

ENGINEERING DESIGN STANDARDS



Adopted by the Township Board

November 18, 2008

Issued Revisions

March 28, 2023

Prepared by:



SPALDING DeDECKER
Consulting Engineers
905 E South Blvd
Rochester Hills, MI 48307
248.844.5404 T - 248.844.5400 F
www.sda-eng.com

Hartland Township Engineering Design Standards

These Engineering Design Standards are intended to provide a reasonable basis for design of public and private improvements in Hartland Township. They are not intended as a substitute for sound engineering judgment. The Standards may not apply to all conditions, and alternate solutions shall be permitted as approved by the Township's Administration and/or Engineer.

| Index | Page No. |
|--|-----------------|
| SECTION 1 GENERAL | 2 |
| SECTION 2 WATER MAIN..... | 6 |
| SECTION 3 SANITARY SEWER..... | 10 |
| SECTION 4 STORM SEWER..... | 11 |
| SECTION 5 DETENTION / RETENTION FACILITIES | 15 |
| SECTION 6 GRADING..... | 16 |
| SECTION 7 PAVING..... | 18 |
| SECTION 8 WELL HOUSES | 21 |
| 8.1 GENERAL | 20 |
| 8.2 CONSTRUCTION | 22 |
| 8.3 ELECTRICAL..... | 24 |
| 8.4 MECHANICAL..... | 29 |
| 8.5 PAINTING..... | 33 |
| 8.6 WELL ISOLATION AREA | 34 |
| 8.7 GENERATOR REQUIREMENTS..... | 34 |
| 8.8 SUPERVISORY CONTROL & DATA ACQUISITION (SCADA) | 44 |
| SECTION 9 RECORD DRAWINGS..... | 45 |
| SECTION 10 PLAN REVIEW & OBSERVATION COSTS | 47 |

Hartland Township Engineering Design Standards

1. GENERAL

- 1.1 Complete improvement plans bearing the seal of a licensed Professional Engineer, Surveyor or Architect licensed to practice in the State of Michigan shall be submitted prior to review and approval of any portion thereof.
- 1.2 A certified boundary survey of the site, prepared and sealed by a licensed Professional Engineer, Surveyor licensed to practice in the State of Michigan, or a copy of the completed plat shall be submitted with the engineering drawings.
- 1.3 Plans submitted shall be on 24" x 36" white prints having blue or black lines, and shall be neatly and accurately prepared.
- 1.4 For projects or subdivisions having more than one sheet of plans, a general plan having a scale of 1" = 100' shall be provided showing the overall project and indicating the size and general location of all improvements shown in the detailed plans.
- 1.5 Street names, street and easement widths, lot lines, lot dimensions, lot numbers and ownership shall be shown on all plans.
- 1.6 Elevations shall be on U.S.G.S. Datum. Two (2) permanent bench marks for the work shall be indicated on the plans.
- 1.7 Any areas that are considered to be "wetlands" as defined by the Michigan Department of Environmental Quality (MDEQ) shall be indicated on the plans. No improvements will be allowed in wetlands unless the MDEQ issues a permit, or a letter of "No Authority", for such improvements.
- 1.8 Finished grade shall be indicated for all structures.
- 1.9 The developer or their engineer shall be responsible for forwarding plans for approval to any private utility company (gas, electric, phone, cable, etc.) and any Federal, State or County (Drain Commission, Road Commission, etc.) agency whose facilities or rights-of-way may be affected by the proposed construction.
- 1.10 It shall be the owner's engineer and contractor's responsibility to verify the existence and location of all underground utilities.
- 1.11 All engineering construction plans shall contain the latest version of the applicable Hartland Township Standard Detail Sheets and the developer's/owner's company and contact name(s), address, phone number and fax number.

- 1.12 An Engineer's Opinion of Construction Cost must be supplied with the Site Plan submittal. This estimate will be used by the Township to establish review fees, observation escrow accounts and performance bonds for the improvements in accordance with the Township Ordinance.
- 1.13 All utility trenches under the 45 degree zone of influence line of existing or proposed pavements, bike paths, sidewalks or drive approaches shall be backfilled with sand compacted to at least 95% of maximum unit weight.
- 1.14 Utility crossings of paved roadways will be required to be bored. Open cutting of paved roadways will not be permitted.
- 1.15 An itemized quantity list will be required for all proposed utility improvements (water main, sanitary sewer, storm sewer).

