility, currently under construction.

Table 3.2.5 Reservoir Storage Requirements (Current Population)

Element	NEDA Reservoir (m3)	Village Reservoir (m3)
A (Fire Storage)	2,484*	1,944**
B (Equalization Storage)	123.8	179.5
C (Emergency Storage)	43.7	35
Total Required Storage	2,651.5	1534.5
Total Available Storage	6,000	3,400

* based on “Commercial/Light Industrial” requirements under Fire Underwriters Survey

** based on “School, Institutional” requirements under Fire Underwriters Survey

As seen in Table 3.2.5, both reservoirs appear to meet capacity requirements for the existing population

3.2.3.2 Distribution System Performance

The water distribution system was modeled at two critical operating conditions: maximum day demand plus fire flow (MDD+FF), and peak hour demand (PHD). Fire flows result in a concentrated demand on the distribution network, while peak hour flows create a system wide network demand. The limiting condition on a particular distribution network can depend on the magnitude of the fire flow in relation to base consumer demands. In large municipalities, additional demands resulting from a residential fire are normally small compared with overall community needs. In smaller cities and towns, the amount of fire flow required can be significantly larger than base demands. The distribution network must be sized to meet the largest predicted demand flow condition.

MAXIMUM DAY DEMAND PLUS FIRE FLOW (MDD + FF)

The distribution system was analyzed to determine (1) if there is adequate hydrant coverage and (2) if it is capable of delivering maximum daily demand plus the required fire flow from a single fire at a minimum residual main pressure of 150 kPa (20 psi) for the specified fire duration (reservoir fire flow storage requirements are addressed in Table 2.3).

Figure 3.2.2 shows the existing hydrant coverage within both the Village and NEDA. As seen in the figure, hydrant coverage within NEDA is limited to the Casino and Chief Lapotac Boulevard. There is one hydrant located adjacent to the 108-unit apartment complex, and only two hydrants were found within the Millennium neighborhood. No hydrants were found near the 123-unit apartment complex either, with the nearest hydrant located at the intersection of Chief Lapotac Boulevard and Range Road 261. Hydrant coverage for these areas is considered inadequate, and the Nation should consider retrofitting hydrants at these locations at a minimum spacing of 180 m in order to provide adequate fire protection. New commercial developments in NEDA should include the installation of hydrants at a minimum spacing of 90 m.

Hydrant coverage within the Village is also sparse, particularly in areas that are designated as institutional/ commercial, where spacing should be reduced to 90 m. Residential areas at the southeast corner of the village have sufficient coverage, but retrofitting hydrants at a reduced spacing should be considered for all other areas where non-residential development currently exists.

The network is evaluated for the available fire flows at each hydrant during MDD when reservoirs are at their minimum service elevation (balancing and equalization storage have been consumed) as recommended by FUS guidelines. Flow is considered to be acceptable if a hydrant can deliver 90% of the recommended FUS fire flow, based on its location and the nearest building type.

Figure 3.2.3 shows the fire flows of the existing water distribution system after the completion of the NEDA connection. It also depicts the areas where fire flow is sufficient, and shows areas where the fire flows are insufficient and of concern. As seen in the figure, there are no concerns on fire flow availability within the NEDA area. Within the village, approximately half of the hydrants were found to have insufficient fire flow, particularly for areas of non-residential development, where fire flow requirements are larger.

PEAK HOUR DEMAND (PHD)

The distribution network is modeled to determine network pressures during PHD conditions with all reservoirs at the minimum service elevations. System pressures during PHD conditions are shown in Figure 3.2.4.

As seen in the figure, most areas in the Nation experience pressures within the City of Edmonton standard. No areas were identified as experiencing operating pressures below the standard. Particular attention should be paid, however, to areas where operating pressures are above this standard (mostly located within NEDA). High pressure may result in damage to household appliances and plumbing systems. In order to avoid such damage, the installation of individual PRV's at each home may be required. These valves should be properly maintained to avoid damages due to high pressures.

Figure 3.2.2 *Existing Hydrant Coverage*

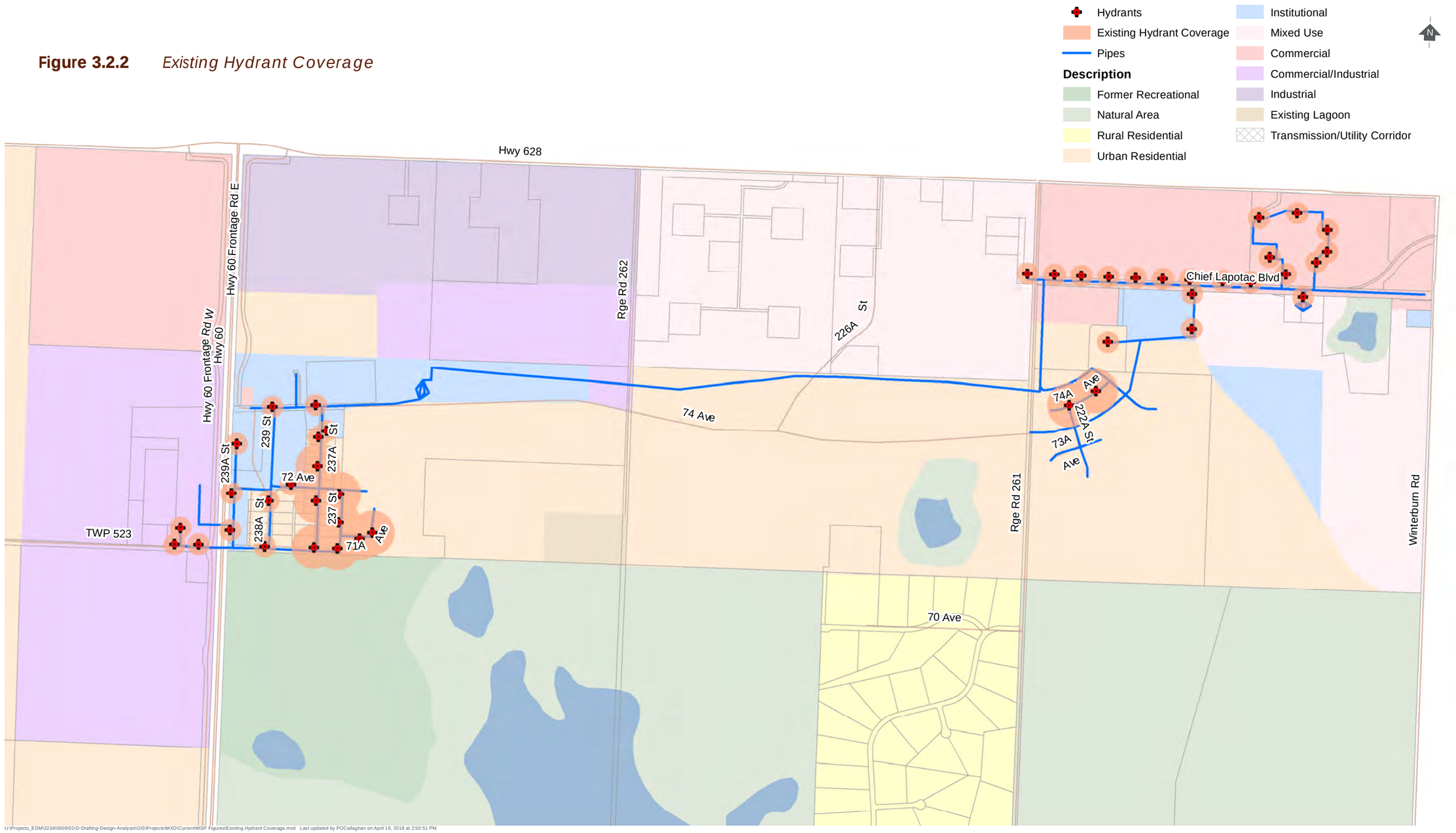

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Figure 3.2.3 *Existing Fire Flow Availability*

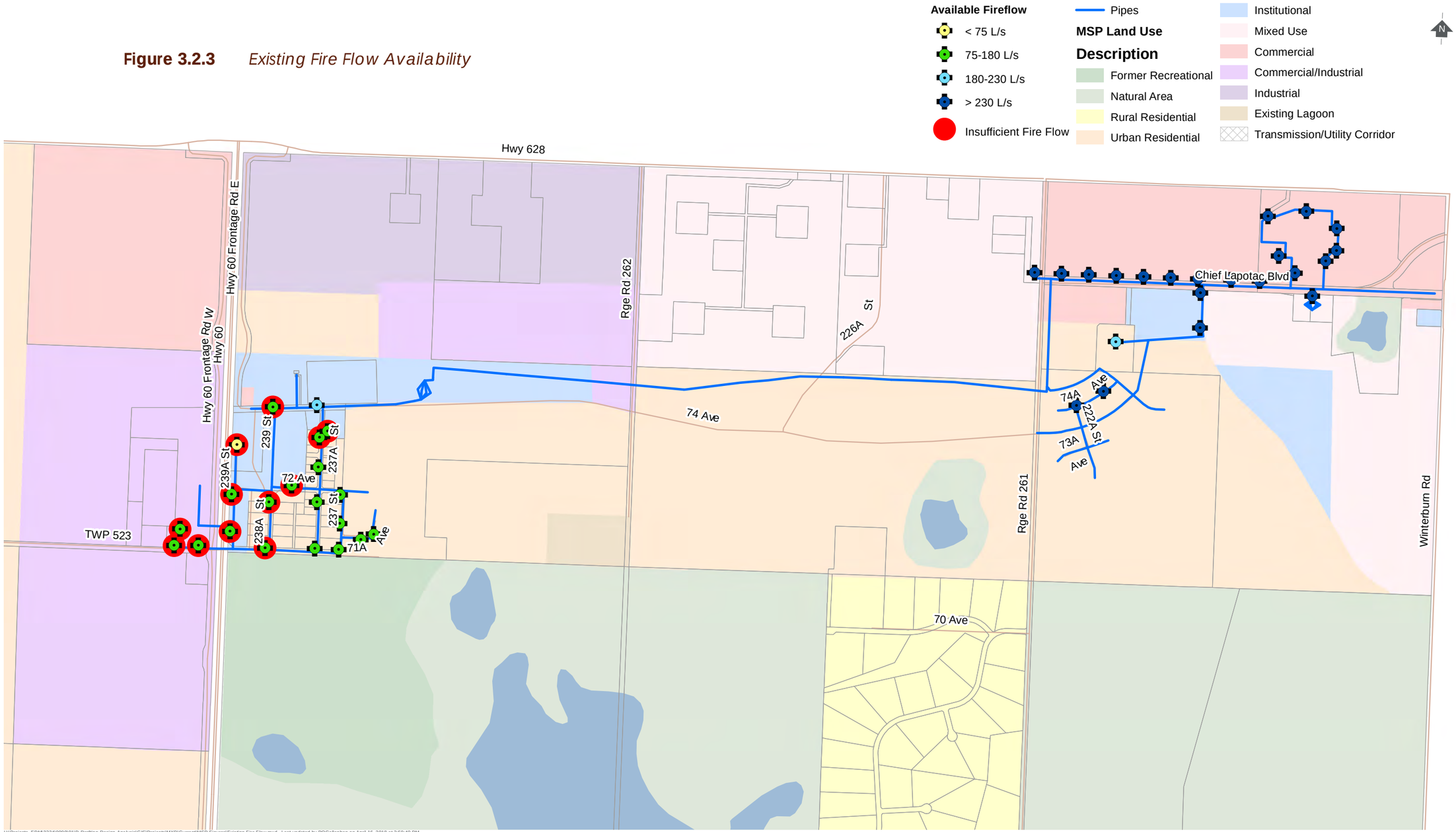

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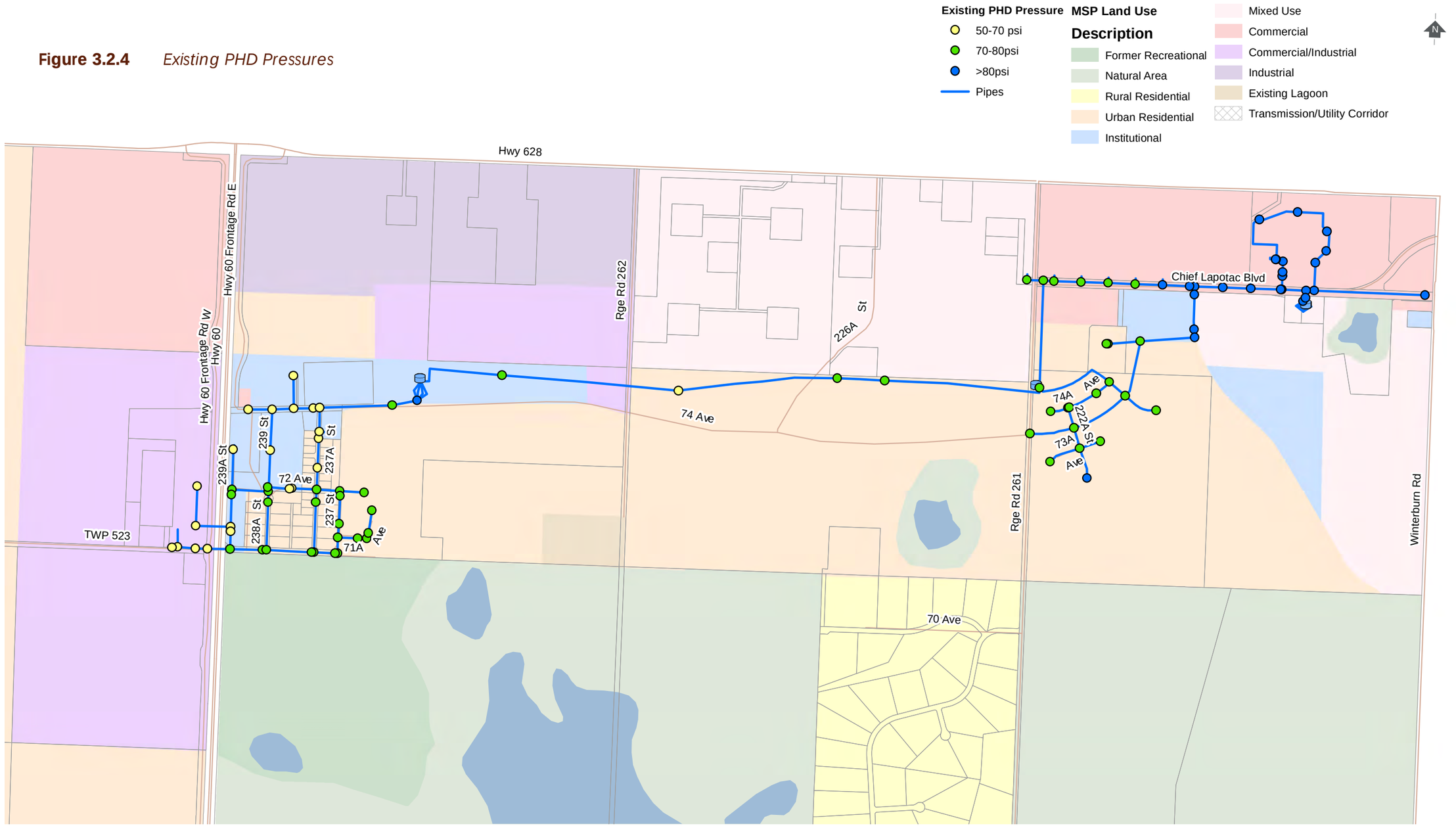
Figure 3.2.4 *Existing PHD Pressures*



3.3 Future Water Distribution System

3.3.1 ANALYSIS CRITERIA

3.3.1.1 System Demands

In order to establish the requirements for potable water infrastructure in the Nation and identify triggers for major capital investments, projected demands were established for 5-, 10-, and 20-year growth projections. Table 3.3.1 below describes the existing and projected future demands based on the population projections and assumptions described in previous sections.

Table 3.3.1 Water System Demands

Scenario	NEDA (L/s)			Village (L/s)			Rural (L/s)
	ADD	MDD	PHD	ADD	MDD	PHD	MDD
Existing Condition	3.37	5.73	9.74	2.70	4.59	8.10	3.72
5-year	6.01	10.22	17.67	2.94	4.99	8.81	4.02
10-year	6.74	11.46	19.86	3.82	6.50	11.47	4.44
20-year	7.77	13.21	22.94	5.82	9.89	17.46	5.41

3.3.1.2 Fire Flow Requirements

For all future scenarios, the criteria for fire flow requirements was assumed to be the same as that adopted for the existing system analysis. A fire flow requirement of 180 L/s, which is suitable for schools, institutional buildings minor neighborhood commercial developments and most multi-family residential developments, was assumed for all developable land within the Village ASP area, and should be established for all new residential developments. Similarly, a fire flow requirement of 230 L/s, which is suitable for most commercial applications as well as multi-family and light industrial uses, was assumed for all developable land within the NEDA area. It will be prudent for future developments within the Village and NEDA to verify that their building construction and layout will require fire flows that are less than the design flows established in this document.

3.3.2 SERVICING CONCEPT

3.3.2.1 EPCOR Servicing Agreement

The current servicing agreement with EPCOR is held by the River Cree Resort and Casino (the Resort). The Resort and Enoch agree that in the future, the servicing agreement should be held and managed by Enoch Utilities Ltd. (EUL) such that water, sewer, and stormwater services, linked to either the City of Edmonton or EPCOR's infrastructure, can be managed and planned from a community perspective. Discussions with EPCOR were initiated in 2016 to better understand the current agreement and EPCOR's willingness and requirements to transfer the servicing agreement over to EUL. Both the City of Edmonton and EPCOR confirmed that they are willing to transfer their servicing agreements with the Resort to EUL once Enoch and EUL are in a position to do so. EPCOR has also confirmed that the total volume of water required to meet the ECN's demands as the Nation grows, will be supplied, with the understanding that the Nation will manage and maintain its potable water infrastructure.

3.3.2.2 Other Possible Sources of Potable Water

Typically, a municipality needs to consider a second source of potable water when its population reaches approximately 20,000 people. With the assumed annual growth rate of 2%, the Nation will not reach this threshold within the next 100 years. As a result, a second feed of potable water is not as high of a priority to the Nation, particularly given that the servicing agreement with EPCOR will be expanded to include servicing for both the Village and rural areas.

With the above in mind, there are a number of possible sources for potable water to feed the Nation once the population threshold is achieved. The Capital Region Parkland Water Services Commission (CRPWSC) in Parkland County constitutes the most viable source for a secondary feed of potable water to the Nation. Note however, that if the system ties into the CRPWSC, the current agreement with EPCOR would need to be amended. That said, this should not pose as a serious obstacle, given that EPCOR is also the supplier to the CRPWSC.

There is also a potential for using groundwater sources that may have not been impacted by surface waters. Note, however, that geotechnical investigations to find this source may be costly and there may not be a guarantee that a viable source could be found.

3.3.2.3 Utility Corridors for Long-Term Servicing

HWY 60 is recommended corridors to consider for long-term servicing routes. HWY 60 will be an important corridor to consider the expansion of any developments to the South of the Village. It will also be an important corridor to be used for a potential connection to the water transmission network in Parkland County if and when this is required.

3.3.2.4 Distribution

As outlined previously, ECN is in the process of connecting the NEDA distribution system to the Village system via a 350mm transmission line, reservoir and pump station. Before public use, flushing of the current Village distribution lines will have to be conducted. Once connected, both the Village and NEDA will be serviced via EPCOR water stored in reservoirs in each of these areas and distributed as needed. As the Village and NEDA grow, the system will also expand, and proper design and planning will have to be conducted to ensure a maintained level of service is provided to members of the Nation living in these areas.

3.4 Implementation

Identification of Triggers and Infrastructure Requirements

3.4.1 SHORT-TERM (5 YEARS)

The NEDA system has begun to expand towards new adjacent developments that will be coming online in the short-term, namely the River Cree Crossing development, which includes a new car wash, gas station, convenience store and administrative building. As NEDA grows and expands, the distribution network should be designed and constructed to be able to meet fire flow requirements and system demands accordingly. On-going discussions with developers and proper planning will allow new infrastructure to be sized according to the long-term needs of the Nation, and not only the individual servicing needs for new developments as they come on-line.

It is imperative that the Nation understands that the main from NEDA to the Village that is currently under construction is a transmission line, to which future developments cannot connect for servicing. It is expected that in the 5-year time frame, an updated agreement with EPCOR has been fully executed to supply water beyond the NEDA developments. Also note that as soon as water has been tied into the new Village reservoir and pump station, a flushing program should be implemented as soon as possible for residents of the Nation to be able to use the new source of potable water.

For the Village, the system will continue to grow as new housing is added, and new institutions are built. To ensure the safety and resiliency of the Village, **Figure 3.4.1** depicts recommended upgrades to the existing system to meet minimum fire flow requirements. More specifically, a number of existing mains within the north and west areas of the Village require upgrades to 200 and 250mm pipe sizes (approximately 1.1 km) and two additional connections, 250 mm in size, will also be required to provide looping. These upgrades will ensure proper operating pressures, and adequate fire protection which the Village does not currently have, thus increasing the existing level of service. Fire flow availability post-implementation of the proposed upgrades is shown in **Figure 3.4.2**. Note that the two hydrants at the southwest corner of the Village will not be able to provide adequate fire flows until long-term looping has been completed.

It is expected that a new Institution will be constructed for the South of the Village Centre and Commercial and Light Industrial to the West of HWY 60. This will require the construction of new distribution lines to be able to service these developments. With all these new developments potentially coming online in the next 5 years, best practice design should be implemented with looping in the system for proper redundancy, circulation of water, and the avoidance of water stagnation.

As the Village transitions to the use EPCOR treated water from the shallow aquifer wells, a plan for decommissioning and abandoning the wells should also be implemented, or a means of repurposing these available resources and existing infrastructure for non-potable water uses could also be explored.

Overall for the entire Nation, as the immediate infrastructure priorities are met, opportunities to be proactive and manage the maintenance and operations of the existing system will arise. To ensure the water system can last as long as intended and save on long-term costs, it is recommended that the Nation develop and implement an asset management program and policy, an operations and maintenance program, consideration of water utility rates and a water conservation program and strategy. This begins with a condition assessment of the existing system and an inventory of all existing infrastructure, allowing for the creation of a Geographical Information System (GIS) and an Asset Replacement Forecast for proactive planning and budgeting.

An operations and maintenance plan developed with Public Works is also important. The plan should include programs such as water quality monitoring, hydrant maintenance and flow testing, valve exercising, and regular flushing of the system. These exercises allow confirmation of modelled data, and will help identify issues and problems as early as possible. This plan will also require commitment to implement and continue for the longevity for the system, to further the Nation's self-reliance and resiliency in water service infrastructure.

The creation of a water utility rate and installing water meters will allow for stable funding of water services for the future of the Nation. Water conservation programs and policies will allow the Nation's infrastructure to last longer. These can include public outreach and education workshops, rebates to encourage existing users to move towards water efficient appliances and fixtures, school and youth education, and public policy changes through Band Council Resolutions. These initiatives will set the Nation up to understand their water assets better and prepare them for the future.

3.4.2 MEDIUM-TERM (20 YEARS)

By the end of the Medium Term, NEDA is expected to meet significant growth and build out. As seen in **Figure 3.4.3** either Cell 3 of the Village ASP (west of Range Road 261) or the quarter section north of it (Dean Alexander Lands) will most likely begin development, and the watermain will need to be expanded to these developments. This development will connect to the existing 350 mm transmission line, and the 200mm pipe from the southwest end of the Millennium residential neighborhood, with a 250mm line. This 250mm line has been modelled to be sufficient in servicing the mixed-use residential community it has been planned for. Note that the future mains to service the mixed use and institutional areas south of the Casino as shown in this report, match AECOM's original designs and have not been modified. The reason being the uncertainty around the development that will occur in this area, which is tied to economic factors more so than population growth. Future servicing needs in this area should be evaluated on an as-needed basis, and in greater detail through the preparation of the NEDA Area Structure Plan.

For the Village, the expectation is to continue utilizing the EPCOR-treated water that will be supplied once the construction of the transmission line is completed in the short-term. As seen in **Figure 3.4.3** Cells 1 and 2 will be expected to be fully developed within this time frame. The Commercial and Light Industrial developments to the West of HWY 60, and north of the existing town site, will continue to grow in this time frame as well, and will also require servicing. These two development sites will be serviced by a 250mm pipe.

3.4.2.1 Storage Capacity

Based on Alberta Environment Guidelines, the current reservoir being constructed for the Village (3,400 m3 storage capacity) will have sufficient capacity to accommodate the projected 20 years of growth for this area, including fire protection, equalization storage and emergency storage (estimated at 2,926 m3, including rural needs). Note however, that if growth rates and development exceed projected expectations, an expansion of the reservoir will need to be considered.

Table 3.4.1 Reservoir Needs

Element	NEDA Reservoir Needs (m3)	Village Reservoir Needs (m3)
A (Fire Storage)	2,484*	2,484*
B (Equalization Storage)	196.8	330.6
C (Emergency Storage)	69.5	75.4
Total Required Storage	2786.3	2,890.0
Total Available Storage	6000**	3400

* based on "Downtown Commercial" requirements under Fire Underwriters Survey

** from AECOM 2011 NEDA Report

3.4.2.2 Pumping Capacity

Based on projected demands, pumping capacity on both of the existing facilities appears to be adequate to serve the needs of the Nation for the next 20 years, and may only require upgrades if growth and development exceeds projected expectations. Existing pumping capacity and requirements for the 20-year projection are summarized in Table 3.4.2 on the following page.

Table 3.4.2 – Flow requirements and available pumping for 20-year growth

	NEDA (L/s)	Village (L/s)
MDD	28.9 L/s*	15.3 L/s**
Fire Flow***	230 L/s	230 L/s
Pumping Capacity Required	258.9 L/s	245.3 L/s
Existing Pumping Capacity	311 L/s	406 L/s

*includes MDD of NEDA and Village, NEDA must be able to supply the needs of the Village

**includes rural MDD needs

***based on fire flow needs for commercial/light industrial development

It should be reiterated that growth and development should be monitored over time to ensure the validity of the assumptions made in this report. It is also recommended that pump capacity, specifically in the NEDA pumphouse be assessed following the 5-year mark to ensure proper servicing to both the NEDA area and the Village.

3.4.2.3 Other Considerations

Figure 3.4.3 & Figure 3.4.4 depict the recommended areas of growth for the Nation in both the Village and NEDA. These areas were determined to be sufficient for the projected growth within the next 20 years to meet the residential, commercial, institutional, and industrial needs of the Nation. These areas were recommended based on ease of construction, minimizing costs, and maximizing development needs. The figure also shows areas that, if chosen to develop, will trigger the need to construct lift stations to provide sanitary servicing, therefore, it is also advised not to build the water system in these areas until needed. Note that the Nation can still choose to build outside of any of the recommended areas, however, doing so will trigger additional infrastructure that could create design challenges and significant increases in costs. That is to say, the Nation can move forward with these proposed projects with the understanding that developers who propose these projects should upfront these costs in required infrastructure.

Rural residents are expected to continue their use of the truck fill system provided by the new Village reservoir. As time goes on, and as the rural population grows, the Nation may decide on other ways of providing water services to these residents. Some communities have adopted trickle-fill systems for rural customers once sufficient densities have been achieved. These options can be explored further in the early years of the 20-year term and further developed and planned as time and funding allow.

In the meantime, as design, construction and servicing to the Nation grows out of the Village area, the consideration for future connections should accounted for. As previously mentioned, this could include a connection to the CRPWSC Parkland County system. This could mean becoming a customer of either Parkland County or the CRPWSC, each with its own responsibilities to manage. Note that the option with CRPWSC has been explored, and it has been expressed that they do not intend to take on any more customers. However, being a customer of Parkland County is still an option for further discussion as both systems grow.

3.4.3 LONG-TERM (100 YEARS)

As alluded to, the conversations with Parkland County have indicated general support for becoming a future customer to connect the Nation's water system between EPCOR and the CRPWSC. Doing so will allow for redundancy in the Nation's water system to ensure the Nation has a water supply at all times. This will allow the Nation to be resilient and to ensure a maintained and sustained level of service to its residents for multiple generations.

As the Nation grows, the expansion of the water distribution network to service any expanding areas of the Nation's interest may require extra infrastructure, such as another reservoir or booster station, to ensure supplies and maintained pressures.

As time goes on, changes to growth rates, urban planning and land uses, and the direction in which the Nation would like to go, will require proactive re-evaluation, re-modelling and re-designs to allow flexibility and control to make feasible decisions in the best interest of the Nation.

Figure 3.4.1 *Short-term Upgrades to Water Distribution System*

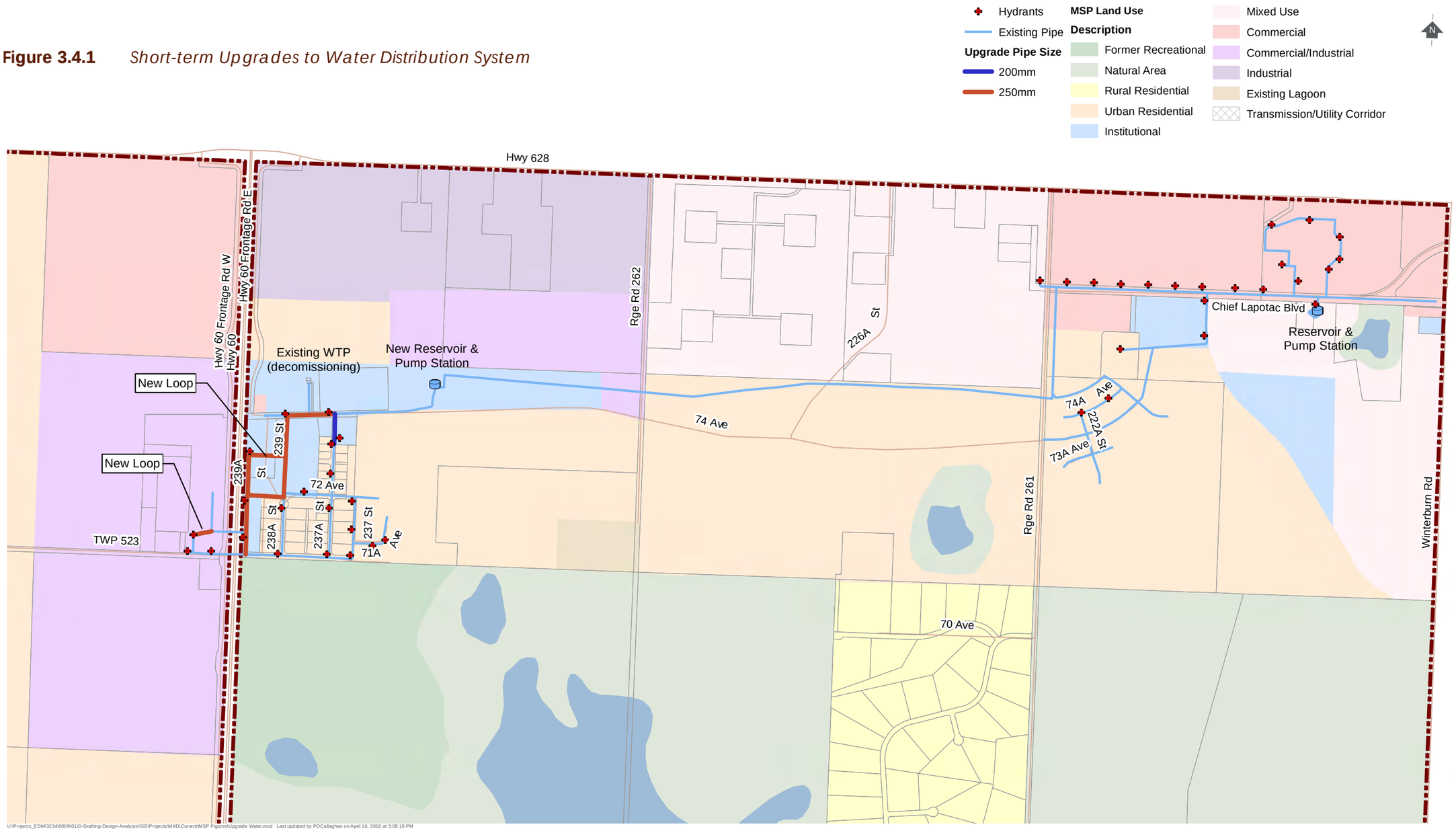


Figure 3.4.2 *Upgraded Fire Flow Availability*

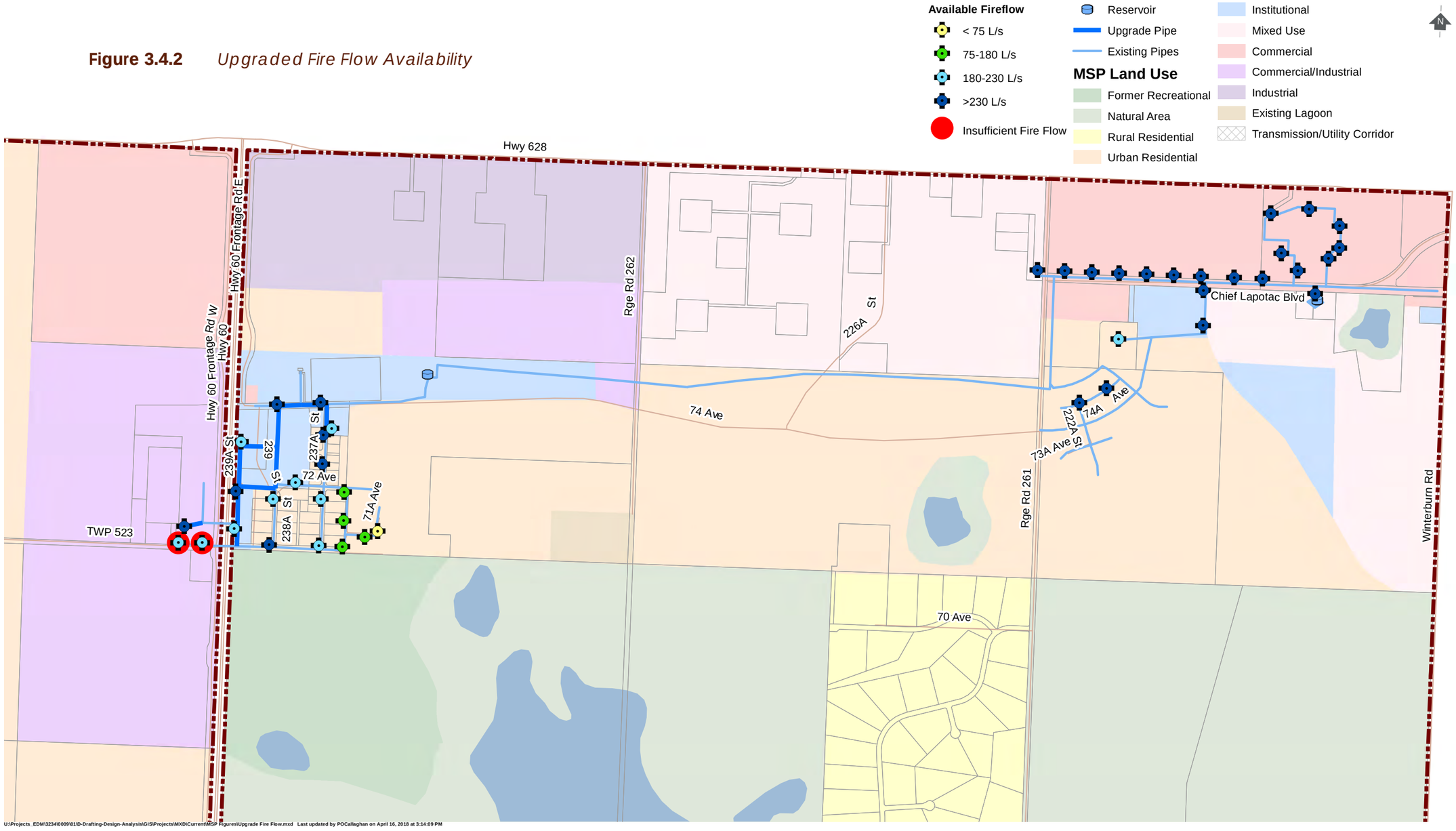


Figure 3.4.3 *Future Water Distribution System*

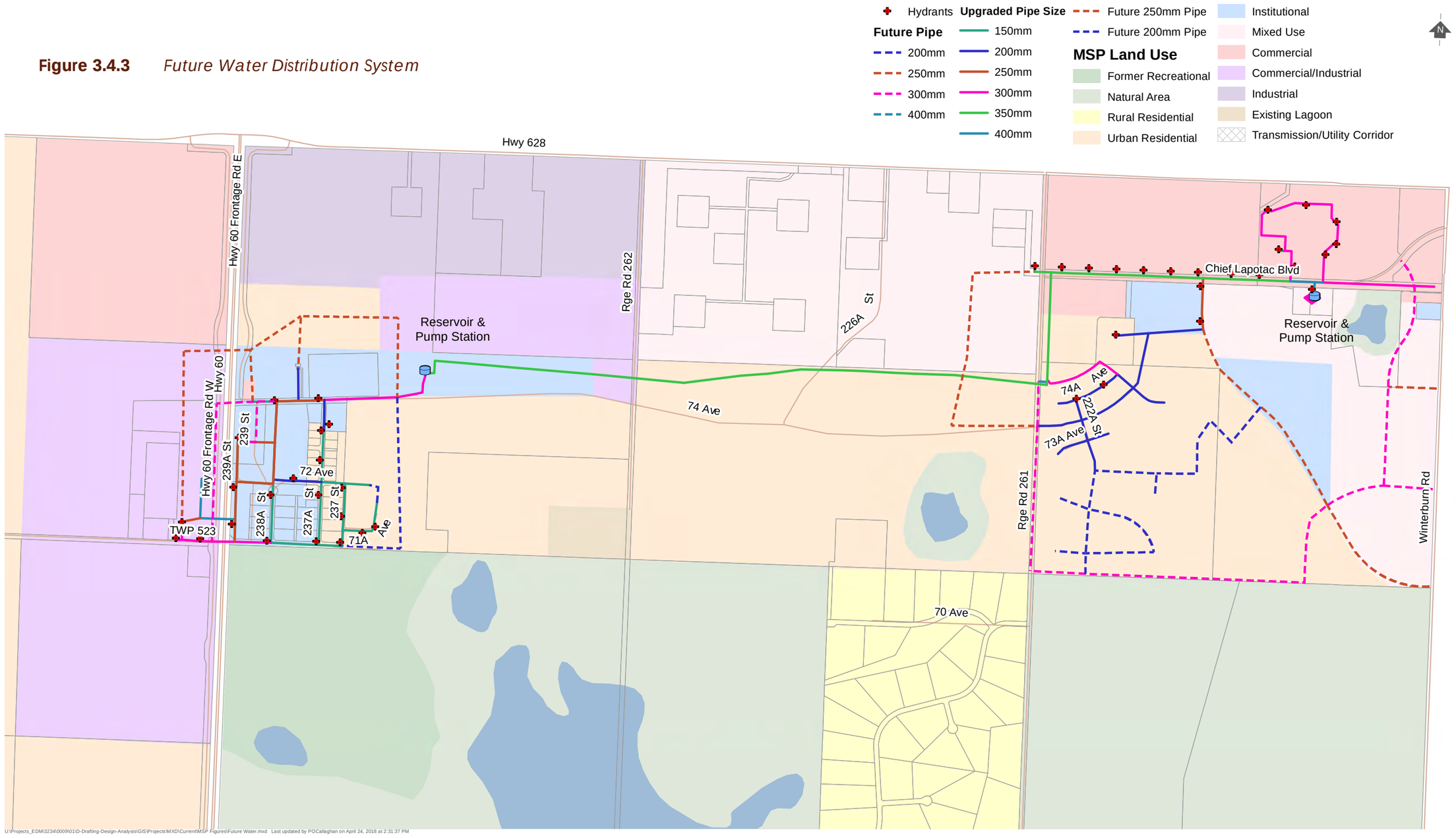


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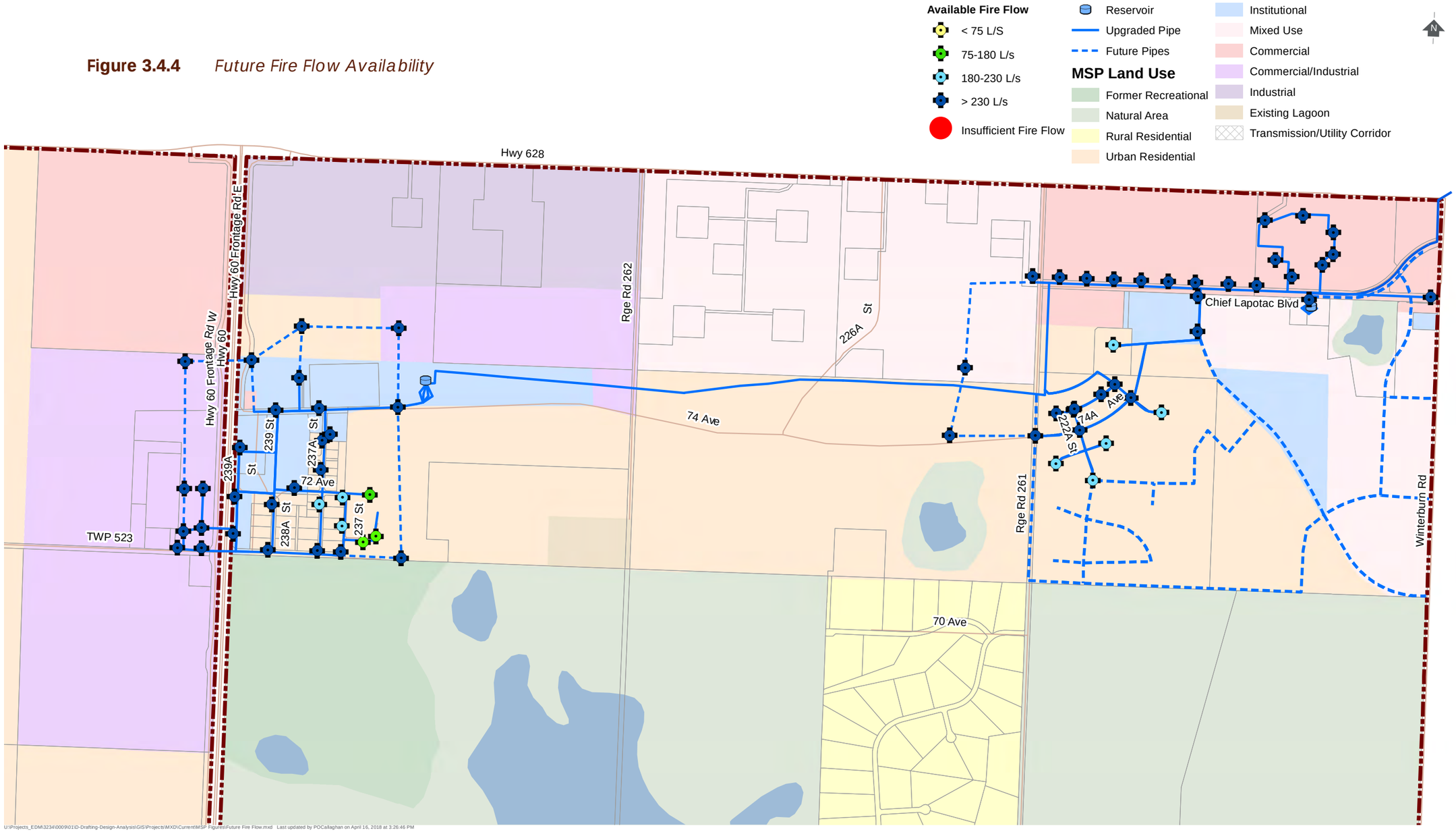
Figure 3.4.4 *Future Fire Flow Availability*



3.5 Design Standards

3.5.1 WATER SYSTEM STANDARDS

The design and construction of the water distribution system should follow a set standard and guideline. It is recommended that this be based off of the City of Edmonton and EPCOR water design standards, as it is an extension of their line into Nation lands. Some of the key points from these standards are as follows:

- Best practices should be used such as looping to decrease the opportunity for the stagnation of water, and to maintain higher pressures and sufficient fire flows.
- Proper hydrant coverage should also be implemented and followed to ensure Nation members are protected from fire or fire-related incidences, based on land use and population densities.

3.5.2 EXPECTATIONS FOR NEW DEVELOPMENTS

3.5.2.1 Residential Within ASP Areas

As mentioned previously, residential areas are recommended to be built strategically in the Village and NEDA. If the areas of development outlined previously are prioritized first, it puts the Nation in a position to more easily manage its infrastructure. If developers would like to develop outside of these areas, the cost to build infrastructure to service these areas should be provided by the developers.

It is encouraged, that residential homes implement the use of water efficient fixtures to reduce the use of potable water.

Water metering of residential properties can also be an effective way to encourage wise use of water in particular for outdoor irrigation requirements.

3.5.2.2 Commercial/Industrial/Institutional

Commercial, Industrial, and Institutional developments should be mandated to include water efficient fixtures. Consideration of metering these developments and charging a user fee, can assist in the continuous funding and maintenance of the overall water distribution network.

The revenue generated from the metering will contribute directly back to the community. This will also encourage the owners of these developments to be more conscious of their water-use. Water user rates can also be adjusted, based-on the type of service the development is providing.

It should be reiterated that if developers would like to develop outside of the designated growth areas, the cost to build infrastructure to service these areas should be provided by the developers.

3.5.2.3 Rural Residential

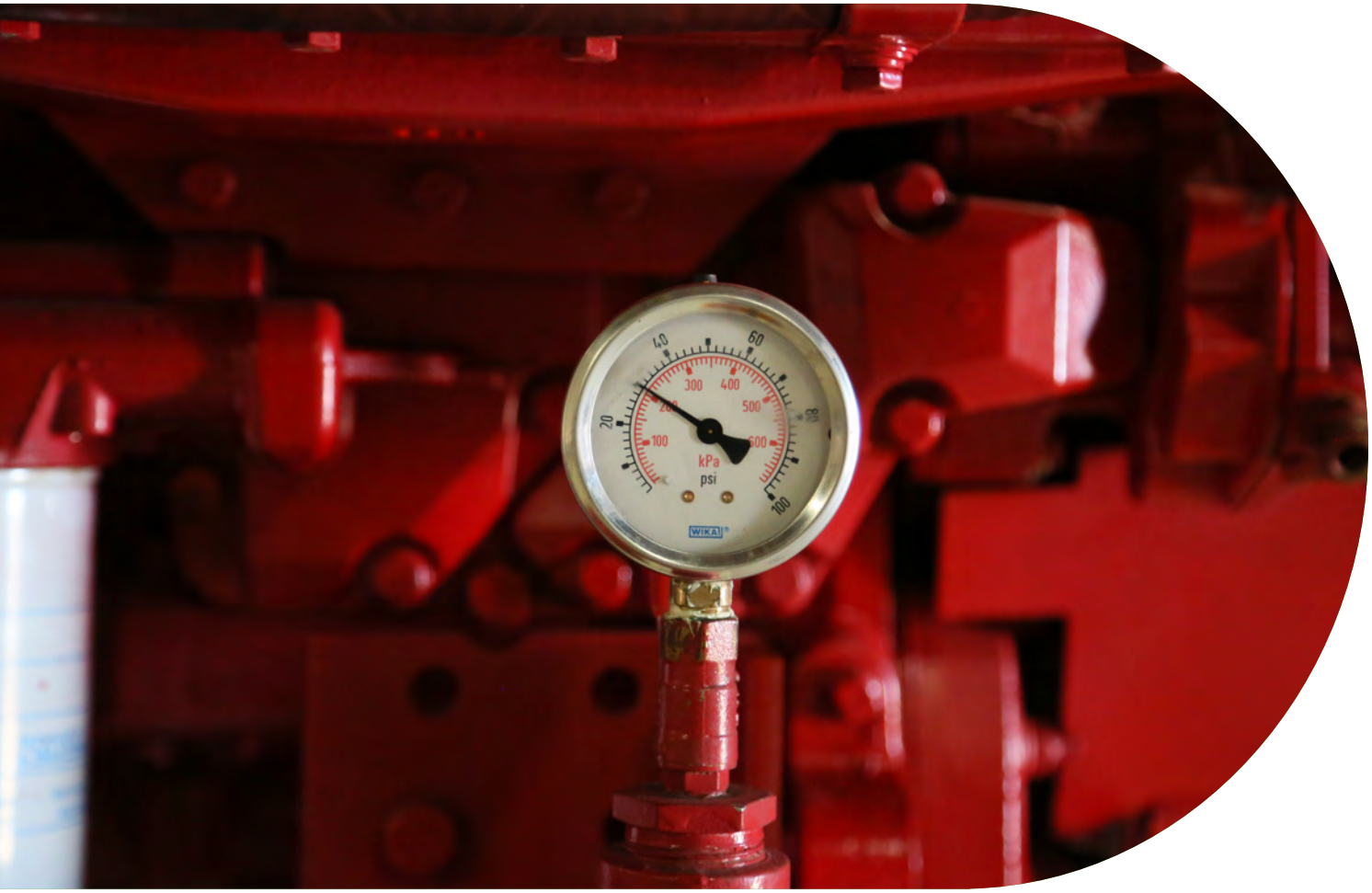
Rural residents are expected to continue obtaining water from Public Works vehicles, trucking it in. However, with the new reservoir and fill station, the service will be much closer, allowing the Nation members to be more self-reliant. As mentioned previously, it is possible to expand the projected water distribution network to evaluate the inclusion of a trickle-fill system as a means of providing water services to populations living farther from the Village and NEDA areas once densities make this option viable.

3.5.2.4 Water Conservation Initiatives

Several different technologies exist that focus on water conservation directly. These include water efficiency fixtures that directly reduce the amount of water used by each individual in a household. There is also technology that affects sanitary sewer uses. This can come in the form of grey and blackwater treatment and re-use. These technologies are described in more detail in Section 4.5.4 of the Sanitary Master Plan.

There are other means that lead to reducing potable water uses. Low Impact Development (LID) technologies utilize stormwater runoff for watering plants in place of potable and treated water.

Also, water conservation comes from education and public policies. Educating youth in school will allow for understanding responsible usage of water from an early age. Public policies such as water usage rates or implementation of water-use restriction scenarios will also go towards encouraging residents to not overuse water.



3.6 Summary and Recommendations

The following capital projects will require immediate attention to ensure the water distribution system can handle the growing community's demand in the next few years to the next 100 years:

- Upgrades via connections to already existing sections of the water distribution network, particularly in the Village, will allow for improved fire flows and operating pressures for the existing system.
- The north and west areas of the Village town site will require approximately 1.1 km of upgrades to 200 and 250mm pipe to ensure proper operating pressures and fire flows.
- Hydrant coverage was found to be deficient, in particular along the residential areas within NEDA and the non-residential areas within the Village. Retrofitting hydrants at the appropriate spacing is recommended.

The following are general utility management strategies the Nation should adopt in order to meet the established water service delivery goals for the ECN for the short, medium and long term:

- Operations and maintenance program, including hydrant flow tests, flushing programs, and exercising valves.
- Asset Management plan and policy, starting with condition assessments, GIS database creation, and asset replacement forecasting.
- Maintaining the relationships with the City of Edmonton, Parkland County and the Capital Region Parkland Water Services Commission (CRPWSC) in terms of water servicing for the Nation, both currently and into the future, to improve redundancy and resiliency of the Nation's potable water source.
- Considering the installation of water meters and the implementation of water rates for maintaining adequate levels of service. The Nation can plan on different strategies for commercial and industrial versus residential.
- Work with developers to ensure contiguous development and avoid the need for large off-site improvements. Otherwise, coming to an agreement on a fair contribution of developers to put in infrastructure to service developments that are not contiguous to existing infrastructure.

4. Sanitary Master Plan

4.1 INTRODUCTION

As the Enoch Cree Nation (ECN) community grows, it needs for a reliable sanitary collection and treatment system that meets the needs of both residents and the environment. In recent years, the community has seen some struggles, particularly with regards to the operation and maintenance of its sanitary sewage lagoon in the Village, and the rapid growth of the NEDA area which has posed some questions as to whether the existing system and agreements with the City of Edmonton will meet the Nation's economic development needs.

4.1.1 PURPOSE OF SANITARY MASTER PLAN

The purpose of a Sanitary Master Plan is to prepare a short to long-term plan to guide the development of sanitary sewer collection infrastructure to support the goals and objectives of the Enoch Cree Nation (ECN), specifically the growth and development of the community. This plan takes a look at existing infrastructure and their conditions, projected sewer collection needs, and develop options for the community to consider.

4.1.2 LEVELS OF SERVICE

4.1.2.1 Typical Sanitary Level of Service

The piped sanitary collection system is sized to handle average daily flows and peak wet weather flows without surcharging. Wastewater treatment facilities are sized to meet the needs of the community and discharge effluent that meets the Environment Canada "Guidelines for Effluent Quality and Wastewater Treatment at Federal Establishments". Wastewater released to neighbouring community sewer systems conforms to the flow and quality limitations contained with the respective servicing agreements. Inflow and infiltration into the sanitary sewer system from groundwater and rainwater is minimized to the greatest extent practical.

Levels of service are a defined set of standards and services that a community adopts as performance expectations from its infrastructure systems. These levels of service inform how infrastructure is designed, operated, maintained, repaired and upgraded or replaced.

4.1.2.2 Currently Achieved Sanitary Level of Service in Enoch

Enoch Cree Nation currently provides a sanitary system in NEDA that meets the above noted levels of service. This system flows by gravity to an existing lift station which is then pumped via forcemain to the City of Edmonton sanitary sewer system. The Village has a separate sanitary collection system that discharges to a sewage treatment lagoon. Rural members either use sewage holding tanks with truck haul to the Village lagoon or septic tanks with mound infiltration systems. Currently the existing lagoon is over capacity and provides insufficient treatment and storage volume for the service area.

4.1.3 SERVICE DELIVERY GOALS

Achieving service delivery goals for the Nation's sanitary service requires a combination of utility operational and infrastructure development strategies. Establishing service delivery goals for the sanitary service will help focus and prioritize the efforts and investments both in the on-going operation and maintenance of the systems and the capital investments in infrastructure improvements.

The focus of this master plan is to develop a plan for infrastructure renewal and development that is based on achieving the service delivery goals of the utilities. Although not comprehensively addressed in this study, utility management and operational strategies that are required to achieve the service delivery goals of the wastewater system are also identified.

4.1.3.1 System Back-ups

Sanitary sewer back-ups are an unfortunate but common problem in most Canadian municipalities, despite efforts to prevent them. Back-ups usually involve blockages either in the sewer lines or in the private service lines, which residents typically own and maintain. The Nation's main goal is to minimize system back-ups through control and monitoring of pipe breaks and cracks, root intrusions and system deterioration, in mains and the portion of services that are within the Nation's control.

Utility management and infrastructure planning strategies to achieve this goal include:

1. Undertake root cutting and flushing maintenance program based on historical blockage information and regular video inspections.
2. Educate residents on the causes of sewer back-ups in order to minimize the occurrence of service line blockages.
3. Conducting risk of failure and risk of consequence analyses that involve factors such as property damage and environmental impacts to ensure these areas are prioritized in maintenance and upgrade programs.

4.1.3.2 System Reliability

Future sanitary sewer systems within developable areas will be designed with sufficient capacity to minimize system back-ups. However, given the unpredictable nature of sewer line blockages, and the age of some of the older systems within the Nation, back-ups can become an inevitable component of sanitary system management and operation. The Nation's goal should be to minimize the response time to 30 minutes in 90% of the cases when blockages occur, and provide temporary services after 8 hours of continuous sanitary service interruption.

Additional utility management and infrastructure planning strategies the Nation could adopt to reach its system reliability goal include:

1. Conduct risk of failure and risk of consequence analyses for both collection and sewer pumping systems.
2. Inspect and monitor high risk areas such as major trunk mains.
3. Develop infrastructure renewal strategy that rehabilitates or replaces aged and deteriorated mains.
4. Develop facility maintenance management plans to determine infrastructure renewal plans for sewer utility facilities.

4.1.3.3 Capacity for Growth

The Nation's sanitary system discharges either into the City of Edmonton's system, or into the existing sewage lagoon by the Village. As a result, the overall capacity of the Nation's system is largely dependent on the capacity for treatment of the sewage lagoon and the pumps that lift the effluent to the City's system. In addition, there is a current agreement for disposal to the City which provides a limit to the amount of effluent to be accepted by the City from the Nation.

The Nation's goal for accommodating growth in the sanitary system is to provide enough capacity in the treatment system and the collection system to support the Nation's development plans. Utility Management and Infrastructure planning strategies that the Nation could adopt include:

1. Undertake regular updates to master servicing plans to ensure planned upgrades will meet the needs of growth and development patterns. Investigate opportunities for effluent re-use strategies to lower the capacity requirement for the treatment and disposal systems.
2. Continue water conservation strategies that also reduce effluent disposal such as low flow toilets.

4.1.3.4 Environmental Impact

Minimizing the environmental footprint of the design, construction, operation and maintenance of sanitary infrastructure is the key environmental objective for the Nation's sewage collection and disposal system. The goal is to meet corporate energy conservation and climate change targets, and avoid discharging sanitary effluent to surface water bodies.

In order to achieve this goal, the Nation should implement the following utility management and infrastructure planning strategies:

1. Conduct composite or sequential point-of-discharge sampling to reduce the disposal of high strength effluent and other deleterious substances into the downstream systems.
2. Conduct risk of failure assessments that incorporate possible impacts to the environment that would result from system failure.
3. Develop a CCTV inspection program that inspects high risk mains due to age, potential impact to the environment and recent blockage/failure history.
4. Develop a replacement program to upgrade aged, damaged or under-capacity infrastructure that considers possible impact to the environment that would result from failure
5. Prioritize system monitoring and maintenance on mains that are at high risk to impacting environment as a result of failure or blockage.
6. Undertake energy audits to identify possible areas for energy efficiency improvements.
7. Evaluate infrastructure improvement needs on a triple bottom line basis including financial, system performance and impacts to the environment.
8. Develop standards for design and construction of infrastructure that minimizes energy usage, considers renewable energy options, minimizes impacts to the environment, considers water re-use and water reduction options, and investigates options for waste reduction.

4.1.3.5 Financial Effectiveness

Understanding the full costs associated with providing sanitary sewer services to the community is key for ensuring the system remains sustainable for existing and future developments. Principles of full cost recovery through appropriate methods of cost allocation and funding should be implemented by the Nation, as well as ensuring service rates are stable and sustainable over the long-term.

In order to achieve the goal of financial effectiveness, the Nation should adopt the following utility management and infrastructure planning strategies:

1. Conduct long-term planning that incorporates forecasting construction, operation and maintenance costs, prioritizing and staging of upgrades and identifying funding mechanisms to support the upgrade plans.
2. Consider life-cycle costs of infrastructure when determining infrastructure design standards and strategies.
3. Minimize system back-ups and sewer blockages.
4. Undertake utility rate review and ensure full-cost accounting is the basis for establishing utility rates.
5. Educate customers on costs of sanitary service.

4.1.4 SANITARY SERVICE SHORT- AND LONG-TERM PRIORITIES

In order to achieve the aforementioned service delivery goals, the following short- and long-term priorities have been identified. These were derived from visioning sessions, discussions and workshops with the Nation. It is with these priorities in mind that the following short- and long-term recommendations for the sanitary infrastructure were made.

4.1.4.1 Short-term Priorities

All members are using a collection system that meets the needs of the Nation while preserving the natural environment.

- Establish sanitary sewer management plans in conjunction with the NEDA and Village ASPs.
- Correct the capacity and operation of the existing lagoon such that environmental health is not impacted and the needs of the community are met.
- Ensure adequate bylaw provisions are in place to enforce discharge quantity and quality for existing and future developments.
- Evaluate performance of the sewer system on an annual basis and rectify inflow and infiltration where necessary.

4.1.4.2 Long-term Priorities

The sanitary collection system not only meets basic needs but gives back to the natural environment.

- If an alternative long-term servicing plan can be developed for the Village then explore future uses for the existing lagoon site.
- Implement development regulations that provide the option of purple pipe systems to utilize reclaimed water.
- Explore greywater treatment and reuse for future higher density uses.
- Explore district energy possibilities such as heat exchange and biogas.
- Evaluate performance of the sewer system on an annual basis and rectify inflow and infiltration where necessary.

Existing Municipal Agreements that affect the sanitary system are as follows:

- M-355 with the City of Edmonton states that a maximum peak daily flow of 60.0 L/s is permitted into the City's sanitary sewers. This includes the servicing of the Resort & Casino (initially under Agreement M-214), residential developments for the "First Development Phase" (initially under Agreement M-271), and commercial developments included with the "Second Development Phase".

4.2 SANITARY SYSTEM
ANALYSIS AND ASSESSMENTS

This section describes performance analyses results for the Nation's existing sanitary collection system, and servicing requirements for future developments, in the context of the service delivery goals established in previous sections. This includes a description of analysis criteria, an assessment of the capacity of the treatment and disposal systems, an analysis on the performance of the collection system and long-term system requirements.

4.2.1 ANALYSIS CRITERIA AND ASSUMPTIONS

4.2.1.1 Computer Sanitary Model

For the present study, a new model was developed to assess the performance of the existing system account for the projected growth of the Nation. The model was developed using the PCSWMM modeling software. The model was based on the best available information, which included as-built drawings and information from the previous studies.

For the existing lift station in NEDA, the pumping rates were based on flows determined provided by the Nation's operators. Forcemains were not modeled, but rather the entire length of the forcemains was idealized as single pump links set to the capacity of the specific pump station.

System demands were allocated as a percentage of water demands developed for the water master plan. The estimated flow from each lot cluster then allocated to the closest pipe and attached to the most upstream manhole on that pipe. Inflow and infiltration was determined based on roof surfaces and areas that were considered could contribute to the system during large rainfall events.

4.2.1.2 System Demands

The following table lists all of the assumptions made to estimate sewage generation in the system.

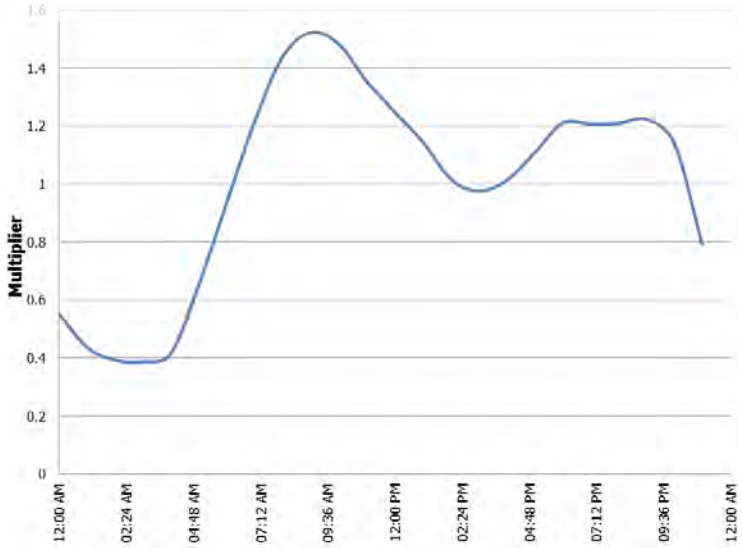
Category	Value	Units
Residential ADD	225	L/cap/day
Comm., Inst., Ind. ADD	15	m3/ha/day
Average Dry Weather Flow	0.85	of ADD
Peaking factor (for PDWF)	3	
Inflow/Infiltration	0.28	L/s/ha

Sanitary sewage generation of the ECN has been assumed based on 85% of an average daily consumption of 225 Litres of water use per person per day. This number is aggressive and will require concerted efforts in water metering and conservation efforts. The intent being that the Nation will pursue standards set to be an example that all peoples and neighbouring municipalities can follow.

4.2.1.3 Diurnal Pattern

A typical diurnal pattern used from municipalities that are pre-dominantly residential developments was used for the model in this Nation. This curve determined the peaking factor used in peak dry weather flow calculations and modelling. It is recommended that the Nation conducts sanitary flow monitoring. This will allow for an accurate diurnal curve to be created for the Nation and used in any future models and calculations to depict actual sewage generation of its members and residents.

Figure 4.2.1 *Diurnal Pattern*



4.2.2 EXISTING SANITARY SYSTEMS

Currently the existing sanitary system within the Nation consists of two separate systems that work to service two distinct areas, namely NEDA and the Village. **Figure 2.2** depicts the existing sanitary system, including lift stations, forcemains, treatment facilities and pipes and sizes.

4.2.2.1 Northeast Development Area (NEDA)

Developments within the Northeast Development Area (NEDA) are currently serviced by a sanitary system that flows by gravity to the existing lift station located south of Chief Lapotac Boulevard and the River Cree Resort & Casino. Sewage is then pumped via forcemain into the City of Edmonton sanitary sewer system.

Lift Station

The existing sanitary lift station is located south of Chief Lapotac Boulevard and the River Cree Resort & Casino. Under the current servicing agreement (M-355) with the City of Edmonton, a maximum peak daily flow of 60.0 L/s is permitted. The existing capacity of the lift station is at 20.0 L/s, well below the maximum allowable discharge to the City of Edmonton system.

Discharge to the City

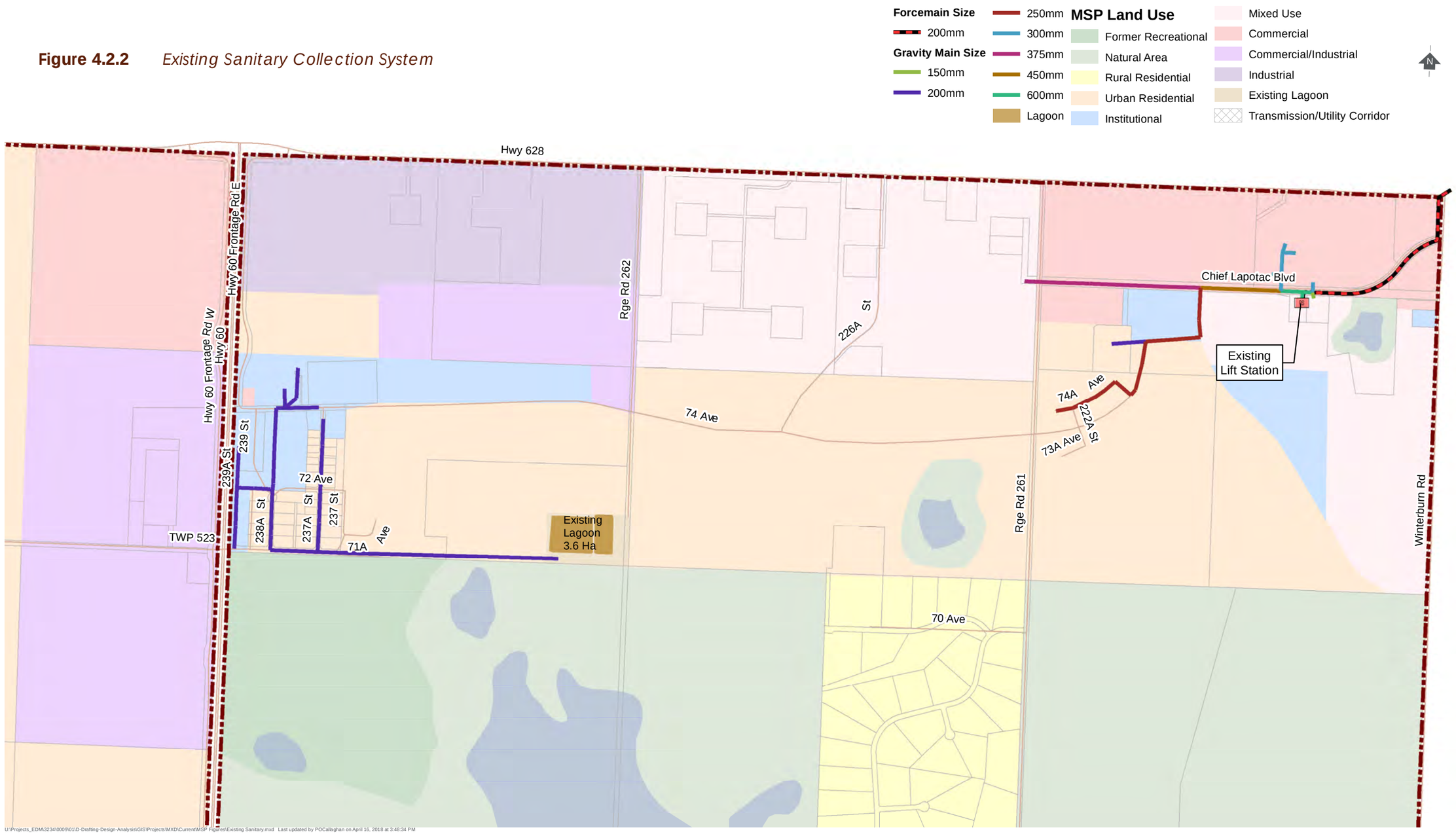
The Nation currently has a Municipal Servicing Agreement with the City of Edmonton to discharge sewage to its sanitary sewer system that has a maximum limit of 60.0 L/s. Due to the limitations of the current lift station, only 20.0 L/s can presently be discharged. Thus, there is still capacity to upgrade the station to provide an additional 40.0 L/s of discharge into the City of Edmonton.

Conveyance System

Currently, the sanitary sewer system, collects sewage from the River Cree Resort & Casino, a multi-family residential (123) complex located northwest of Chief Lapotac Boulevard and Range Road 261, the Enoch Cree Nation multi-family (108), and a low density single family residential block located southeast of Chief Lapotac Boulevard and Range Road 261. This network of pipes range in size from 200mm to 450mm.

The main sanitary trunk exists along Chief Lapotac Boulevard conveying sanitary sewage from the west (multi-family complex, single-family residential and Enoch Cree Nation Office) as 200mm and 250mm pipes via gravity flow. The lands west have a 375mm trunk pre-servicing future commercial developments, meeting the residential trunks from Chief Lapotac Boulevard. The combined flows lead to a 450mm pipe east towards

Figure 4.2.2 *Existing Sanitary Collection System*



the River Cree Casino & Resort and to the existing lift station. From the lift station, the sewage is conveyed through forcemain into the existing City of Edmonton sanitary sewer system. This system has been modelled in PCSWMM and currently has sufficient capacity to continue operations with no expected negative impact on levels of service. All the pipes have been modelled with results under 33% utilized capacity, and therefore will not require capacity upgrades.

Although information on the existing system and its condition in the NEDA is known, it is recommended that prior to design and construction, a flushing and camera inspection regiment be implemented on any tie-ins of new to old infrastructure.

4.2.2.2 Village

The Enoch Village is situated on the west side of the Nation and the Village Area is handled separately from NEDA. It has its own collection system with sewage lagoon treatment. Little is known of the conditions of the existing sanitary sewer system in the Village. Previous reports and figures do not depict pipe sizes, materials, or locations; no record drawings of the system have been found. Original design drawings of the Village Core's infrastructure were provided by Enoch and have been used for estimates of inverts, pipe sizes, and pipe locations. However, the size, material and alignment of the mains discharging to the existing lagoon are currently unknown.

Lagoon

A recent assessment (AECOM 2012) indicated that the Village lagoon provides insufficient treatment for the service area. Its design capacity has been exceeded and it periodically overtops its berm. There is also leaking through the berm and through the outlet control structure. Regulated and unregulated releases discharge into a nearby wetland area just north of the lagoon with ultimate drainage to Yekau Lake. Anecdotal information from the Nation indicate that a regulated release had not occurred for at least 10 years. An emergency release, granted by INAC and Environment Canada, had occurred in the spring of 2016 under an emergency scenario. It was recommended as part of the emergency assessment work, that a detailed assessment of the current condition of the lagoon and eventual upgrades could improve the level of service for the Village.

There is significant damage to the lagoon's liner system. The lagoon liner has suffered damage from beavers establishing homes on the lagoon. In the spring of 2016, a beaver lodge and its inhabitants were removed from the lagoon.

As current operating conditions already represent a significant environmental and public health risk, the existing lagoon cannot service any additional lands.

Conveyance System

The entire sanitary sewer collection system for the Enoch Village is gravity-based, taking wastewater from the existing mixed-use community (comprised of the single-family residential area, Enoch Business Centre, Enoch Health Centre, Enoch Recreation Centre, and Kitaskinaw School), towards the lagoon. Presently and mentioned above, there is little to no information or confirmation of pipe sizes, flow, and locations of the existing conveyance system to the lagoon. Following proposed design drawings, it has been estimated that the current sanitary system throughout the Village is sized at 200mm. It is highly recommended that before any major design work or construction connections are made, that a thorough survey and camera inspection plan of the pipes be conducted. Better understanding of the current system and its condition will determine best practices moving forward on how to handle incorporating new infrastructure and development in connection to the existing system.

4.2.2.3 Rural Areas

Rural residents currently either (1) use sewage holding tanks with truck haul to the Village lagoon; or (2) use septic tanks with mound systems.

4.3 Future Sanitary System

4.3.1 SANITARY SERVICING CONCEPT

The servicing concept of the sanitary system has been modeled according to the phasing proposed in the Village ASPs and assumptions made in the NEDA area ahead of preparation of its ASP. Demands have been based on population growth projections for the Nation at 2% per year, and the zoning outlined in the Village ASP and ILUP.

The following table depicts the total peak wet weather flows from the entire Nation, and the three main areas. Both the NEDA and Village demands are based on conventional gravity systems that incorporate inflow and infiltration (I/I). The Rural demands do not include I/I as it assumes that septic systems are being used, therefore only dry weather flow demands are considered.

Commercial, institutional and industrial demands have been estimated based on populations, and an overall ratio of development between NEDA and the Village.

Table 4.3.1. Sanitary Flow Estimates

Scenario	NEDA (L/s)	Village (L/s)	Rural (L/s)	Total (L/s)
Existing Condition	9.84	10.99	5.58	26.41
5-year	17.64	11.93	6.04	35.61
10-year	20.66	15.59	6.66	42.91
20-year	24.89	23.79	8.11	56.79

4.3.1.1 Conveyance

Due to the existing constraints of natural topography, oil and gas wells and pipelines, conditions of the existing lagoon, and the volatile development potential of NEDA, it is highly recommended that both systems remain independent. This independence will allow for NEDA to grow unrestricted, limited only by the maximum allowable discharge to the City of Edmonton of 60 L/s, which, based on estimated flows as shown in **Table 3.1** above, would not restrict development in the foreseeable future. The separated system will also allow for the reduction in trunks and lift stations required for an estimated 20 years, reduce the complexity of the system, and improve the ease of constructability and operability of required infrastructure.

Based on the expected growth rates and land use planning used in the NEDA and Village ASPs, and inputted the PCSWMM model, **Figure 4.3.1** was created to depict the recommended areas of development for the Nation, and the pipe main sizes required to service these developments.

NEDA will have expanded lands to the west in adjacent quarter sections, requiring 250mm lines feeding into the existing 375mm line intended for commercial expansion. The Millennium neighbourhood development will be expanded with connections of 200mm mains to the existing 250mm sewer mains with no indicated capacity issues from modelling.

The Village will be expanded using 200mm pipes into expected areas of growth for residential, light industrial and commercial developments. Developments to the north of the Village town site, will have a twinned line of 250mm pipe to the existing 200mm line towards the lagoon.

The calculations of a conventional gravity system will be sufficient in handling the growth of the NEDA system within the 60.0 L/s as per the integrated land use plan based on the assumed 2% population growth (AECOM's proposed pipe network for NEDA has been included in Figure 4.3.1). Current modelling shows that the future network has sufficient capacity, with simulated capacity reaching below 45%.

However, NEDA is an area that is market condition driven, and therefore, less predictable, and could exceed what was assumed in calculations and models. In the case that growth exceeds assumptions, this could challenge the existing 60.0 L/s restriction on the input into the City of Edmonton system. There are several different technologies that can be used to maximize the 60.0 L/s capacity. These include using low pressure systems, blackwater or greywater sewage re-use systems, system optimizing softwares, or storage and off-peak pumping.

4.3.1.2 Treatment

As previously mentioned, due to the present condition of the lagoon, this facility must be upgraded or replaced. It is recommended to upgrade to a higher level of treatment that will allow for less land use, and more opportunities for discharges.

It has been previously recommended that the lagoon be drained, dredged with biosolids removal, and assessed. Once assessed, decisions can be made on how to repair the lagoon cells and be expanded. The lagoon should be upgraded and/or be redesigned to handle demands for the next 20 years. Note that if the Nation decides to implement a higher level of treatment, less land may be required, but more attention will need to be paid to operations and maintenance of the infrastructure.

Options in terms of treatment could also be found in the context of blackwater or greywater re-use systems, should the Nation choose to utilize these processes or technologies. These are explained in more detail in Section 5.4.

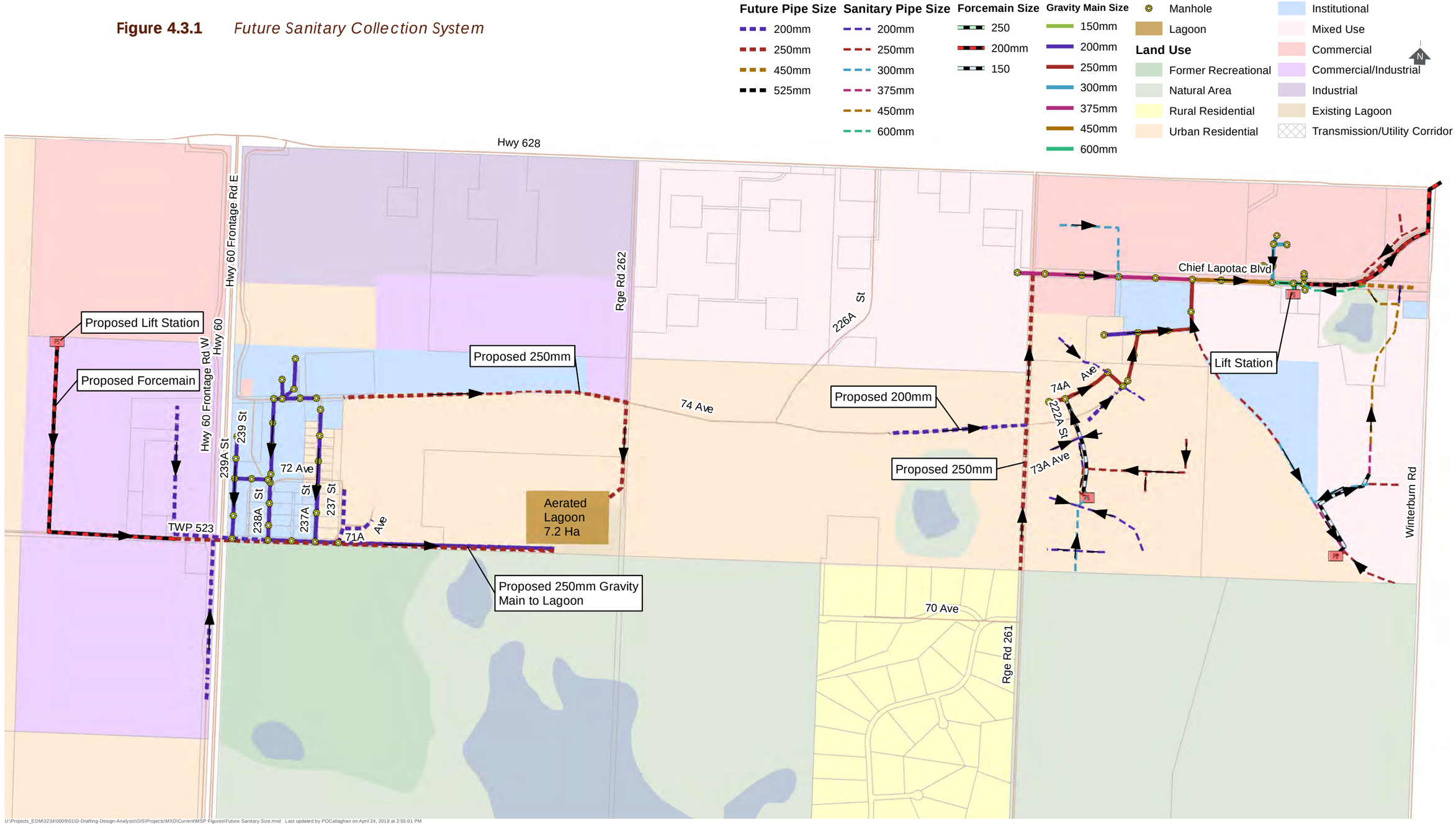
4.3.1.3 Discharge Locations

For the foreseeable future, the NEDA sanitary system will continue to discharge into the City of Edmonton, under the 60L/s moratorium. Regular assessments of market conditions and growth within NEDA, in conjunction sanitary flows monitoring at the lift station is recommended, in order to determine whether a second discharge location will be required. Note that initial estimates indicate that the 60 L/s moratorium into the City will continue to allow unrestricted growth of the NEDA area, at least for the next 100 years.

Beyond the 20-year growth of the Nation, the ECN will need to consider which direction they would like to take to discharge their sewage, and which adjacent neighboring system works best for their management. Although the construction of these connections will not have to be made until 2037, however, the discussions and agreements with adjacent system operators will need to be sorted out proactively.

For the Village, there are two options put in focus. First, the sanitary system can connect to NEDA's and therefore, also discharge to the City of Edmonton's sanitary sewer system. The current agreement specifically states that only the developments in the NEDA area are permitted to discharge into the City system and the City has already noted that it is unlikely that additional capacity beyond the 60.0 L/s will be available without significant downstream upgrades. To consider the option of connecting to NEDA's system would require an amendment to the current Master Servicing Agreement with the City. Second, the sanitary system could discharge to Parkland County's (Acheson's) system, or become a customer of the Alberta Capital Region Wastewater Commission (ACRWC), both resulting in a connection to the North. Conversations with both the ACRWC and Parkland County have begun to determine implications on the Nation. ACRWC would require the Nation to be a full participating member, creating additional financial and political responsibilities in order to do so. Being a customer to Parkland County would only require a customer fee and utility rate to connect. The recommended route would be for the Nation to be a customer of Parkland County, and to continue these conversations and negotiations into the future.

Figure 4.3.1 *Future Sanitary Collection System*



4.3.2 UTILITY CORRIDORS FOR LONG-TERM SERVICING

It has been recommended that any sanitary sewer trunks be constructed within and in correspondence to the main transportation routes and road rights-of-way as suggested in *Section 2.2.1*. The purpose in doing so would be to reduce the impact of the sanitary sewer infrastructure from potential developable land that the Nation would like to pursue, while providing an accessible trunk to handle the sanitary demand of said developments adjacent to the established trunks.

The main corridors being considered at this point in time, parallel with the proposed roads. These include the following:

- Hillview Road – the north-south corridor on the eastern edge of the Village that gravity feeds into the NEDA system
- HWY 60 – the north-south corridor through the western part of the Village. This will be a useful corridor for any future developments and its respective servicing.
- Chief Lapotac Road – the existing main road in NEDA that has the main trunk conveying sewage towards the lift station
- HWY 628/Whitemud Drive – the northern boundary of the ECN, would be a beneficial corridor for utilities. However, agreements with Alberta Transportation would have to be in place.

4.4 Implementation

4.4.1 5 YEAR - SHORT TERM

NEDA

Within the next year, it is expected that there will be a car wash, administrative building, and a gas station with convenience store to complete construction and be commissioned. This development ties in directly with the existing sanitary lift station.

The estimated flows from the NEDA area in the short term are summarized below:

Source of Sanitary Sewage	Average Dry Weather Flow (L/s)	Peak Dry Weather Flow (L/s)	**Inflow / Infiltration** (L/s)	Peak Wet Weather Flow (L/s)
Existing (Residential & Casino)	2.87	8.60	1.24	9.84
Car Wash	1.473	4.42	0.04	4.46
Office Building	0.2	0.60	0.06	0.66
Convenience Store	0.056	0.17	0.02	0.18
Bank	0.323	0.97	0.06	1.03
TOTAL	**4.922**	**14.76**	**1.42**	**16.17**

A peaking factor of 3 was used across all new developments to determine peak dry weather flow. Due to the smaller building footprints, and recycled water systems of the designed car wash system, it was determined to be more reasonable and realistic compared to what was recommended by the City of Edmonton Drainage standards.

The existing system is estimated to discharge 16.17 L/s under peak wet weather flow conditions. The lift station has two pumps that can discharge at 10 L/s each, resulting in a total capacity of 20 L/s. The addition of the four developments will reach over the capacity of one pump, and reduce the redundancy of the lift station system. Therefore, the system will require an immediate upgrade to handle the required pumping capacity of the oncoming developments.

The increase in flow from these developments will bring the existing lift station above maximum capacity and immediate upgrades will be required. A Sewage Pumping Station Upgrades Conceptual Design has already been prepared for the Nation by AECOM (2015). The report discusses building a new lift station adjacent to the existing facility with a new wet well that can handle ultimate flow pumps and operation rates. This upgrade should be adequate to handle flows up until the end of the Medium/Long Term (20 years) projection. It is important to note that the original design from AECOM recommends a system that can handle both flows from NEDA and the Village. However, it is recommended that this design be revised so that no flow from the Village be accounted for, but rather that the lift station handle flow solely from the NEDA area.

Village

Due to the Lagoon already being at capacity and reaching its design life, in the short term, rehabilitation of this facility is considered the number one priority. As recommended in a letter the Nation by Urban Systems dated June 2016, the lagoon requires draining, dredging of biosolids and an assessment before final decisions and designs are implemented. The re-design should include adding the required anaerobic cells for treatment, and ensuring there can be enough capacity to house the Village and rural residential dry weather flows as well. As noted above, it is recommended to keep the NEDA and the Village Systems separate, therefore, a previously proposed lift station and forcemain connecting the lagoon to NEDA will not be required.

The Nation has two options to consider for their lagoon infrastructure upgrades; (1) keep a facultative lagoon design or (2) move to an aerated lagoon design.

A facultative lagoon will keep the same basic principles of the existing lagoon, with minimal operation and maintenance cost and an annual release. There will be a requirement of committed operations for the annual discharge. The main downside of a facultative lagoon

is the increased land area it would require to meet this 20-year population growth design and capacity. It is estimated the area required would near four times the existing lagoon's land area, taking away from valuable land and resources.

An aerated lagoon will be a mechanical and operational upgrade from the current lagoon design. A change to an aerated lagoon will result in increased operational and maintenance costs, and higher commitment from public works staff to operate the facility. However, an aerated lagoon requires significantly less land area than that of a facultative lagoon. Due to the higher level of treatment that an aerated lagoon provides, the effluent would theoretically be allowed to discharge continuously. Alberta's winter season and tendency for frozen water bodies and permafrost ground will limit discharges to the late spring and summer period, with storage needed to keep treated wastewater over the winter months. An 8-month storage cell would be recommended with an aerated lagoon if discharges continue to occur towards the wetland.

The following table shows the volumes and areas required for the expected sewage generation for the 20-year growth projections.

Cell (days of storage)	Facultative Lagoon Storage (m^3)	Facultative Lagoon Area (m^2)*	Aerated Lagoon (8 Months)	Aerated Lagoon (8 Months) Area (m^2)*
Anaerobic (2 days)	1,634	467	-	
Facultative (60 days)	49,027	32,685	-	
Complete Mix (2 days)	-	-	1,634	327
Partially Mixed Aerated (28 days)	-	-	22,879	4,576
Polishing (5 days)	-	-	4,086	817
Storage (365 days)	298,248	99,416	196,108	65,369
Total	348,909	132,568	224,707	71,089

* Areas provided are preliminary estimates and do not take into account sideslopes, spacing between cells and weir structures needed to maintain water levels

In both cases, the discharge point will be a seasonal wetland system that leads to Yakau Lake. The Lake can handle approximately 5,000,000 m^3 of water. This is more than sufficient space to handle treated effluent from the lagoon without spilling into a downstream water course that would lead to fish bearing waters.

As design and construction of these lagoons begin, it would be valuable for the Nation to conduct camera inspections and assessments of existing infrastructure to ensure that designs and capacities can be met for any proposed infrastructure to come on-line.

The lagoon designs can also be phased to meet the demands and needs of the Village area, bringing components on-line only or expanding existing components when the population grows to certain thresholds. After the lagoon has been completed and is operational, the next priority should be to complete the trunk systems to meet the demands of the village as it grows in Cells 1 and 2, as depicted in the Village ASP. Consideration for any upgrades required to handle increased density, proposed institutional developments, and additional residential areas should be incorporated at this stage.

Overall, for the entire Nation, as the immediate infrastructure priorities are met, opportunities to be proactive and manage the maintenance and operations of the existing system will arise. To ensure the sanitary sewer system can last as long as intended and save on long-term costs, the Nation can implement an asset management program and policy, an operations and maintenance program, consideration of sewer utility rates and a water conservation program and strategy. The initial steps of this would begin with a condition assessment of the existing system and the development of an inventory of all existing infrastructure through camera inspections. This would allow the creation of a Geographical Information System (GIS) and an Asset Replacement Forecast for proactive planning and budgeting.

An operations and maintenance plan developed with Public Works would also be important, including inspections on existing infrastructure, mainly manholes, pipes and service connections. These exercises would allow confirmation of modelled data, and help catch issues and problems as early as possible. This operation and maintenance plan will require commitment to

implement and continue for the longevity for the system to further the Nation's self-reliance and resiliency in sanitary sewer service infrastructure.

The creation of a sewer utility rate will allow for stable funding of sewer services for the future of the Nation. There can be many ways of achieving this, and one that works for the Nation and its members is important in ensuring and maintaining expected levels of service. This could look like any combination of rates determined by sewer sizes needed to service the users' development, fixed rates to different groups of users, or based on water usage. Water conservation programs and policies will also allow the Nation's infrastructure to last longer as mentioned in the Water Master Plan. These initiatives will set the Nation up to understand their water assets better and prepare them for the future.

4.4.2 20 YEAR – MEDIUM TERM

NEDA

NEDA is expected to show significant growth in this time frame. Due to topographic constraints, the development of NEDA into the southernmost quarter sections will trigger the need to design and construct at least one more lift station that connects to the existing lift station that discharges into the City of Edmonton. This could be costly to the Nation if not developed in a contiguous way, maximizing built infrastructure. It is recommended that the areas depicted in **Figure 4.3.1** be prioritized and developed first to avoid expensive offsite infrastructure. If the Nation decides to allow development in these areas, developers should be negotiated to pay a significant proportion for the required offsite infrastructure.

Continued monitoring and updated assessment of growth and flows in this time period will position the Nation to be proactive in ensuring adequate capacity is available, and lead to the longevity of the infrastructure for this system.

Village

As the Village continues to build out through the 20-year term, dependent on various factors, such as the choice of commercial, institutional and industrial developments that are allowed to be built, the Village could potentially reach capacity for its sanitary infrastructure within this time frame, and on-going assessments and planning by the Nation will be needed.

In this time frame, the Nation will require securing HWY 60 as a corridor for a future connection to a secondary discharge point in Parkland County. The rehabilitated and expanded lagoon options will reach its capacity and new developments will have to consider discharging into separate systems that convey sewage to the ACRWC. In doing so, the ACRWC has stated that any municipality that wants to use their infrastructure will require becoming full members of the commission. Before becoming a member, there will be process of board approval, after assessments of system capacity, short and long-term operations, maintenance and capital costs, distance to wastewater treatment plant, and risk. It will also cost the Nation any expenses required to review its application and is expected to not create any financial burden on the commission and any of its members.

As the lagoon reaches this point, consideration of the future of the lagoon should continue. The Nation can choose to keep the lagoon to continue servicing the users it does at that point in time, or the Nation can begin to decommission the lagoon, as its existence limits growth and development with its 300m setback requirements. The longevity of the lagoon can be extended if several technologies are implemented to increase capacity of the pipe. Options include low pressure systems, greywater and blackwater re-use systems, and household appliances, coinciding with potable water demand reduction. These are explained in more detail in future sections.

Through initial, high level analyses and estimates, a large contribution of sewage generation for the Village comes from expected Commercial, Institutional, and Industrial developments. If properly planned and assessed, and restrictive covenants are placed on these developments, further extension of the lagoon lifespan will occur. This could come in the form of allowing only certain commercial, institutional, or industrial businesses to be developed (ones which limit sewage generation, e.g. pipe laydown yards or warehouses), or enforcing water diversion technologies be implemented as part of construction.

Dependent on what the Nation may decide to develop on its lands, treated effluent could be used more efficiently, storage needs may be reduced.

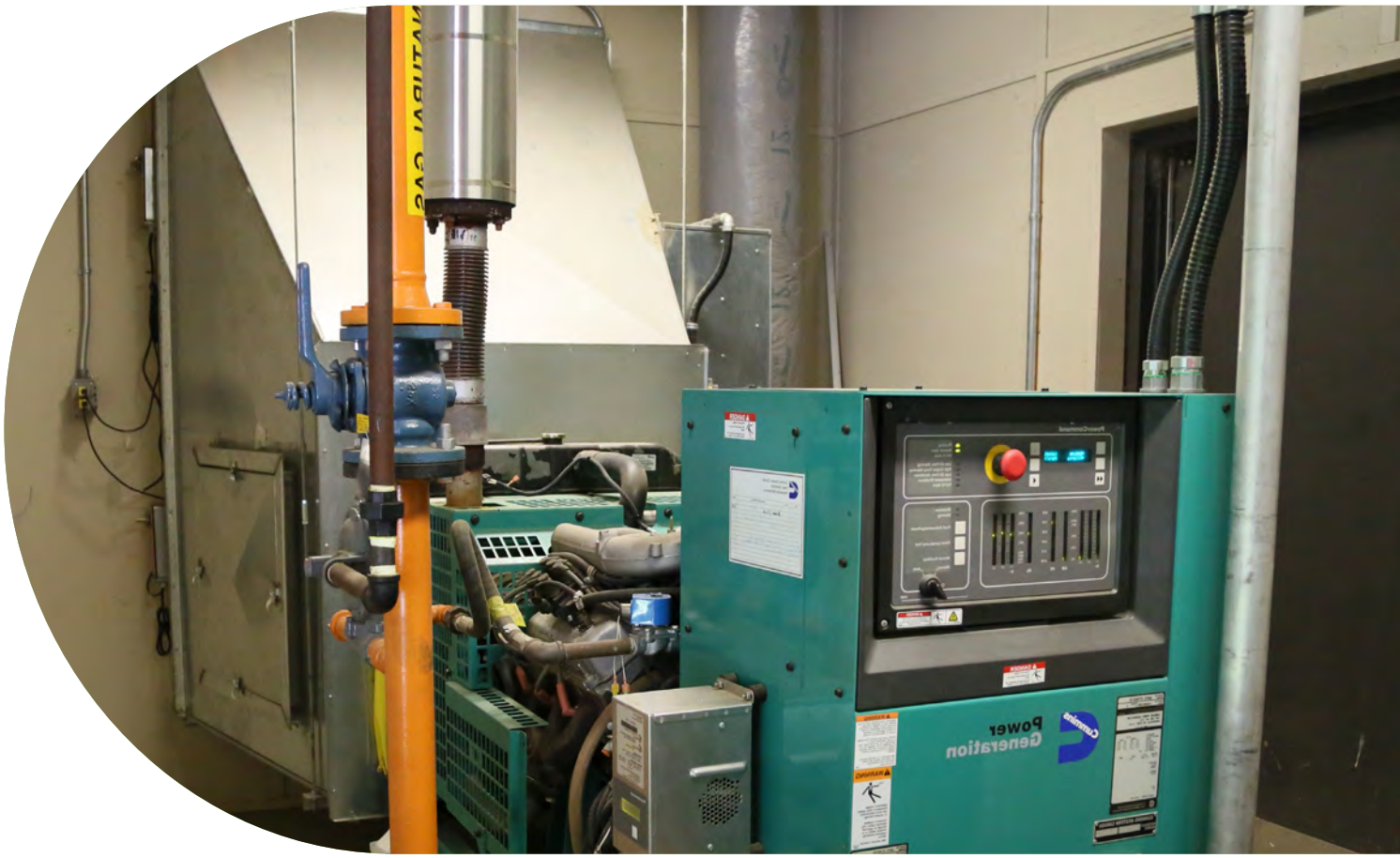
4.4.3 100 YEAR – LONG TERM

NEDA

NEDA is expected to reach full build out beyond the 20-year time frame, with land allocated to commercial growth being the limiting factor. As time goes on, NEDA's growth and system will be driven by the residential market. This will be an expansion of development to the west of the NEDA lands. As sewage generation increases, further assessment and planning by the Nation may determine the need to use other means to maximize the 60.0 L/s discharge allowed by the City of Edmonton. This could be in the form of storage and off hour sewage pumping. Alternatively, peak flows may be able to be pumped to the Village system should capacity exist.

Village

As time goes on beyond the 20-year growth period, it is expected that many of the sour gas wells and oil and gas pipelines will be abandoned and remediated, opening up opportunities to further develop and expand the Village lands. However, in doing so, new discharge points will have to be established for the Village development, as the lagoon will not likely have capacity for further growth for any development of cells beyond Cells 1 & 2 of the Village ASP. This will be true should commercial, industrial and institutional development occurs faster than anticipated. Note that this will also increase the need for a second discharge point being secured, which even though reduces the Nation's independence and self-reliance, it guarantees a higher level of service.



4.5 Design Standards

4.5.1 SANITARY SYSTEM STANDARDS

The design and construction of sanitary sewer systems will be based on the City of Edmonton's Drainage Design Standards, due to its proximity, and the discharging of wastewater to the City's infrastructure. The application of a well-established and widely used design standards should also reduce confusion for any contractors working on the construction of sanitary services, and their enforcement will ensure services are constructed well.

4.5.2 EXPECTATIONS FOR NEW DEVELOPMENTS

4.5.2.1 Residential within ASP areas

Residential developments within the Village and NEDA ASP areas should be planned proactively in terms of the phasing of developments as recommended in **Figure 4.3.1**. Designing and constructing new developments in a contiguous fashion will maximize the use of infrastructure that already exists. This will allow the Nation to properly plan for infrastructure priorities and ways of funding these capital projects.

4.5.2.2 Commercial/Industrial/Institutional

Development of commercial, industrial or institutional services should take place based on the planned trunks and the phasing recommended by the ASPs. This will maximize the use of existing infrastructure and will allow timelines of construction to coincide with residential development needs. Dependent on their proposed use, Commercial/Industrial/Institutional sites may need to consider private servicing instead of connecting to the existing system and triggering high costs for infrastructure upgrades.

The quality of the effluent from non-residential developments should also be reviewed through the use of a sewer-use Bylaw or Band Council Resolutions. This is particularly important if the ultimate discharge is the City of Edmonton's sewer system, as certain industries may produce effluent that may be not be allowed to discharge into the City's system.

4.5.2.3 Rural Residential

Rural residential developments should consider having enough storage onsite for sanitary sewage. The storage site should also be easily accessible to main transportation routes to be able to be hauled away and discharged to either the existing/upgraded lagoon or the upgraded lift station wet well. Dependent on the availability and frequency of operators and service vehicles to service these rural homes, storage should be designed to handle expected or modelled flows.

4.5.3 ALTERNATIVE TECHNOLOGIES

4.5.3.1 Household Scale

Fixtures

In a household and the individual context, the best means of reducing the production of the sanitary wastewater would be through fixtures available in each home. Toilets, showers, sinks and appliances use a significant amount of water when flushing, and there are now numerous means of reducing the water required.

Some examples include low flow fixtures, urine diversion toilets, composting toilets, vacuum toilets, air water forced toilets, or closed household toilet re-use systems.

Source separation or diversion tools such as urine diversion toilets, composting toilets, or closed household toilet re-use systems allows for the opportunity to reduce the types of wastewater and find another potential uses or means of handling the produced wastewater.

Volume reduction tools such as low flow toilets, vacuum toilets or air water forced toilets have the main function of using reduced volumes of water to dispose of wastewater into the sanitary system. While these technologies are not commonly used in residential developments, they may become much more common place in the near future.

4.5.3.2 Communal Scale

Greywater Re-use

Greywater is the wastewater produced that does not contain any fecal matter or urine, usually sourced from sinks, showers, dishwashers and washing machines. As there is no fecal matter present in this form of wastewater, the amount of treatment required to bring the water quality to an acceptable and expected level is more manageable. Depending on the level of treatment, various re-use streams can be utilized. For example, greywater treated minimally, can be used for non-potable water uses, such as irrigation for personal or communal gardens and lawns, and toilet water. Advanced treated greywater, can be brought up to potable water quality, and re-used back in sinks, laundry machines, dishwashers and showers, subject to currently regulations.

There are several advantages of a communal greywater re-use system. First, re-using greywater means a reduction of potable water demand. In the case of the ECN, NEDA's Master Servicing Agreement with EPCOR's water distribution system is limited to 12.27 L/s to an established 215 ML/yr via a 300mm watermain feeding a reservoir tank. The ability to re-use greywater will stretch the current agreement with EPCOR to meet future development demands in NEDA. Greywater re-use will reduce the wastewater released into the sanitary sewer system. For NEDA, this reduces the stresses on the limitations set upon the discharge rate into the City of Edmonton sanitary sewer system at 60.0 L/s, and the existing capacity of the lift station, extending operational life of the existing infrastructure. In the Village, less wastewater discharged would reduce strain on the existing lagoon, which is already at capacity. Overall, for rural residents, the benefits are more independent and household focused, however, re-use systems would allow for relaxation of dependency to the stressed demands already put on the Village.

The disadvantages is that for communal uses, a greywater re-use system would require additional infrastructure set-up in rights-of-way. For existing developments, to retrofit a system could be costly and difficult to undertake. Another disadvantage would be the additional operation and maintenance attention that would be required to ensure successful implementation. Finally, policy and regulations in terms of greywater re-use systems and infrastructure are still novel to a Canadian context as there has not been anything done at this potential scale.

Blackwater Re-use

Blackwater is the wastewater produced that contains fecal matter, usually sourced from toilets. Due to the presence of fecal matter, the level of treatment for re-use is more intensive, in order to address public health safety concerns.

Blackwater can be treated to water quality levels for non-potable and even up to potable water uses as mentioned above, similar to greywater. Although the means to do so will require more advanced technologies.

Due to the concentrated organic content present in blackwater, a re-use system could produce several streams of by-products, dependent on the types of treatment used. These by-products could be utilized in various means to the advantage of the community. Some of these by-products could look like methane for natural gas (heating and cooking) or biosolids for fertilizers.

These systems are fairly novel in North America, and have only been completed in small scales in other countries. They would require higher levels of investment in operations and maintenance. Depending on the scale, implementing this system could be initially expensive.

District Energy (heating)

The by-products that are created from Greywater and Blackwater treatment options listed above, can sometimes be utilized for energy production. If an anaerobic system is used for the treatment of the blackwater or greywater, methane gas will be produced, which can be used as biogas for redistribution to single-family and multi-family homes, commercial and institutional buildings for heating. An even more complex system, could see the “smart” exchange of heat between building types to ensure the most efficient use of heat and energy.

Low Pressure System

Low pressure systems are alternatives to the conventional gravity systems and is a system of pumps that allow for more distributed flows, and is not restricted by topography. This technology will require more operational and maintenance attention. The use of low pressure systems are advantageous in areas where flow is limited or restricted. They can be used and operated in a way that evens out flows and reduces peaks in sewage flows.

There are two main types of low pressure systems in sanitary sewer systems; septic tank effluent pumps (STEP) and grinder pumps (GP). STEP systems utilize a typical septic tank to hold and store sewage, but also has a pump to discharge sewage at a controlled rate by the user. STEP systems are susceptible to pump replacements and deteriorating septic tanks. For GP systems, sewage flows to a vault, smaller than a septic tank, and is ground up to create a more uniform effluent to be pumped out. GP systems are more energy intensive and may cause TSS problems for downstream treatment processes.

4.6 Summary and Recommendations

The following capital projects will require immediate attention to ensure the sanitary system can handle the growing community's demand over the short- and long-terms:

- Upgrades to the existing NEDA lift station to maximize the 60.0 L/s capacity into the City of Edmonton sanitary system to handle new NEDA developments. This includes providing wet well storage to handle NEDA's volatile market expansion potential.
- The existing lagoon requires immediate attention to allow for additional growth in the Village and to address the leaking that is causing contamination of the existing groundwater and surrounding environment. This will come in the form of draining the lagoon, dredging and removing all biosolids remaining, assessing the current state of the lagoon and designing and constructing any upgrades the lagoon requires.
- The lagoon should be upgraded to an aerated lagoon system, in order to achieve the best balance of land area, treatment, cost, and flexibility.
- Although not a capital project, it is important to reiterate, that the NEDA and Village systems should remain independent from one another for the following reasons:
    - Restrictions and complexities of design and construction with the oil and gas pipelines;
    - Topography where a significant ridge exists between the NEDA and the Village;
    - And a restriction of allowable discharge of 60.0 L/s in NEDA, the market driven area of the Nation, that has the most potential for growth can be allowed to grow without the added flow from the Village to be managed.

The following are general utility management strategies the Nation should adopt in order to meet the established sanitary service delivery goals for the ECN for the short, medium and long term:

- Develop a CCTV camera inspection program to inspect the existing sanitary system's condition and determine which infrastructure requires upgrades and immediate attention. Having this information will also be useful for any design and construction of new connections to the existing system.
- Operations and maintenance program, including inspections on manholes, pipes and services.
- Asset Management plan and policy, including a full condition assessment of the infrastructure, the creation of GIS database, and the development of asset replacement forecasts.
- Prepare for long-term infrastructure renewal and upgrades.
- Further developing and maintaining the relationships with the City of Edmonton, Parkland County and Alberta Capital Region Wastewater Commission in terms of sanitary servicing for the Nation.
- Develop and adopt sanitary sewer design standards and sewer-use bylaws
- Commit to the proposed phasing of development of the Village and NEDA ASP areas, to maximize the use of existing infrastructure and avoid high capital costs on offsite services.
- Consider the utilization of alternative technologies to extend the life and capacity of existing and proposed sanitary systems.

5. Stormwater Master Plan

5.1 Introduction

5.1.1 PURPOSE OF STORMWATER MASTER PLAN

Stormwater management is important to consider in conjunction with long-term capital plans for funding and construction of improvements. This plan can be used to support funding applications, future budget planning, as well as high level policy planning and enforcement of stormwater related development conditions.

The purpose of a Stormwater Master Plan is to provide a guide to development of stormwater management systems to support the goals and objectives of the Enoch Cree Nation (ECN) alongside anticipated short and long-term growth and development within the community. This plan looks at potential improvements to address existing issues, as well as identifying required infrastructure to support community growth.

5.1.2 LEVELS OF SERVICE

5.1.2.1 Typical Stormwater Servicing

The stormwater management system is intended to store and convey stormwater runoff and minimize the risk of flooding, as well as enhance runoff quality and protect downstream receiving watercourses from environmental harm including erosion, pollutants, and flooding. It will utilize minor and major systems, where the minor system consists of conveyance features (i.e., swales or storm sewers) sized to accommodate runoff from a 5-year storm event, and the major system consists of conveyances for infrequent large flows of a 100-year event. Both systems are designed together to provide a comprehensive approach to managing stormwater runoff.

These conveyances are supplemented with site specific Stormwater Management Facilities (SWMFs) which are typically storage facilities intended to enhance water quality, attenuate discharge rates, or fully retain flows to limit the discharge volume leaving the catchment in a 100 year event. Such SWMF's may be applied "at the source" (eg. on each lot) or at the "end of the pipe"; a centralized facility servicing a larger community area. The City of Edmonton Drainage Design and Construction Standards provide typical guidelines appropriate for ECN as it is in close proximity to the City.

5.1.2.2 Current Stormwater Servicing in NEDA

The Northeast Development Area (NEDA) is currently the most densely developed area within Enoch Cree Nation, and is continuing to see ongoing development. The stormwater management system in NEDA is comprised of a network of underground storm mains and overland drainage pathways that direct storm runoff toward a constructed SWMF, which is manually pumped as needed to a ditch draining into the City of Edmonton. The SWMF was designed to provide water quality enhancement and attenuation for the 100 year design storm, for a catchment of approximately 64 ha in size, while minor and major drainage systems provide the levels of protection indicated above.

Under the current Master Servicing Agreement, ECN pays the City a flat fee of nearly $11,000 per month in order to pump the NEDA storm pond to the City at a maximum rate of 2 L/s/ha. At the current level of development, pumping is infrequent.

In the Enoch Village area, all drainage is overland via curb and gutter and roadside ditches, and generally directed toward the Yekau Lake wetland complex. It is unclear whether the existing major drainage pathways within the Village are adequately sized to convey runoff from a 100 year design storm event without surcharge. The Yekau Lake catchment is entirely self-contained and does not have an established discharge point. All other areas within ECN are considered rural and consist of poorly defined natural drainage corridors connecting natural wetlands, reaching tributaries and ultimately the North Saskatchewan River. **Figure 5.1.1** shows high level drainage routing of the existing stormwater management system.

5.1.2.3 Desired Stormwater Level of Service

The stormwater management systems throughout ECN should reflect the typical level of service outlined in *Section 5.1.2.1*, and should account for future development as discussed throughout this report. The Nation is supportive of using naturalized stormwater systems as much as possible to respect and enhance the natural environment while providing flood protection and minimizing risks to the community.

5.1.3 PRIORITIES AND GOALS

This stormwater master plan is informed by the guiding principles laid out in the Integrated Land Use Plan (ILUP), as well as the priorities and goals for the stormwater management system as laid out in the visioning document.

Short Term Priorities

- Establish stormwater management plans in conjunction with the NEDA and Village ASPs.
- Establish wetland and riparian area conservation incentives (e.g. ALUS program).
- Evaluate the Nation under traditional (pipe, pond) and sustainable (naturalized ponds, ditches, LID and xeriscape) scenarios.

Long Term Goals

- Explore rainwater capture for future commercial and institutional buildings.
- Implement development and housing regulations that require downspout disconnection.
- Educate members on best management practices that can be implemented at home.

Eliminating discharge and the associated fee to the City of Edmonton for the NEDA pond outlet is a high priority given the short timeframe of anticipated activity within this area.

The Village ASP area will likely be the next area to see significant development. Goals for this and surrounding areas include sizing infrastructure to prevent flooding, and directing clean runoff to Yekau Lake in an effort to increase water depth.

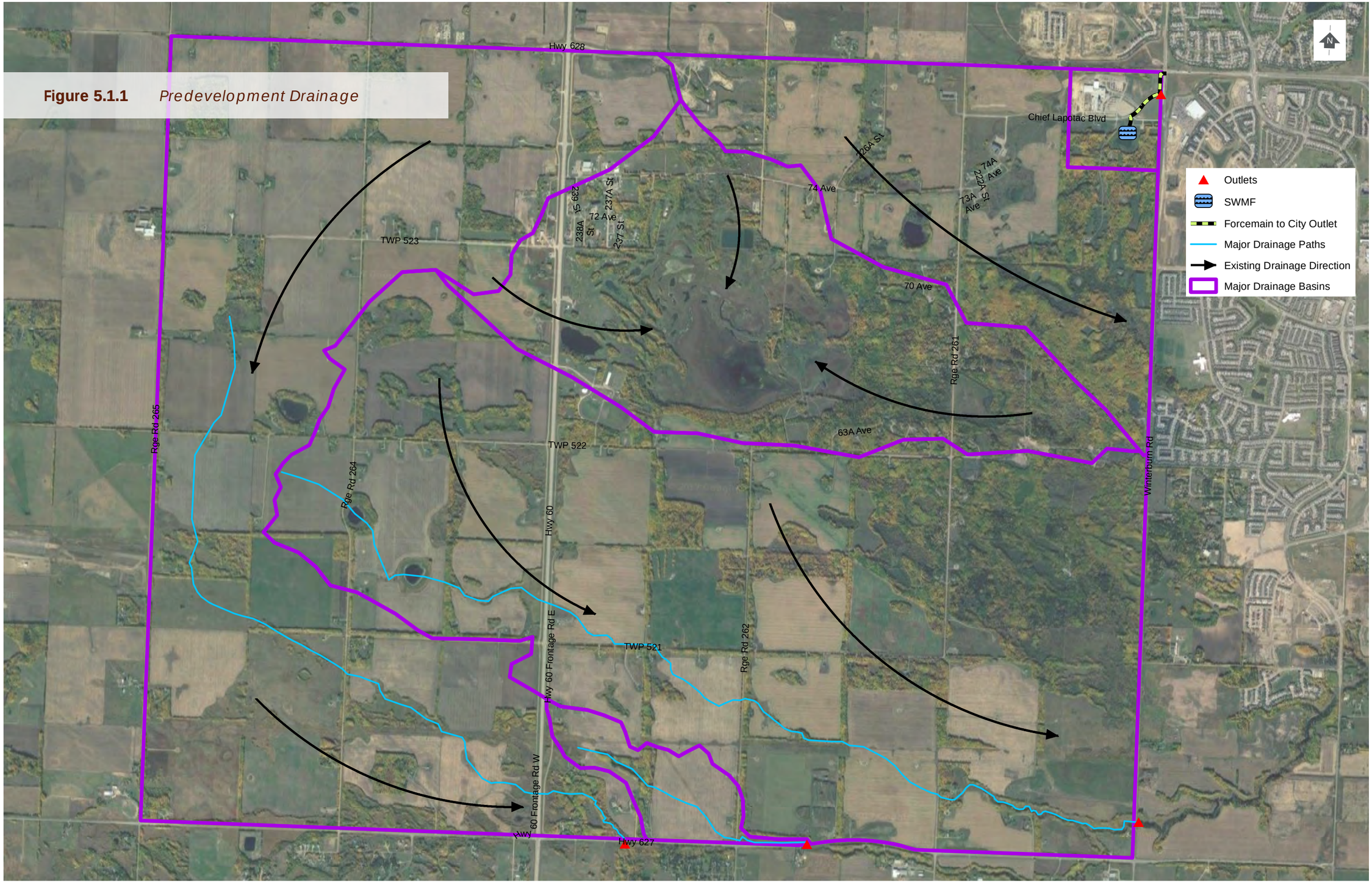
The intent for the remainder of ECN lands is to remain primarily rural and to maintain existing drainage pathways while preserving natural wetlands.

5.1.4 HISTORICAL INFORMATION

This Stormwater Master Plan is informed by the following historical reports and documents:

- Area Structure Plan (Urban Systems, 2017)
- Integrated Land Use Plan (Urban Systems, 2016)
- Enoch Master Servicing Plan – Visioning Document (Urban Systems, 2016)
- Enoch Environmental Overview (Urban Systems, 2015)
- River Cree Crossing Geotech Report (ENC Testing, 2015)
- Chief Lapotac Boulevard Geotech Report (ENC Testing, 2016)
- Enoch Village ASP Geotech Report (ENC Testing, 2017)
- Master Servicing Agreement (City of Edmonton)
- River Cree Resort and Casino Stormwater Management Engineering Drawings (Associated Engineering, 2006)
- City of Edmonton Design and Construction Standards (2014)
- City of Edmonton Low Impact Development Design Guide Edition 1.1 (2014)

Figure 5.1.1 *Predevelopment Drainage*



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5.1.5 ASSUMPTIONS

From 1940 to 1945, Sections 14 & 15 were used by the Federal government for the Yekau Lake Practice Bombing Range. Studies over the last ten years have revealed that anomalies and potential hazards remain as a result. The Nation is pursuing a claim with the Federal government on this matter. For the purposes of the Stormwater Master Plan, it is assumed that all lands within Enoch Cree Nation will have been remediated and cleared of all hazards. It is recommended to have this dealt with prior to reestablishing water levels in Yekau Lake.

Figure 1.5.1 shows the Future Land Use Concept for Enoch Cree Nation. The following table summarizes the assumed imperviousness values for each land use type for use in preliminary runoff modelling:

Table 5.1.1: Typical Imperviousness Values

Land Use	Imperviousness
Rural Residential/Natural	5%
Urban Residential	60%
Institutional	80%
Mixed Use	70%
Commercial	60%
Commercial/Industrial	70%
Industrial	70%

5.1.6 HYDROLOGIC MODELLING

Rainfall-runoff computer simulations were developed using the United States Environmental Protection Agency's Stormwater Management model (PCSWMM 2011). The primary purpose for the computer simulation is to demonstrate a representative mass balance relationship to predict evaporation and infiltration rates. This will be used to determine stormwater storage requirements with the ultimate goal of reducing or eliminating dependence on the City of Edmonton for pumped stormwater discharge.The model is set up using the following available information:

- Existing LIDAR contours
- NEDA storm pond record drawings
- Geotechnical information
- Hourly precipitation and temperature data from the City of Edmonton (2009-2017)
- Monthly average evaporation rates

While the model is not intended to provide detailed design results, a conservative calibration can be obtained based on historical information on the stormwater system, as well as reasonable expectations for runoff behavior. A detailed study of existing and historical site conditions is required for more accurate stormwater modelling. The intent of this model is to illustrate high level water balance trends and impacts of future development.

5.2 Existing Conditions

The Enoch Cree Nation is located in the upper reaches of the Strawberry Sub-watershed in the North Saskatchewan River Watershed. The area is composed of typical prairie parkland with much of the land currently used for agriculture. There is little topographical relief and drainage is not well defined; runoff collects in various wetlands which are connected via poorly defined overflow channels.

The overall area contains several distinct sub-basins:

- Yekau Lake, lies in an isolated basin near the center of the study area. It has a relatively small contributing basin with no clearly defined inlet or outlet.
- The northeastern developed portion of the Nation (NEDA) encompasses the Casino lands and adjacent development that is underway. An existing SWMF currently services the Casino lands, which is pumped out via forcemain to the City of Edmonton at a maximum allowable rate of 2 L/s/ha.
- A catchment area which lies between the boundaries of Yekau Lake catchment and NEDA catchment, primarily undeveloped and without a defined outlet.
- The northwest and southern sub-basins discharge to Wedgewood Creek via several overland channels.

Because of its location and topography, the Enoch Cree Nation receives relatively little drainage from off-site. Areas north of Highway 628 are located within the Acheson Industrial Area which drains northward (Sturgeon River Sub-watershed). However, agricultural lands (~2165 Ha) west of the boundary do discharge to Enoch lands and will need to be considered for any development in the western or southern catchments of ECN.

5.2.1 CATCHMENTS

Figure 5.1.1 shows a schematic of the existing topography driven drainage system including catchment boundaries based on LIDAR contour data. Overall there is little topographical relief and drainage is not well defined. Runoff collects in various wetlands which are connected via poorly defined overflow channels.

5.2.1.1 Northeast Development Area (NEDA)

Currently NEDA is the most developed portion of Enoch Cree Nation, and additional development is currently underway and expected to continue in the short-term. The developed areas have highly impervious surfaces, increasing runoff to the constructed storm pond. The existing casino facility and soon to be completed River Cree Crossing commercial development feature onsite minor drainage systems which are connected to a storm main along Chief Lapotac Blvd, which discharges into the NEDA storm pond.

According to the terms of the Master Servicing Agreement with the City of Edmonton, ECN pays $11,000 per month for the right to discharge at a maximum rate of 2 L/s/ha into a ditch within City limits. This flat rate is charged based on the 64 ha design catchment area of the NEDA storm pond, regardless of pumping frequency. Pumping is controlled manually by Aquatech, however a detailed pumping history is not available. This agreement is valid until July 7, 2053, and any additions to the service area must be approved by the City of Edmonton.

5.2.1.2 Village/Yekau Lake

The Yekau Lake catchment is isolated with no clearly defined inlet or outlet, with a small contributing area consisting of primarily pervious surfaces and sandy clay surficial geology. In recent years, the lake water level has dropped to all-time lows, and the environmental hazards in the area have resulted in limited recreational activity in and around the lake, including the closure of the Indian Lakes Golf Course.

A large portion of the Village ASP area is contained within the Yekau Lake contributing catchment; currently the village utilizes only surface drainage.

Discussions with ECN indicate that there are several groundwater wells in the vicinity of Yekau Lake. According to well records obtained for the Enoch Cree Nation Environmental Overview (USL, 2015), there are approximately 500 water wells throughout ECN for domestic, stock, industrial, investigative, dewatering and irrigation uses. These may be playing a role in the lowered water level of Yekau Lake, however more detailed study of groundwater zones is required to confirm the impact.

5.2.1.3 Northeast Undeveloped Area

A portion of land between the Yekau Lake and NEDA catchments is primarily undeveloped and generally slopes to the east/southeast. Borehole logs indicate this area has a range of clay surface soils becoming sandy toward the southeast end of the catchment. The slope is generally toward the southeast and Winterburn Road. The entire east boundary of the catchment forms a low lying area adjacent to the road, with no single defined low point. No culverts were found crossing Winterburn Road, indicating that there is currently not enough surface runoff reaching this boundary to require an outlet.

5.2.1.4 West/South to Wedgewood Creek

To the west and south of Yekau Lake are rural residential areas consisting of poorly defined drainage pathways connecting various natural wetland areas. Approximately 2,165 ha of agricultural lands to the west of the Enoch boundary discharge to Enoch lands. This large undeveloped area generally drains to the southeast of the ECN boundary and reaches Wedgewood Creek through several overland discharge points.

5.2.2 GEOTECHNICAL

Geotechnical information has been collected from borehole logs on the Government of Alberta Water Wells directory, and the following three geotechnical summary reports:

- Proposed River Cree Crossing – Phase 1 (ENC, 2015)
- Proposed Extension of Chief Lapotac Blvd to Range Road 261 (ENC, 2016)
- Proposed Enoch Cree Nation Area Structure Plan (ENC, 2017)

While the available geotechnical information is limited with respect to the full extents of Enoch Cree Nation, the available resources do show surface soil conditions ranging from clay to silt to sand. The following table summarizes the general soil conditions present in each of the existing catchment areas.

Table 5.2.1: Subsurface Soil Condition Summary

Catchment	Soil Summary
NEDA	Silt, Clay
Village/Yekau Lake	Silt, Sand
Northeast Undeveloped Area	Clay, Sandy Clay
West/South to Wedgewood Creek	Clay, Sandy Clay, Silty Clay

5.3 Future Stormwater Management

5.3.1 STORMWATER SERVICING CONCEPT

The areas with the highest potential for development include the Village ASP area as well as NEDA, areas outside of this are considered to remain primarily rural for the purposes of this Stormwater Master Plan. As developed area grows, pervious surfaces are covered by hard surfacing, increasing rainwater runoff volumes. Development must be undertaken responsibly to protect downstream systems from flooding, erosion, sedimentation and other environmental harm due to increased runoff.

The most practical and cost effective stormwater management strategy will be to follow existing drainage catchments and conveyance routes as much as possible. This can be accomplished by retaining the existing topography driven drainage system with adjustments to the Village ASP area and NEDA as they are developed.

Through discussion with Enoch Cree Nation, it has been determined that the community is supportive of green infrastructure wherever practical. Absorbent landscaping will also reduce intermediate stormwater storage requirements and associated footprint areas. Some best practices for increasing stormwater absorption in both high and low density development areas include:

- Vegetated ditches and swales
- Downspouts discharging to soft landscaping only
- Rain barrels
- Porous pavement

Small wetland areas are common throughout ECN and can be utilized as naturalized stormwater management facilities. It is important that wetlands and riparian areas be protected, and development should be avoided in these zones. Any development proposed within 50 m of any body of water should be assessed by a qualified environmental professional to determine an appropriate setback. If disturbance is necessary, native vegetation should be incorporated into a re-vegetation plan if possible.

5.3.1.1 NEDA

The primary stormwater management goal in NEDA is to eliminate dependence on the City of Edmonton for pumping from the existing stormwater management facility. The existing stormwater management facility is undersized, as the design drawings indicate a contributing catchment area primarily including the casino lands only. Current stormwater routing due to the extension of Chief Lapotac Blvd has expanded this catchment area further to the west.

There are three available options to address the expected increase in stormwater runoff associated with future development in NEDA. These three options are summarized below and conceptually shown in **Figure 5.3.1.**

Option 1: Continue Pumping Offsite

The first option considered for handling increased runoff from future development in the Northeast Development Area is continued pumping of the storm pond to the City of Edmonton at a maximum rate of 2 L/s/ha as set out in the Master Servicing Agreement. Allowable discharge has been set based on City of Edmonton drainage system capacity and is acceptable only during periods of available capacity in the downstream system. The current fee for this service is nearly $11,000 per month.

In order to accommodate the increase in runoff that would be associated with further development in the catchment, the storm pond needs to be large enough to attenuate flow while maintaining a maximum release rate of 2 L/s/ha based on the original NEDA pond catchment area of 64 ha. Any increase to the maximum release rate would need to be renegotiated with the City and may not be accepted.

Option 2: Evaporation and Infiltration

One option to meet the goal of eliminating dependence on the City of Edmonton and the associated fee for stormwater discharge is to direct runoff toward infiltration and evaporation facilities within Enoch lands. In this scenario, the NEDA storm pond could still be used for storm attenuation and connected to a shallow infiltration and evaporation pond. Sizing of this pond is dependent on the extent of development in the catchment and can be approximated through modelling using historical average evaporation values and conservative infiltration parameters. Discussion on potential pond sizing is included in Section 4.

Option 3: Pumping to Yekau Lake

A third option of pumping runoff directly to Yekau Lake would address two priorities of this Stormwater Master Plan: eliminating pumping to the City of Edmonton, and recharging water levels in Yekau Lake. This option would be the most beneficial to Enoch, however potentially cost prohibitive due to pumping distance and head requirement. A force main approximately 2.5 km long would be required to pump from the NEDA storm pond to the Yekau Lake catchment, gaining 15 m in elevation. Model analysis and implications are discussed in the following sections.

Additional measures such as irrigation systems and aggressive LID techniques could be utilized in any of the three options to further reduce the storage volume requirement in the NEDA storm pond.

5.3.1.2 Village/Yekau Lake

As discussed in Option 3 above, another goal of the Stormwater Master Plan is to recharge water levels in Yekau Lake. For the Village ASP area, future development and redevelopment should direct as much runoff as possible toward the lake. Where topography is not prohibitive to directing surface drainage toward Yekau Lake, absorbent landscaping should be encouraged in an attempt to recharge groundwater levels which may be impacting the lake level. As discussed in Section 1.5, reclamation work within Yekau Lake should be completed while the lake water levels are still low.

The Village is intended to ultimately contain urban local road cross sections with curb and gutter, discharging overland to swales and ditches. Other roads throughout ECN will feature a rural cross section with roadside ditches for stormwater conveyance. These cross-sections can be found in the Transportation Master Plan Section.

Runoff from developed areas within the Village will be the main concern for pollutants and therefore should all be directed to a pre-treatment pond prior to discharging into Yekau Lake. This pre-treatment pond, in combination with landscaped conveyance systems and proper erosion control will provide a preliminary level of quality enhancement for runoff reaching Yekau Lake.

5.3.1.3 Northeast Undeveloped Area

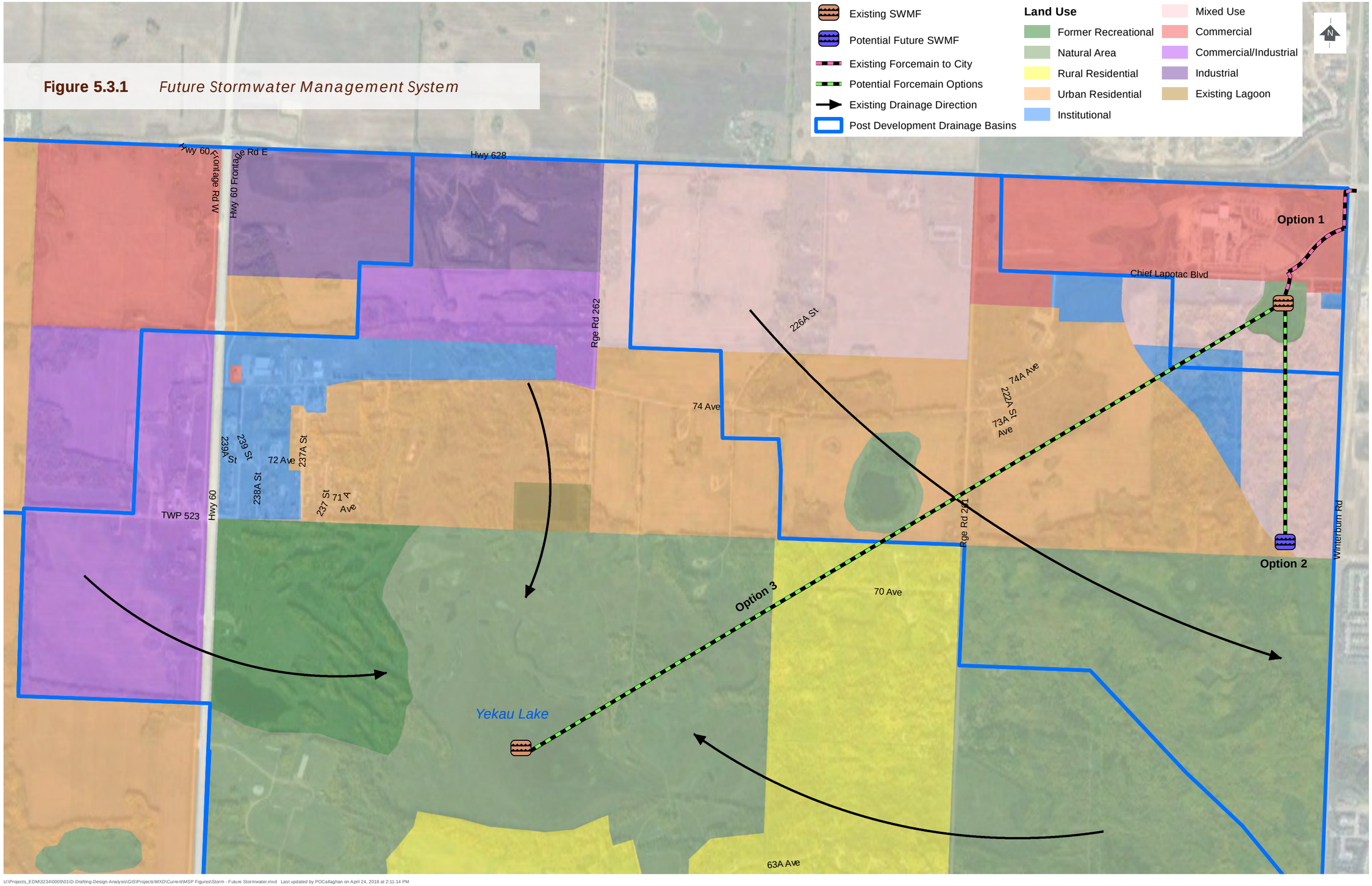
Some medium and long-term development is expected in the catchment which lies between Yekau Lake and NEDA. As there is currently no outlet from this catchment, any runoff increase from future development will need to be analyzed in detail to ensure no discharge is introduced offsite. Depending on the impact of development, this catchment may need to be considered in conjunction with NEDA and dealt with internally through increased storage, evaporation ponds or pumping elsewhere within ECN.

5.3.1.4 West/South to Wedgewood Creek

Rural areas outside of the Village ASP area and NEDA are expected to remain rural for the foreseeable future, and negligible impacts on runoff are anticipated within the 100 year timeframe of this Master Servicing Plan. In these areas the focus will be preserving the existing major drainage corridors. Any new developments that does occur in this area should be strategically located where existing natural topography conveys runoff away from susceptible infrastructure.

The northwest portion of ECN contains little topographic relief and is difficult to service. If development in this area were to be planned, particular attention would need to be given to stormwater management and downstream conveyance may need to be upgraded.

Figure 5.3.1 *Future Stormwater Management System*



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5.4 Implementation

Different timeframes were analyzed to understand impacts of the increased runoff associated with varying levels of development.

For each timeframe, the anticipated development levels are summarized along with the potential challenges and solutions with respect to stormwater management.

5.4.1 5 YEAR – SHORT TERM

5.4.1.1 NEDA

NEDA is currently the most developed area within ECN, consisting of the River Cree Resort and Casino complex, and an adjacent commercial development slated for completion in 2017. With the recently completed extension of Chief Lapotac Blvd, the catchment area of the NEDA storm pond has increased, as discussed above. Development is expected to continue within the catchment in the next five years, putting additional strain on the existing pond.

Model results indicate that the pond is already undersized for the design storm event due to the expansion of the catchment and the inability to increase the pumping rate according to the terms of the Master Servicing Agreement. While the model does not show that overtopping is expected, the pond exceeds the design High Water Level (HWL) during an extreme event. Given the increasing frequency of high intensity storm events, the risk of continuing to operate the NEDA storm pond with no upgrades must be considered. In the short term, the unlikely event of spill from the pond may not have a major impact since LiDAR data appears to show a shallow graded channel connecting the pond to a wetland approximately 800 m to the south. This should be confirmed with detailed survey, but it would appear that the consequences of pond overflow are low in the short-term.

Despite the low risk level, planning for future stormwater independence should begin in the short-term. The three NEDA storm pond discharge options presented in Section 3.1.1 were incorporated into the model and analyzed under short term simulations.

Option 1: Continue Pumping Offsite

As discussed above, Option 1 does not remove dependency of the City of Edmonton and the associated monthly fee for stormwater discharge. This may be the most logical solution in the short-term; however, in order to ensure storm pond operation within design depths, upgrades will need to take place. Model simulations show that in order to stay within design pond depths, an additional 20,000 m3 of storage volume will be required in the next five years. This could be accomplished by expanding the existing storm pond, or constructing a new permanent or temporary storage facility elsewhere within the catchment.

If no additional storage capacity is constructed, an increased maximum pump rate of 700 L/s would be required, which is over five times the rate of current pumping to the City. This solution is not advisable due to the high cost of installing new pumps to accommodate this rate, as well as the fact that a pumping increase is unlikely to be accepted by the City even with higher monthly fees.

Option 2: Evaporation and Infiltration

Long-term storm modelling was conducted to simulate evaporation and infiltration and determine an approximate size for an alternative discharge location. According to model results, a minimum area of 15 ha would be required to achieve adequate annual evaporation. Detailed design would need to be undertaken to determine an exact size of evaporation pond. This should include a full hydrogeology investigation to confirm accurate infiltration rates and groundwater conditions in potential pond locations. Such an assessment would also need to consider the impacts of any increased infiltration on the adjacent Granville neighbourhood in the City of Edmonton.

Based on topography, the most logical location for an evaporation and infiltration facility would be to the south of the existing NEDA pond. This is the only area which could potentially be reached by gravity, and is not slated for development in the foreseeable future. In the ILUP, the next section of land to the south of NEDA is identified as culturally significant, however an evaporation pond could be incorporated into the existing open spaces and low lying ponds/wetlands. **Figure 5.4.1** shows the approximate scale of a 15 ha evaporation/infiltration facility in this area, however it is not required to be a single 15 ha pond and could be split between several areas, minimizing land disturbance.

Option 3: Pumping to Yekau Lake

Option 3 addresses two of the main stormwater management goals of eliminating pumping to the City from NEDA as well as recharge of Yekau Lake water levels. Model simulations show that pumping from the NEDA storm pond in the short-term time frame would roughly double the current volume of runoff reaching Yekau Lake. Long pumping distance and head requirements further add to the potential costs of this solution. While it is difficult to accurately predict the impact this would have on water levels without more detailed infiltration and historical water level information, it is expected that such an increase in runoff volume would have a noticeable impact on water depth.

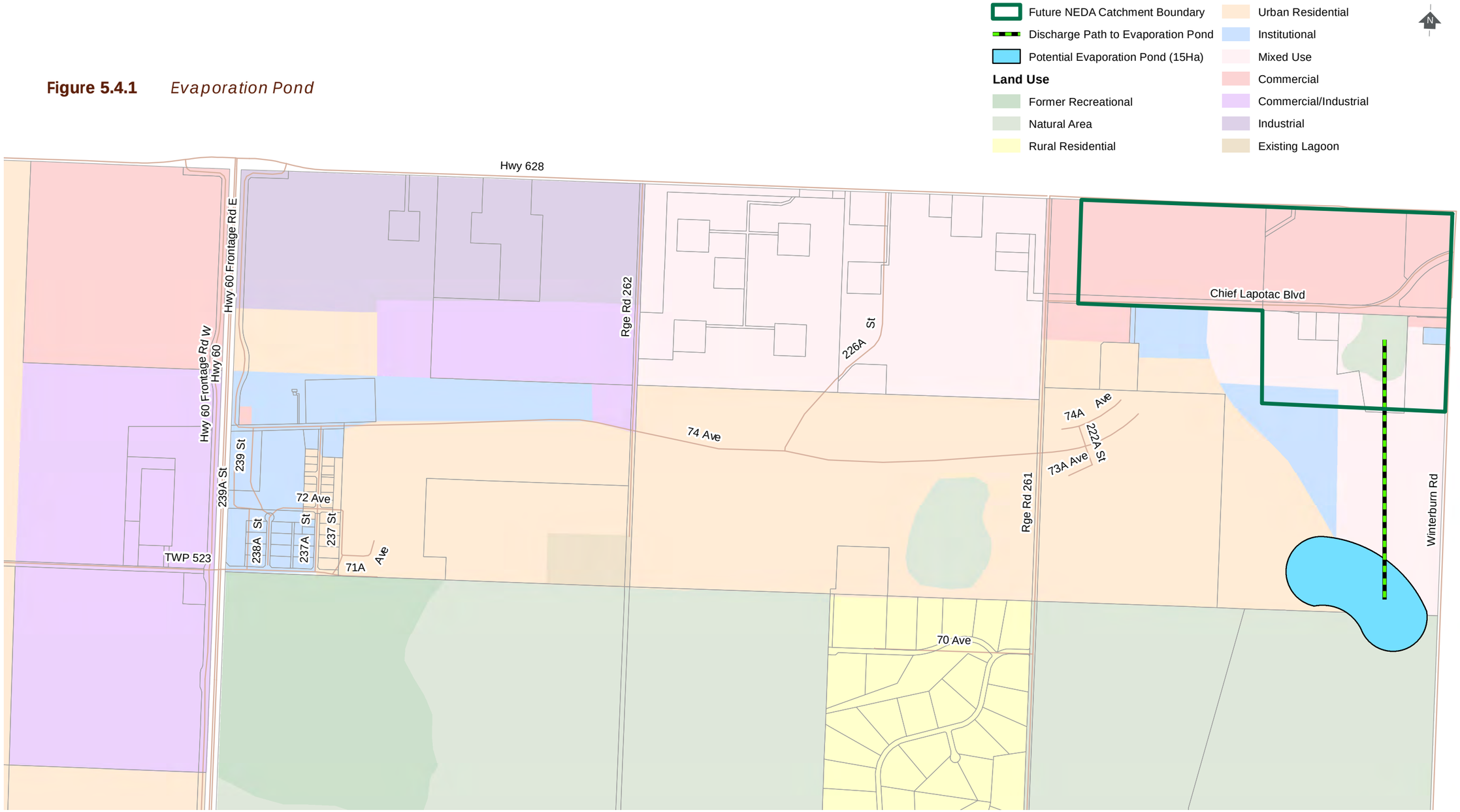
Note that the intent of the model simulation is not to predict an exact water depth, but to gain an understanding of what impact the levels of development and additional inflow might have on the long term water level trends of Yekau Lake.

In the short-term, this solution is not recommended to be pursued since it is likely the highest cost option. In addition, the environmental reclamation should be completed in and around Yekau Lake prior to any attempt at recharge of water levels, as discussed above. Prior to any consideration of this option, a hydrogeological study would need to take place to better understand infiltration rates and groundwater in the catchment, and the influence of water wells on these parameters.

5.4.1.2 Village

In the short-term, no substantial development is anticipated to take place within the Village and Yekau Lake catchment area. Future development planned for the Village should be preceded by more detailed stormwater planning, accounting for urban road cross section drainage via curb and gutter, as well as roadside ditches in lower density residential areas. In these areas, some treatment will be provided by the vegetated ditches and swales, however construction of a pre-treatment pond should be anticipated alongside any urban development as an added level of water quality enhancement prior to discharge into Yekau Lake. Such a pre-treatment pond should be planned for construction in conjunction with transportation corridors in and around the village.

Figure 5.4.1 *Evaporation Pond*



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5.4.2 20 YEAR – MEDIUM TERM

NEDA

For the medium-term time frame, land uses are shown in **Figure 5.3.1** of Section 5.3.1.1 reflecting approximate development extents assumed to be completed in the next 5-20 years. NEDA will see significant development in this time frame, and modelled boundaries have been updated accordingly within expected development areas for the analysis.

Option 1: Continue Pumping Offsite

Further to the short term time frame discussion, continuing to manage stormwater without upgrades will further increase the NEDA storm pond operating depths and increase likelihood of overtopping. The anticipated development will result in approximately 25,000 m^3 of additional stormwater storage required from what is currently provided, or a pump rate increased further to approximately 750 L/s. As discussed above, an increased pump rate is not expected to be a viable solution.

While the increases to storage and pump rate are not substantial relative to the short term, a 20 year time frame requires more careful consideration of the risks involved. The longer time period increases the likelihood of major rainfall events occurring at some point, and there is also potential for areas to be developed which would be impacted by any overflow from the storm pond. It is not recommended that the NEDA storm pond operates with its current configuration beyond the short term.

Option 2: Evaporation and Infiltration

Model results for the 20-year time frame do not differ greatly from the short-term simulation with respect to an evaporation and infiltration facility. A total area of at least 15-20 ha will be required to accomplish the stormwater goals, and the previously discussed area to the south of the NEDA storm pond is not anticipated to undergo substantial development.

Option 3: Pumping to Yekau Lake

Option 3 remains an attractive choice in the medium-term due to the benefits to both NEDA and Yekau Lake, as well as elimination of pumping fees to the City. Model results show a slight increase to the water volume reaching Yekau Lake from the short term simulation, and a similarly minor increase in water depth.

This solution is much more favourable in the medium term, under the assumption that the environmental reclamation of Yekau Lake occurs within this timeframe as well. The only drawback to Option 3 is that it will likely require the most upfront capital investment.

5.4.2.1 Village

In the next 20 years, it is expected that the Village will see some progress toward buildout. Modelled catchment boundaries have been updated within expected development areas for the analysis according to the anticipated medium-term land uses.

Model results show that the impact of increased development and intentional direction of runoff into Yekau Lake will have a negligible impact on water levels in the medium term time frame. However, it is still recommended to direct as much runoff as possible toward Yekau Lake.

As discussed in the short-term analysis, vegetated ditches and swales should be utilized as much as possible for surface drainage, and a pre-treatment pond constructed upstream of an eventual Yekau Lake discharge point. A pre-treatment pond should be designed to remove coarse sediment and can include baffles at the outlet to assist in retention of any floating oils and grease. Based on the catchment area which would contribute to a future pre-treatment pond, it would require a land area of approximately 0.5 ha. **Figure 5.4.2** shows one potential configuration for the pre-treatment pond with approximate sizes of catchments, future drainage routing, and pond footprint. This should be constructed as development within the Village begins.

5.4.3 100 YEAR – LONG TERM

Land use associated with the long-term time frame is not anticipated to be completed within 100 years and includes many uncertainties. For the purposes of this analysis, the long-term time frame is assumed to include the "ultimate" build out scenario.

5.4.3.1 NEDA

Option 1: Continue Pumping Offsite

The most important factor to consider beyond the 20 year time frame at this point is the status of the Master Servicing Agreement with the City of Edmonton with respect to stormwater management. The terms of the current agreement expire on July 7, 2053. If continued pumping to the City of Edmonton remains a long term plan for ECN, the current Master Servicing Agreement will need to be renegotiated prior to this date. There is no guarantee that the City will agree to extend the terms beyond this date, or allow for increased discharge, therefore it is not recommended that Option 1 be expected to continue in the long term.

Option 2: Evaporation and Infiltration

The evaporation pond may be an effective solution in the future, however at "ultimate" buildout of the entire ECN, model results show that the evaporation pond would need to be a minimum of 20-25 ha. Consideration will also need to be given to the extent of development in this long term timeframe, as the available space for such a facility may become limited.

Option 3: Pumping to Yekau Lake

In the long term, the benefits of Option 3 become even more obvious. Model results show that at full development stages, pumping of the NEDA storm pond into Yekau Lake would double the runoff volume entering the lake from the already increased runoff of a fully developed Village. This would have the most noticeable impact on water levels, however a detailed hydrogeology assessment would still be required to accurately predict water levels.

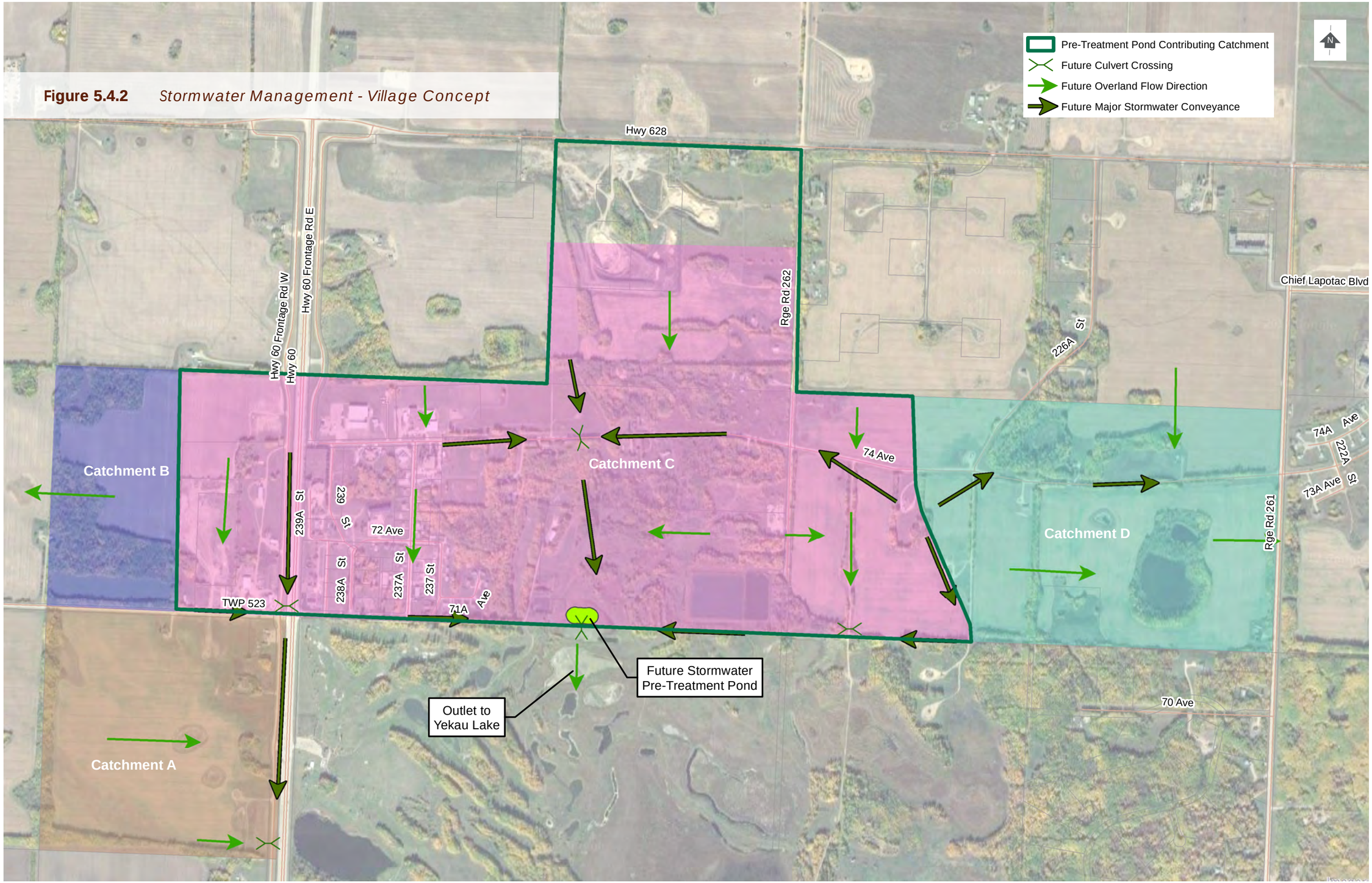
The major drawback of this option in the long term is the required pump rate given the currently available stormwater storage volume of NEDA. Depending on the cost implications of pumping at a higher rate, a combination of pumping and increased storage in NEDA for storm attenuation may provide the best balance in the long term. In this case, the benefit of a phased sequence of stormwater management techniques becomes clear.

5.4.3.2 Village

Modelling shows that a fully built out Village area will have a noticeable impact on the runoff volumes entering Yekau Lake. An infiltration and groundwater assessment will add clarity to the impact this will have on lake levels, and allow for better long term planning of development nearby.

It becomes even more critical at full build out to ensure the quality of runoff, as increased development will have an adverse impact on runoff water quality. Maintenance and monitoring of vegetated major drainage channels and the proposed pre-treatment pond should be ongoing.

Figure 5.4.2 *Stormwater Management - Village Concept*



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5.4.4 NEDA OPTIONS SUMMARY

The following table summarizes pros and cons to the stormwater management options discussed above relating to future NEDA development.

A common benefit of each option is that they all include the ability to be phased and used in conjunction with other solutions. Ponds and pump stations can be added and expanded as the need arises, and temporary ponds are a commonly used storage option. When considering upfront costs of any stormwater solution, it is important to keep in mind that if the current offsite pumping continues until the Master Servicing Agreement expires in 2053, ECN will spend nearly $5 million in total monthly fees over the next 36 years. If the Agreement needs to be renegotiated at that time, the monthly fee can be expected to increase. This needs to be factored into the decision along with the fact that any stormwater management infrastructure constructed in NEDA will be expected to last well beyond the next 36 years.

Table 5.4.1: NEDA Options Summary

	Pros	Cons
Option 1: Continue Pumping Offsite	• Low short-term risk • Can be temporary, part of phased solution	• Does not eliminate dependence on City • Requires additional storage to mitigate risk • Risk will grow as time passes and development progresses • Master Servicing Agreement terminates in 2053 • May not be able to negotiate higher release rate
Option 2: Evaporation and Infiltration	• Eliminates dependence on City • Low risk • Can be temporary, part of phased solution • Potential for long-term costs to be less than current monthly fees to City • Potential to connect to NEDA via gravity, no pumping	• Upfront capital cost • Land area requirement • Hydrogeology assessment required
Option 3: Pumping to Yekau Lake	• Eliminates dependence on City • Contributes to recharge of Yekau Lake level • Low risk • Can be part of long term phased solution	• High upfront and ongoing costs • Hydrogeology assessment required • Prior environmental reclamation of Yekau Lake required

5.4.5 NORTHEAST UNDEVELOPED AREA

The catchment between Yekau Lake and NEDA generally slopes to the eastern boundary of Enoch Cree Nation, reaching a low lying area south of NEDA. This area features some localized ponds and wetlands, however no single defined drainage corridor is evident, and a field visit did not reveal any outlet culvert across Winterburn Road. It is therefore assumed that runoff from this catchment is not substantial enough to overtop Winterburn Road and enter the adjacent neighbourhood within the City of Edmonton.

Model results indicate that the total volume of runoff reaching the eastern boundary of ECN is not noticeably impacted within the anticipated 20 year development scenario. However, in the Ultimate Land Use scenario, there is enough development within this catchment that the total volume of runoff reaching the east boundary will nearly double.

Despite model confirmation that runoff will not increase within the anticipated 20 year development period, more detailed study should be undertaken to fully understand runoff behavior in the area. This should include a hydrogeological assessment to confirm infiltration rates, groundwater conditions, and implications on the adjacent City of Edmonton neighbourhood across Winterburn Road. Once runoff behavior is more fully understood, additional measures of stormwater management may be necessary to protect onsite and offsite infrastructure. If an evaporation pond is proposed for this area as described above in Option 2, there is opportunity to include this catchment in the sizing considerations.

5.4.6 WEST/SOUTH TO WEDGEWOOD CREEK

The remainder of Enoch Cree Nation is not expected to see any substantial development within the timeframe of this study. Aside from minor catchment area redistributions resulting from future development in the Village, no changes are anticipated that would result in required infrastructure upgrades in the western and southern catchments. The primary goal in these rural areas is to maintain all existing major conveyances and ensure any development is located strategically based on topographical considerations.

5.5 Design Standards

5.5.1 STORMWATER SYSTEM STANDARDS

The design and construction of the stormwater management system should generally follow the design standards set out in the City of Edmonton Drainage Design Standards. This is a logical system to adopt due to proximity, as well as the City of Edmonton having well established, thorough standards.

5.5.1.1 Unit Area Release Rate (UARR)

NEDA is the only area within ECN that currently utilizes an underground minor drainage system. Based on the remaining capacity of the existing storm main along Chief Lapotac Blvd and the remaining developable area, the recommended 5-year minor system UARR for developments in NEDA is 25 L/s/ha. This should be adhered to for all future developments within NEDA which connect to the existing underground storm main along Chief Lapotac Blvd.

Storm runoff conveyance elsewhere in ECN is intended to remain primarily via overland ditches and swales, with curb and gutter in the Village urban areas discharging to surface ditches. The intent of specifying a major system UARR for future developments is to ensure roadside ditches are appropriately sized for major drainage during a 100-year storm, while keeping in mind the constraints on developers to attenuate stormwater onsite. With this in mind, a major drainage system UARR of 50 L/s/ha for a 100-year storm event is suggested for future development where no minor system is present.

5.5.1.2 SWM Standards

Major system conveyance and storage elements, such as roads and drainage ditches, should be designed to accommodate runoff rates and volumes for a 100-year return period rainfall event, while any minor system elements (i.e. underground storm mains) should be designed to accommodate runoff from a 5-year return period even without surcharging.

5.5.2 CLIMATE CHANGE CONSIDERATIONS

Modelling has been carried out based on current historical rainfall data, however the effects of climate change are having increasing impacts on communities around the world. Storms are becoming more severe, and low probability events are occurring with greater frequency. The IDF_CC tool is an online resource created by Western University which compiles international climate change models and derives future IDF design storm data projections. While there is still uncertainty in the accuracy of these projections, this is a valuable tool and can be used to proactively plan for future stormwater designs in ECN. Infrastructure may not need to be designed for future scenarios at this point, but sensitivity to the projected intensities can be analyzed to better understand future risk potential.

When considering the long-term impacts of climate change, flooding and drought must be given equal emphasis. Although individual storm events are expected to continue increasing in severity and frequency, overall rainfall volumes may decrease over the long term. These trends should be evaluated further upon detailed design of evaporation ponds and reflected in any studies on long term water levels in Yekau Lake.

5.5.3 EXPECTATIONS FOR NEW DEVELOPMENTS

5.5.3.1 Source control

As discussed in Section 5.1.1, stormwater attenuation will be a key requirement for future developments in ECN. Options of site level discharge restrictions vs communal infrastructure must be explored and presented to developers. The drawback of both is the land area requirement for infrastructure and added cost associated with some of the more aggressive Low Impact Development practices. Imposing individual site level controls may discourage development, while communal infrastructure would take up potentially developable land.

Since development in NEDA is underway and the area is serviced by an existing storm pond, the short-term solution will be to impose a reasonable Unit Area Release Rate (UARR) requirement for future developments which are serviced by the NEDA storm pond. Outside of NEDA, UARR requirements will still be a valuable tool in limiting discharge, however it may be difficult for developers to meet these requirements individually, particularly on smaller sites. Consideration should be given to communal stormwater management facilities in areas where several smaller developments may benefit from such a facility.

5.5.3.2 Low Impact Development

Further to Section 5.3.1, Low Impact Development (LID) techniques are beneficial to urban hydrology and are gaining in popularity as a tool to reduce stormwater runoff volume and enhance runoff quality. ECN residents as well as developers should be educated on best management practices that can be implemented throughout the Nation.

Some simple and low cost green infrastructure practices that may be applicable include:

- Rainwater collection and harvesting
- Absorbent landscaping
- Directing roof downspouts to landscaped surfaces

Details of LID best practices have not been included in this Master Plan, but extensive resources are available online through the City of Edmonton, such as the Low Impact Development Best Management Practices Design Guide (2014).

5.6 Summary and Recommendations

Enoch Cree Nation is currently at a very early stage of development, and now is an opportune time to proactively plan for future development which benefits both the Nation and developers. The following stormwater management recommendations reflect the analysis presented throughout this report:

- Conduct a hydrogeological assessment to investigate infiltration parameters and groundwater conditions to:
  - Determine validity of infiltration and evaporation pond to service NEDA, and the impact on adjacent City of Edmonton neighbourhoods.
  - Better understand and more accurately predict water depths in Yekau Lake.
  - Assess the need for stormwater solutions in Northeast Undeveloped Area
- In the short-term, continue using the current NEDA storm pond configuration, but begin planning for stormwater solutions to eliminate the requirement to pump to the City.
- In the medium term, provide additional storage capacity for the NEDA storm pond in the form of a pond expansion, permanent or temporary separate detention facility, or evaporation and infiltration pond.
  - Investigate best long-term solution to determine which option to pursue. Future pumping solution to Yekau Lake can be incorporated into NEDA solution in a later phase, but should be accounted for when determining required additional storage. Should be determined well in advance of expiry of current Master Servicing Agreement in 2053.
- Pending the outcome of the hydrogeology assessment, consider incorporating Northeast Undeveloped Area into future NEDA stormwater management solution.
- Require future development to accommodate 5-year storm discharges in any minor system components, and 100 year discharge in major system conveyance routes and storage facilities.
- Implement 5-year minor system Unit Area Release Rate of 25 L/s/ha for all future developments contributing to Chief Lapotac Blvd storm main in NEDA.
- Implement 100 year major overland Unit Area Release Rate of 50 L/s/ha for all future developments. Developers will be responsible for storing runoff which exceeds this UARR. Facilitate cooperation between developments to encourage use of shared stormwater facilities to meet UARR.
- Plan for future development within the Village to utilize only overland drainage systems.
- Direct as much runoff as possible toward Yekau Lake.
- Provide a stormwater pre-treatment pond to receive runoff from the Village prior to discharging into Yekau Lake. This should be incorporated into plans for Village development.
- Protect, preserve and maintain existing drainage corridors in all rural areas.
- Encourage naturalized drainage systems and Low Impact Development practices among all parties involved in future development planning.
- Consider climate change impact on future stormwater systems. Test sensitivity of all new and existing stormwater infrastructure against future storm projections.

6. Summary of Recommended Actions

Throughout this report, there have been several actions identified, to be undertaken by ECN in the short-medium- and long-terms. These actions are intended to guide the Nation in planning for future capital projects and efforts. The following table summarizes the actions identified in the Master Servicing Plan:

Enoch Cree Nation - Short, Medium and Long-Term Infrastructure Related Needs

	TRANSPORTATION	WATER SERVICING	SANITARY COLLECTION/TREATMENT	STORMWATER MANAGEMENT
"SHORT-TERM ACTIONS (1-5 year implementation)"	• Develop design and construction standards for transportation infrastructure including adoption of roadway cross section standards. • Construction of roadway connection between Chief Lapotac Boulevard and the Costco access at 215 Street to a 2 lane paved standard. • Intersection improvements at Highway 628 / Range Road 261 to address safety concerns in the interim (until Highway 628 is re-aligned and upgraded to freeway status). • Upgrade of Range Road 261 between Highway 628 and Arena Road to a 2-lane paved collector standard. • Upgrade of Arena Road between Range Road 261 and the Village to a 2-lane paved collector standard. • Develop and implement a roadway maintenance program. Document and review annual maintenance efforts and long term roadway performance. • Construct a multi-use trail connection adjacent to Arena Road and Range Road 261 connecting the NEDA area and the Village core. • Develop a framework and bylaw for the collection of offsite levies for the construction of road capital projects	• Adopt City of Edmonton standards for the design, construction and operation of all new water infrastructure. • Construct a new reservoir and pump station at the Village, including a new truck fill station to service rural areas. • Develop and Implement a flushing program as soon as water has been tied into the new Village Reservoir and Pump Station. • Amend Master Servicing Plan with the City of Edmonton to allow for service to the Village • Decommission existing water treatment plant and abandon wells. • Upgrade identified Village mains to 200 mm and 250 mm pipe sizes (approximately 1.1 km of pipe). • Build new 250 mm loops within the Village distribution system to improve reliability and fire flow availability. • Install additional hydrants in the Village area to improve fire flow coverage. • Develop and implement and asset management program and policy. • Develop and implement an operations and maintenance program, which should include water quality monitoring, hydrant maintenance and flow testing. • Develop a framework and bylaw for the collection of offsite levies for the construction of water capital projects	• Adopt City of Edmonton standards for the design, construction and operation of all new sanitary infrastructure. • Complete an assessment and rehabilitation of the Village Sewage Lagoon to extend its service life for the next 20 years. This can be in the form of a facultative or aerated (recommended) lagoon. • Upgrade pumping capacity of the NEDA lift station • Develop a CCTV camera inspection program to assess the condition of existing conveyance infrastructure. • Develop and implement an asset management program and policy. • Develop an operations and maintenance program, including regular inspection of manholes, pipes and services. • Develop a framework and bylaw for the collection of offsite levies for the construction of sanitary capital projects	• Adopt a minimum 5-year pre-development release rate of 25 L/s/ha for all new developments in NEDA. • Expand the NEDA pond, which is currently operating at capacity. • Conduct a feasibility study for the construction of an evaporation pond south of the existing NEDA pond. • Conduct a feasibility study to explore pumping stormwater runoff to Yekau Lake. • Construct a pre-treatment facility to remove sediment and pollutants from stormwater runoff prior to discharging into Yekau Lake. • Develop a framework and bylaw for the collection of offsite levies for the construction of stormwater capital projects
"MEDIUM-TERM ACTIONS (5-20 year implementation)"	• Signalization of the Highway 60 / Arena Road intersection is warranted at the 20 year design horizon. • Conduct a comprehensive transit feasibility study to explore the opportunities for a small-scale transit pilot project and/or connections to regional transit initiatives. • Explore opportunities to become leaders in autonomous vehicle innovation. Consider ways to integrate autonomous vehicle technology with mass transit or shuttle service operations to reduce the reliance on vehicle ownership. • Develop multi-modal transportation linkages to connect the most heavily populated areas of the Nation. Include consideration of multi-modal facilities in the design of all new and upgraded transportation facilities.	• Develop and implement a water conservation and education program. • Create a water utility rate and install water meters on all homes and businesses. • Disconnect all rural homes from groundwater wells and provide cisterns for trucked-in potable water.	• Upgrade wet well and cerate additional wet weather flow storage at the NEDA lift station. • Start conversations with Parkland County and the ACRWC to potentially discharge effluent into their system. • Secure utility corridors for long-term servicing including Hillview Road, Highway 60, Chief Lapotac Road and Whitemud Drive • Explore the use of alternative technologies urine diversion and composting toilets, greywater and blackwater re-use technologies, district energy and STEP (low pressure) systems.	• Construct either evaporation pond or pumping system towards Yekau Lake • Complete reclamation of Yekau Lake. • Implement the use of Low Impact Development techniques such as rainwater collection and harvesting and absorbent landscaping.
"LONG-TERM ACTIONS (>20 year implementation)"	• Construction of Township Road 523 to an arterial standard to provide a connection between 215 Street and Highway 60 and discourage regional traffic from shortcutting through the Village core.	• Explore the installation of a trickle feed system for all rural customers, once sufficient densities have been achieved. • Explore partnerships with the CRPWSC and Parkland County to provide a second feed to the system.	• Refurbish the Village Sewage Lagoon for I/I and PWWF storage and construct outflow towards Parkland County or the ACRWC.	• Conduct regular assessments of stormwater infrastructure on the basis of the long-term effects of climate change.

7. Appendix A Transportation Technical Analysis Memo

1.0 Context

1.1 Study Methodology

This section describes the methodology used to complete the analysis documented in this TIA.

Horizons and Land Use Assumptions

This TIA was developed with the intent of assessing the 20-year development horizon to understand how the transportation network will evolve as development takes place.

It is assumed that the 20-year horizon reflects the year that the proposed land uses are occupied; this is a conservative assumption understanding external forces that creates a dynamic environment for development. The horizon year represents a year in which a significant component of the planned development is anticipated to be developed and the improvements that will be needed to support forecasted growth. Traffic forecasting and operational analysis were completed for the following horizons:

- Existing conditions (2017)
- Background conditions (all with 2.5% linear growth from 2017):
    - 2037
- Post development
    - 20-Year Build Out – (2037)

Traffic Forecast

Traffic forecasts were developed using background growth rates, background assumptions, and trip generation rates.

A 2.5% linear growth rate was assumed on existing traffic to determine base background traffic as recommended in the Alberta Transportation TIA Guidelines.

Trip generation rates used for assessing the 20-year horizon for the Village Core and NEDA Lands are documented in

Table 0-1. Distribution assumptions and internal capture rates for the background and post-development conditions were based on engineering judgement and are generally consistent with other existing available travel patterns adjacent to the surrounding area. The assumed distribution percentages for external trips are summarized in Table 0-2.

Table 0-1: Trip Generation Assumptions

Land Use	ITE Code	Units	Weekday Morning Peak Hour			Weekday Afternoon Peak Hour		
			vph / unit	In	Out	vph / unit	In	Out
Elementary School	520	KSF	1.21	45%	55%	4.92	56%	44%
General Light Industrial	110	KSF	0.48	12%	88%	0.64	83%	17%
General Office	710	KSF	1.49	17%	83%	1.56	88%	12%
Residential Townhomes	230	DU	0.51	67%	33%	0.43	17%	83%
Single Family	210	DU	0.98	63%	37%	0.74	25%	75%
Specialty Retail Center	826	KSF	27.00	43%	57%	21.00	74%	26%
Industrial Park	130	KSF	0.85	21%	79%	0.78	82%	18%
Office Park	710	KSF	1.48	17%	83%	1.56	88%	12%

Table 0-2: Distribution Assumptions

Destination	Percent of External Trips	
	In – AM (PM)	Out - AM (PM)
East	30% (50%)	50% (30%)
West	40% (20%)	20% (40%)
North	10% (20%)	20% (10%)
South	20% (10%)	10% (20%)

Because of the length and complexity of this document, only the resulting total traffic volumes for each development are included in the text. More detailed plots of base (background growth only), internal, and external site trips are included in **Appendix A**.

Analysis

Synchro 10 software was used to assess intersection operations and determine whether improvements were warranted for the specific analysis period.

The overall performance of a roadway is measured by the delays experienced at intersections, commonly referred to as Level of Service (LOS). The LOS assigned to a signalized intersection can range between A and F. LOS A through C generally indicates that the intersection experiences very few delays during the peak hour, whereas LOS F suggests the delays are significant (greater than 60 seconds /

vehicle) and that the intersection/movement is failing. For un-signalized intersections, the level of service is measured for the critical movements that cross free-flow traffic, such as from the minor street or turning left on the main street. LOS E or better is generally acceptable for these critical movements at un-signalized intersections.

Volume to Capacity ratio (v/c ratio) compares roadway demand (vehicle volumes) with roadway supply (carrying capacity). This measure indicates the amount of congestion for each lane group. V/C ratios greater than or equal to 1 indicate that the approach is operating at or above capacity.

Detailed outputs from the Synchro are included in Appendix B.

2.0 Existing Conditions

The existing conditions analysis provides an understanding of how the study intersections are operating with existing volumes in the design hour (100th Highest Hour).

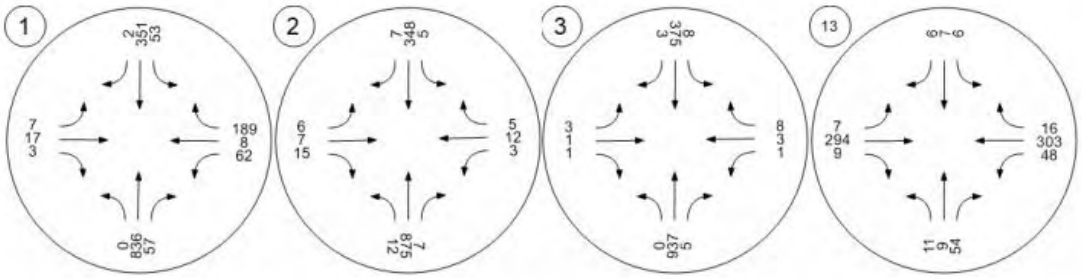
2.1 Existing Road Network

The Village Core and NEDA site is bounded by Highway 628 (Whitemud Drive) to the north, 215 Street to the east, Highway 60 to the west and Township Road 523 to the south. The study area represents 15% of the overall Enoch Lands. More information about each of the roads around the site is provided below.

Highway 60	Highway 60 is a north-south provincial highway under the jurisdiction of Alberta Transportation. It is located 6.8 km west of the Anthony Henday and typically functions as a bypass route for communities to the west and north-west. It connects to Highway 16 to the north just west of Edmonton and Highway 39 to the south just west of Leduc.
Highway 628 (Whitemud Drive)	Highway 628 operates at 80 kph and provides connections to west Edmonton and transitions to Whitemud Drive which connects to University of Alberta and Fort Edmonton Park. Alberta Transportation completed a functional planning study in 2008 which highlights a conversion to a grade separated facility with interchanges at Highway 60, 231 Street and 215 Street.
231 Street (Range Road 261)	231 Street forms part of the municipal boundary between Parkland County and the City of Edmonton. The corridor is posted at 80kph which is consistent with other Range Roads within the County.
Township Road 523	Township Road 523 provides a south access into the Village Core and is posted at 25kph (east of Highway 60) upon entry. Flanking the road includes existing institutional, office, and residential land uses.
215 Street (Winterburn Road)	215 Street forms part of the municipal boundary between Enoch and the City of Edmonton to the east and operates at 60kph. In 2014, the City of Edmonton prepare a Concept Plan which highlights the proposed upgrades to the 215 Street corridor.

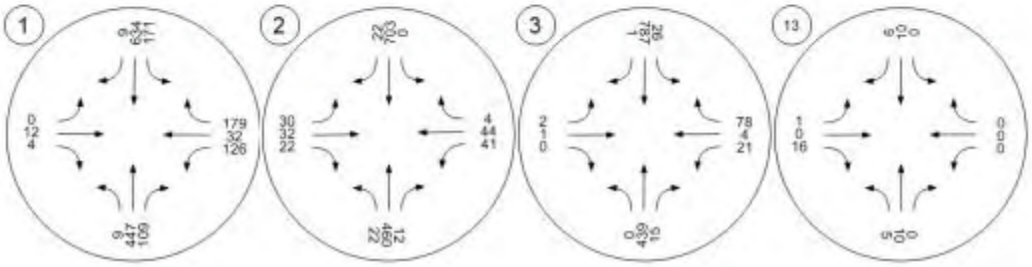
2.2 Existing Traffic Volumes

Morning



Afternoon


1
Township Road 524
628
628
Township Road 524
13
Range Road 26
2
HWY 60
Stony Plain
Indian
Reserve 135
Township Road 523
3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0

2.3 Existing Operating Conditions

Approach	Movement	Control	v/c ratio	Delay (s)	LOS	95th % Queue (m)
Devonian Way (Hwy 60) & Whitemud Dr. (Hwy 628)						
EB Whitemud Dr. (Hwy 628)	Left	Stop	0.17 (0.13)	32.5 (39.7)	D(E)	4.5 (3.3)
EB Whitemud Dr. (Hwy 628)	Thru, Right	Stop	0.17 (0.13)	32.5 (39.7)	D(E)	4.5 (3.3)
WB Whitemud Dr. (Hwy 628)	Left	Stop	0.51 (1.32)	25.2 (127.2)	D(F)	21.5 (132.6)
WB Whitemud Dr. (Hwy 628)	Thru, Right	Stop	0.51 (1.32)	25.2 (127.2)	D(F)	21.5(132.6)
NB Devonian Way (Hwy 60)	Left	Free	0.01 (0.01)	8.9 (8.9)	A(A)	(0.2)
NB Devonian Way (Hwy 60)	Thru	Free	0.25 (0.13)	0 (0)	A(A)	0 (0)
NB Devonian Way (Hwy 60)	Right	Free	0.25 (0.13)	0 (0)	A(A)	0 (0)
SB Devonian Way (Hwy 60)	Left	Free	0.07 (0.17)	10.1 (9.3)	B(A)	1.7(4.6)
SB Devonian Way (Hwy 60)	Thru	Free	0.1 (0.19)	0 (0)	A(A)	0 (0)
SB Devonian Way (Hwy 60)	Right	Free	0.1 (0.19)	0 (0)	A(A)	0 (0)
Devonian Way (Hwy 60) & Arena Road						
Eastbound Arena Road	Left, Thru, Right	Stop	0.08 (0.41)	16.9 (34.5)	C(D)	2.1 (14.2)
Westbound Arena Road	Left, Thru, Right	Stop	0.1 (0.47)	25.1 (40.4)	D(E)	2.5 (17.3)
NB Devonian Way (Hwy 60)	Left	Free	0.26 (0.14)	0 (0)	A (A)	0 (0)
NB Devonian Way (Hwy 60)	Thru, Right	Free	0.26 (0.14)	0 (0)	A(A)	0 (0)
SB Devonian Way (Hwy 60)	Left	Free	0.01 ()	9.7()	A(A)	0.2 (0.6)
SB Devonian Way (Hwy 60)	Thru, Right	Free	0.1 (0.21)	0(0)	A(A)	0(0)
Devonian Way (Hwy 60) & Township Road 523						
EB Township Road 523	Left, Thru, Right	Signalized	0.01 (0.01)	13.2 (10)	B(A)	2.4 (1.1)
WB Township Road 523	Left, Thru, Right	Signalized	0.04 (0.26)	10.7 (6.7)	B(A)	3.5 (7)
NB Devonian Way (Hwy 60)	Thru	Signalized	0.28 (0.17)	1.2 (3.3)	A (A)	18.2 (9.7)
NB Devonian Way (Hwy 60)	Right	Free	0 (0.01)	0.2 (1.5)	A(A)	0.2 (0.9)
SB Devonian Way (Hwy 60)	Left	Signalized	0.01 (0.04)	1.5 (4)	A(A)	0.9 (2.3)
SB Devonian Way (Hwy 60)	Thru	Signalized	0.11 (0.3)	1 (3.7)	A(A)	6.7 (18.3)
231 St. & Whitemud Drive (Hwy 628)						
EB Whitemud Dr. (Hwy 628)	Left, Thru, Right	Free	0.04 (0)	1.4 (0)	A (A)	0.9 (0)
WB Whitemud Dr. (Hwy 628)	Left, Thru, Right	Free	0.01 (0.03)	0.2 (1.3)	A (A)	0.1 (0.8)
Northbound 231 St.	Left, Thru, Right	Stop	0.05 (0.11)	15.1 (12.1)	C(B)	1.2 (2.9)
Southbound 231 St.	Left, Thru, Right	Stop	0.13 (0.12)	12.5 (17)	B(C)	1.5 (3)

3.0 Future Background Conditions

This section documents the development of future background traffic volumes and the assessment of future background conditions. The analysis applies a 2.5% growth rate mirroring the assumption as stated in the AT TIA Guideline. The growth rate was applied as a linear rate to the peak period volumes.

3.1 20 Year (2037) Background Condition

In the 2037 Background Condition, multiple intersections have one or more movements with LOS and / or v/c that exceed the acceptable benchmark. The full analysis is summarized in Appendix B and details concerning intersections that require improvement are provided below.

- The westbound Whitemud Drive at Highway 60 is at LOS ‘F’.
- The eastbound Whitemud Drive at Highway 60 is at LOS ‘F’.
- The eastbound Arena Road at Highway 60 is at LOS ‘F’.

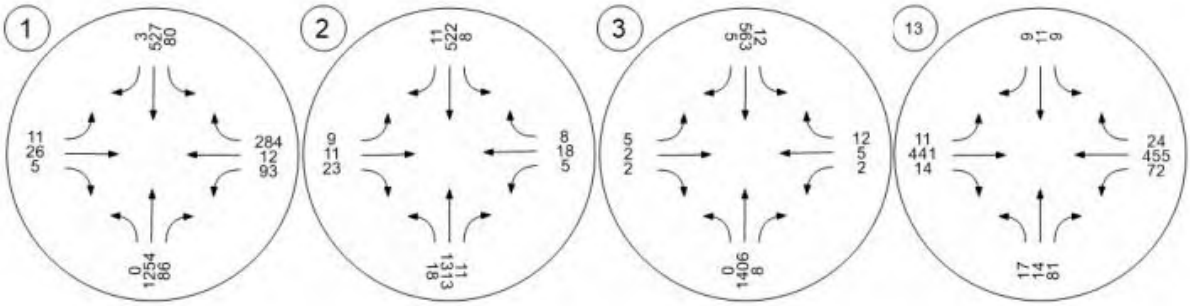
- The westbound Arena Road at Highway 60 is at LOS 'F'.

Understanding the completed functional plan for Highway 628 and the proposed upgrades to the facility, the analysis will not include Whitemud Drive at Highway 60.

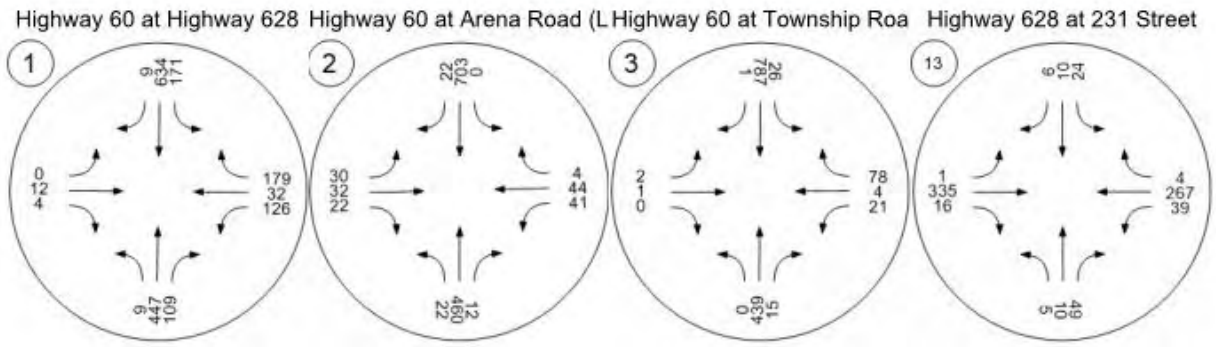
Approach	Movement	Control	v/c ratio	Delay (s)	LOS	95th % Queue (m)
Devonian Way (Hwy 60) & Whitemud Dr. (Hwy 628)						
EB Whitemud Dr. (Hwy 628)	Left	Stop	0.88 (Err)	219.5 (Err)	F (F)	27.5 (Err)
EB Whitemud Dr. (Hwy 628)	Thru, Right	Stop	0.88 (0.74)	219.5 (246.6)	F (F)	27.5 (19.2)
WB Whitemud Dr. (Hwy 628)	Left	Stop	3.53 (12.38)	Err (Err)	F(F)	Err (Err)
WB Whitemud Dr. (Hwy 628)	Thru, Right	Stop	3.53 (12.38)	Err (Err)	F(F)	Err (Err)
NB Devonian Way (Hwy 60)	Left	Free	(0.02)	(10.2)	(B)	(0.5)
NB Devonian Way (Hwy 60)	Thru	Free	0.37 (0.2)	0 (0)	A(A)	0 (0)
NB Devonian Way (Hwy 60)	Right	Free	0.37 (0.2)	0 (0)	A(A)	0 (0)
SB Devonian Way (Hwy 60)	Left	Free	0.16 (0.32)	13.4 (11.7)	B (B)	4.2 (10.7)
SB Devonian Way (Hwy 60)	Thru	Free	0.15 (0.28)	0 (0)	A(A)	0 (0)
SB Devonian Way (Hwy 60)	Right	Free	0.15 (0.28)	0 (0)	A(A)	0 (0)
Devonian Way (Hwy 60) & Arena Road						
Eastbound Arena Road	Left, Thru, Right	Stop	0.29 (4.06)	38.7 (Err)	E(F)	8.5 (Err)
Westbound Arena Road	Left, Thru, Right	Stop	0.38 (2.29)	75.2 (741.9)	F (F)	11.5 (100.6)
NB Devonian Way (Hwy 60)	Left	Free	0.02 (0.05)	8.6 (11)	A (B)	0.4 (1.2)
NB Devonian Way (Hwy 60)	Thru	Free	0.39 (0.2)	0 (0)	A(A)	0 (0)
NB Devonian Way (Hwy 60)	Right	Free	0.39 (0.2)	0 (0)	A(A)	0 (0)
SB Devonian Way (Hwy 60)	Left	Free	0.02 (0.02)	11.9 (0.02)	B (B)	0.4 (0.4)
SB Devonian Way (Hwy 60)	Thru	Free	0.15 (0.31)	0 (0)	A(A)	0 (0)
SB Devonian Way (Hwy 60)	Right	Free	0.15 (0.31)	0 (0)	A(A)	0 (0)
Devonian Way (Hwy 60) & Township Road 523						
EB Township Road 523	Left, Thru, Right	Signalized	0.03 (0.01)	13.3 (9.6)	B(A)	3.1 (1.4)
WB Township Road 523	Left, Thru, Right	Signalized	0.07 (0.38)	11.8 (7)	B(A)	4.5 (8.6)
NB Devonian Way (Hwy 60)	Thru	Signalized	0.42 (0.28)	1.8 (4.3)	A (A)	34.7 (16.3)
NB Devonian Way (Hwy 60)	Right	Free	0.01 (0.02)	0.5 (2.2)	A(A)	0.4 (1.5)
SB Devonian Way (Hwy 60)	Left	Signalized	0.04 (0.08)	2 (4.7)	A(A)	1.3 (3.5)
SB Devonian Way (Hwy 60)	Thru	Signalized	0.17 (0.5)	1.1 (5.7)	A(A)	10.6 (34.2)
SB Devonian Way (Hwy 60)	Right	Signalized	0 (0)	0.2 (0)	A(A)	0.3 (0)
231 St. & Whitemud Drive (Hwy 628)						
EB Whitemud Dr. (Hwy 628)	Left, Thru, Right	Free	0.01 (0)	0.3 (0.1)	A (A)	0.2 (0)
WB Whitemud Dr. (Hwy 628)	Left, Thru, Right	Free	0.06 (0.06)	1.8 (1.6)	A (A)	1.6 (1.4)
Northbound 231 St.	Left, Thru, Right	Stop	0.3 (0.24)	18.8 (17)	C (C)	9.4 (7.2)
Southbound 231 St.	Left, Thru, Right	Stop	0.14 (0.33)	24.7 (34.4)	C (D)	1.6 (10.4)

3.2 20 Year (2037) Background Traffic

Morning



Afternoon



3.3 20 Year (2037) Background Road Network Improvements and Improved Operating Condition

To support the projected background growth assumed in the Parkland Region, the improvements summarized in Table 0-1 highlights the upgrades required at the existing local access at Highway 60.

Table 0-1: Background Improvement Summary

Horizon	Improvements
Existing	• NIL
2037	• Traffic signal at Highway 60 at Arena Road (Local Access 1)

Traffic signals were analyzed at Highway 60 at Arena Road in the Synchro model to improve the operational performance. All movements are operating at a LOS 'B' or better with a v/c ratio at '0.43' or less.

Approach	Movement	Control	v/c ratio	Delay (s)	LOS	95th % Queue (m)
Devonian Way (Hwy 60) & Arena Road						
Eastbound Arena Road	Left, Thru, Right	Signalized	0.12 (0.29)	9.1 (9.2)	A (A)	6.2 (10.8)
Westbound Arena Road	Left, Thru, Right	Signalized	0.09 (0.31)	10.8 (11)	B (B)	5.6 (12.8)
NB Devonian Way (Hwy 60)	Left	Signalized	0.02 (0.1)	1.9 (6.3)	A (A)	1.7 (4)
NB Devonian Way (Hwy 60)	Thru	Signalized	0.4 (0.28)	2 (4.7)	A (A)	33.8 (19.6)
NB Devonian Way (Hwy 60)	Right	Free	0.01 (0.02)	0.9 (2.2)	A (A)	0.7 (1.4)
SB Devonian Way (Hwy 60)	Left	Signalized	0.02 (-)	2.1 (-)	A (-)	1.1 (-)
SB Devonian Way (Hwy 60)	Thru	Signalized	0.16 (0.43)	1.3 (5.6)	A (A)	10.7 (33.2)
SB Devonian Way (Hwy 60)	Right	Free	0.01 (0.03)	0.9 (2.5)	A (A)	1.7 (2.2)

4.0 Development

For the purposes of this TIA, the 20-year Enoch Lands include the forecasted build out for the Village Core and NEDA Lands at the 2037 horizon. This section provides information about the Enoch 20-year land uses and assumptions made throughout the analysis of Post-Development conditions.

The proposed land uses in the Village Core and NEDA are summarized in Table 0-1.

Table 0-1: Development Summary

Land use type	Unit	Total
Elementary School	KSF*	**54**
General Light Industrial	KSF*	**166**
General Office	KSF*	**75**
Residential Townhomes	DU	**255**
Single Family	DU	**530**
Industrial Park	KSF*	**395**
Office Park	KSF*	**219**
Elementary School	KSF*	**54**

*Net area summarizes in Table 0-1. Gross area has been factored by an assumed 0.25 to account for useable floor area.

Village Core and NEDA development traffic used the distribution pattern as recorded by Alberta Transportation at Highway 60 and Highway 628. Table 0-2 summarizes the distribution used for the traffic analysis.

Table 0-2: Assumed Village Core & NEDA Traffic Distribution

Destination	Percent of External Trips	
	In – AM (PM)	Out - AM (PM)
East	30% (50%)	50% (30%)
West	40% (20%)	20% (40%)
North	10% (20%)	20% (10%)
South	20% (10%)	10% (20%)

5.0 Post Development

5.1 20 Year (2037) Post Development Condition

1.7.1 2037 Road Network

The road network configuration for 2037 Post Development is the same as what was assumed for 2037 Background. The analysis assumes that the following improvements to the existing road network have been made at the 2037 Post Development Horizon.

Horizon	Improvements
2037	• Traffic signal at Highway 60 at Arena Road (Local Access 1)

1.7.2 2037 Post Development Traffic Volumes

The site traffic for Stage 1 based on the land use and trip generation summary is documented in Table 0-1. Section 5 describe the land use, internal assignment, and distribution assumptions. The total number of inbound and outbound trips for each peak hour are summarized in Table 0-1: 2037 Post Development Trip Generation. The total traffic volumes for the 2037 Post-Development condition are shown in Table 0-2.

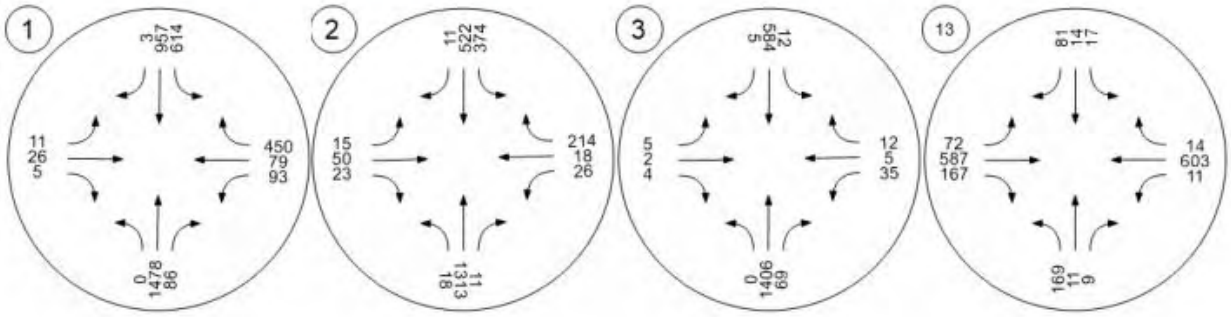
Table 0-1: 2037 Post Development Trip Generation

Land use	No. of units	Units	Weekday AM Peak			Weekday PM Peak		
			In	Out	Total	In	Out	Total
Elementary School	**54**	**KSF***	148	117	265	29	36	65
General Light Industrial	**166**	**KSF***	88	18	106	10	70	80
General Office	**75**	**KSF***	103	14	118	19	93	112
Residential Townhomes	**255**	**DU**	19	91	109	87	43	130
Single Family	**530**	**DU**	97	291	388	314	185	499
Industrial Park	**395**	**KSF***	247	54	301	71	265	336
Office Park	**219**	**KSF***	300	41	341	55	268	323
Specialty Retail Center	**25**	**KSF***	382	134	516	285	378	664
Full Build Out – Total (2037)			**96**	**284**	**1385**	**760**	**2144**	**2208**

No trips were assumed to be internalized within the Village Core and NEDA lands. All trip generated are external trips and were distributed according to the assumptions in Section 5. However, as the lands develop within Enoch and the relationships between the developments are understood, internalized trips should be revisited to capture real-world conditions.

Morning


1
Township Road 524
628
628
Township Road 524
13
Range Road 263
2
HWY 60
Stony Plain
Indian
Reserve 135
263
3
Township Road 523
bing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18
26
11
1313
18
3
5
584
12
5
2
4
12
5
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14
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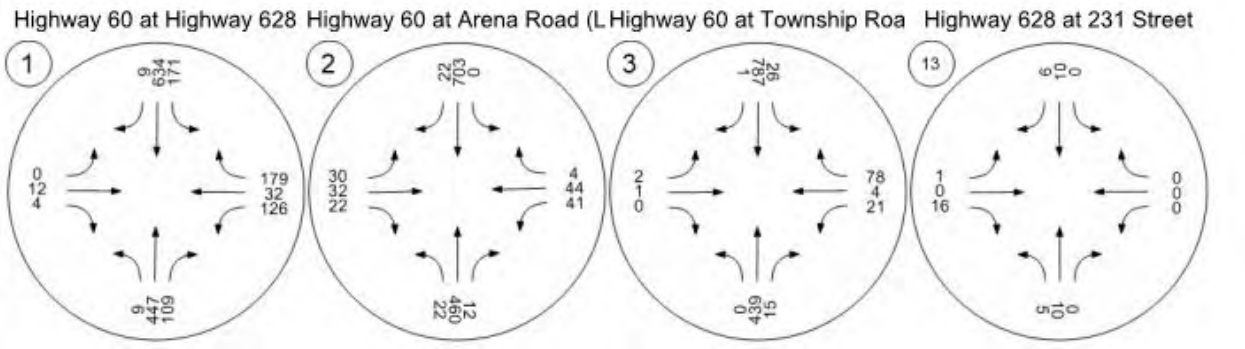
14
603
11
169
11
9

Afternoon



1.7.3 2037 Post Development Operating Conditions

During the 2037 post development horizon, the Arena Road access from Highway 60 and Whitemud Drive at 231 Street experience approaches with LOS ‘F’.

For the purposes of this traffic review, it was understood that improvements along the Highway 628 corridor were proposed and as part of this study, improvements to 231 Street at Highway 628 will not be analyzed.

The remaining intersections operate at a LOS ‘B’ or better with a v/c ratio of 0.43 or less and queues not exceeding 45m. The study locations operate at a LOS ‘B’ or better during the peak travel period with a v/c ratio of 0.43 or less. The operating conditions are summarized in Table 0-2.

Table 0-2: 2037 Post Development AM (PM) Operating Conditions

Approach	Movement	Control	v/c ratio	Delay (s)	LOS	95th % Queue (m)
Devonian Way (Hwy 60) & Arena Road						
Eastbound Arena Road	Left, Thru, Right	Signalized	0.59 (0.45)	69.2 (12.9)	E (B)	38.8 (21.9)
Westbound Arena Road	Left, Thru, Right	Signalized	0.91 (0.83)	63.7 (24.2)	E (C)	82.1 (75.7)
NB Devonian Way (Hwy 60)	Left	Signalized	0.02 (0.22)	2.2 (11.3)	A (B)	2 (6.8)
NB Devonian Way (Hwy 60)	Thru	Signalized	0.44 (0.48)	3.5 (9.9)	A (A)	49 (30.2)
NB Devonian Way (Hwy 60)	Right	Free	0.01 (0.07)	1 (3.2)	A (A)	0.9 (3.7)
SB Devonian Way (Hwy 60)	Left	Signalized	1.21 (0.73)	138.8 (31.4)	F (C)	103.3 (37.9)
SB Devonian Way (Hwy 60)	Thru	Signalized	0.17 (0.73)	2.4 (13.3)	A (B)	15.6 (51.3)
SB Devonian Way (Hwy 60)	Right	Free	0.01 (0.05)	1 (3.5)	A (A)	0.9 (3.1)
Devonian Way (Hwy 60) & Township Road 523						
EB Township Road 523	Left, Thru, Right	Signalized	0.03 (0.01)	10.2 (9)	B (A)	2.6 (1.4)
WB Township Road 523	Left, Thru, Right	Signalized	0.15 (0.43)	11.2 (9.3)	B (A)	7.1 (11.5)
NB Devonian Way (Hwy 60)	Thru	Signalized	0.43 (0.32)	2.4 (5)	A(A)	40.7 (20.8)
NB Devonian Way (Hwy 60)	Right	Free	0.05 (0.06)	1.1 (2.1)	A (A)	2.5 (3)
SB Devonian Way (Hwy 60)	Left	Signalized	0.04 (0.09)	2.8 (5.4)	A (A)	1.6 (3.9)
SB Devonian Way (Hwy 60)	Thru	Signalized	0.18 (0.55)	1.6 (6.9)	A (A)	12.9 (42.5)
SB Devonian Way (Hwy 60)	Right	Signalized	0 (0)	0.4 (0)	A (A)	0.3 (0)
231 St. & Whitemud Drive (Hwy 628)						
EB Whitemud Dr. (Hwy 628)	Left, Thru, Right	Free	0.07 (0)	1.9 (0.1)	A (A)	1.8 (0)
WB Whitemud Dr. (Hwy 628)	Left, Thru, Right	Free	0.01(-)	0.3 (-)	A (-)	0.3 (-)
Northbound 231 St.	Left, Thru, Right	Stop	2.61 (0.39)	850.1 (12.22)	F (B)	139.9 (14.1)
Southbound 231 St.	Left, Thru, Right	Stop	0.48 (0.03)	33.5 (9.7)	D (A)	18 (0.7)

1.8 20 Year (2037) Post Development Road Network Improvements and Improved Operating Condition

To support the forecasted development generated traffic and growth assumed in the Parkland Region, the improvements summarized in Table 0-3 highlights the upgrades required at the existing local access at Highway 60.

Table 0-3: Post Development Improvement Summary

Horizon	Improvements
Existing	• NIL
2037	• Upgrade Traffic signal at Highway 60 at Arena Road (Local Access 1)

The upgraded traffic signals were analyzed at Highway 60 at Arena Road in the Synchro model to improve the operational performance. All movements are operating at a LOS ‘B’ or better with a v/c ratio at ‘0.43’ or less.

Approach	Movement	Control	v/c ratio	Delay (s)	LOS	95th % Queue (m)
Devonian Way (Hwy 60) & Arena Road						
Eastbound Arena Road	Left, Thru, Right	Signalized	0.12 (0.29)	9.1 (9.2)	A (A)	6.2 (10.8)
Westbound Arena Road	Left, Thru, Right	Signalized	0.09 (0.31)	10.8 (11)	B (B)	5.6 (12.8)
NB Devonian Way (Hwy 60)	Left	Signalized	0.02 (0.1)	1.9 (6.3)	A (A)	1.7 (4)
NB Devonian Way (Hwy 60)	Thru	Signalized	0.4 (0.28)	2 (4.7)	A (A)	33.8 (19.6)
NB Devonian Way (Hwy 60)	Right	Free	0.01 (0.02)	0.9 (2.2)	A (A)	0.7 (1.4)
SB Devonian Way (Hwy 60)	Left	Signalized	0.02 (-)	2.1 (-)	A (-)	1.1 (-)
SB Devonian Way (Hwy 60)	Thru	Signalized	0.16 (0.43)	1.3 (5.6)	A (A)	10.7 (33.2)
SB Devonian Way (Hwy 60)	Right	Free	0.01 (0.03)	0.9 (2.5)	A (A)	1.7 (2.2)

6.0 Recommendation and Conclusion

6.1 Background Condition

This TIA recommends a number of improvements at each study horizon. The improvements for the Background horizons would be required if the Village Core or NEDA never developed. They are summarized below.

Horizon	Improvements
Existing	• NIL
2037	• Traffic signal at Highway 60 at Arena Road (Local Access 1)

6.2 Post Development Condition

With the development of the Village Core and NEDA lands, some improvements are needed earlier and some additional improvements are recommended. The recommended external improvements are summarized below.

Horizon	Improvements
2037 Post Development	• Upgrade traffic signal at Highway 60 at Arena Road (Local Access 1)