1.16 Pre-Construction Meeting

Once the engineering plans have been approved by the Township, a pre-construction meeting with the Applicant and/or their representative is required prior to the start of any site work. This meeting will verify that all relevant permits have been applied for, that the proper insurance is provided and to schedule construction observation. The owner's representative and underground contractor are required to attend this meeting.

1.17 Insurance

Prior to commencement of the work, the Contractor shall purchase and maintain during the term of the project such insurance as will protect him, the Owner, and the Engineer from claims arising out of the work described in this contract and performed by the Contractor, Subcontractor(s) or Sub-Subcontractor(s) consisting of: Worker's Compensation Insurance, Comprehensive General Liability, Comprehensive Automobile Liability, Owner's Protective Liability Policy, Umbrella or Excess Liability. A sample form is attached for reference. This form may change or be updated from time to time.

The required limits of liability for insurance coverage shall be **not less than** the following:

Workers' Compensation

Coverage A - Compensation..... Statutory
 Coverage B - Employer's Liability..... \$500,000

Comprehensive General Liability

| | | |
|--|-------------|----------------------|
| Bodily Injury and Property Damage | \$1,000,000 | Each Occurrence |
| Combined Single Limit | \$2,000,000 | Per Job Aggregate |
| | \$1,000,000 | Completed Operations |
| | | Aggregate |

Comprehensive Automobile Liability

Bodily Injury and Property Damage \$1,000,000 Each Accident
Combined Single Limit

Owner's Protective

Bodily Injury and Property Damage \$1,000,000 Per Occurrence
Combined Single Limit \$1,000,000 Aggregate

Umbrella or Excess Liability \$2,000,000 Per Occurrence
\$2,000,000 Aggregate

Notice of Cancellations or Intent Not to Renew – Policies will be endorsed to provide that at least 30 days written notice shall be given to the Township and to the Engineer of cancellation of, or intent not to renew.

The policies shall include the following additional insured on all policies other than Worker's Compensation:

- Hartland Township, their Board members, elected officials, officers, consultants, agents, and employees.
- Spalding DeDecker, their owners, officers, consultants, agents, and employees.

1.18 Performance Guarantee

The Contractor is required to provide a Performance Guarantee in conformance with Section 3.19 Performance Guarantees of the Hartland Township Zoning Ordinances.

2. WATER MAIN

2.1 *General*

- 2.1.1 If the proposed improvements include the construction of public water main, the developer shall submit six (6) sets of water main only plans with a completed MDEQ permit application. This information will be forwarded by the Township to the MDEQ for permitting.
- 2.1.2 All water system improvements shall be designed in accordance with the current edition of "Recommended Standards for Water Works" (a/k/a Ten State Standards).
- 2.1.3 All testing of new water mains (Bac-T, pressure, etc.) shall comply with the latest requirements of the American Water Works Association (AWWA).
- 2.1.4 Water mains in new developments shall be installed from boundary to boundary in abutting road rights-of-way, on roads the project fronts, on interior streets and at other locations as may be deemed necessary by the Township for future extensions.

2.2 *Design Requirements*

- 2.2.1 The hydrant layout must be reviewed and approved by the Hartland Fire Marshall. This review may take precedence over the design standards.
- 2.2.2 Eight (8) inch minimum diameter mains will be installed in single family residential areas.
- 2.2.3 Twelve (12) inch mains are considered to be the minimum size in commercial, office, industrial, and multiple family residential areas except in a looped system of 1,500 feet or less where eight (8) inch mains may be permitted.
- 2.2.4 Maximum length of a dead end main shall be 600 feet in single family and 500 feet in multi-family.
- 2.2.5 Water mains are to be looped whenever possible. Interconnection to existing public water supply systems is encouraged.
- 2.2.6 No service leads are allowed to connect to a hydrant lead.
- 2.2.7 Profile view is required for 12" and larger water mains, and for other smaller sizes when determined necessary by the Township.

- 2.2.8 Water mains shall be kept on one side of the street for the entire length of the street. Water mains shall not be located under pavement or under cul-de-sacs unless approved by the Township and/or their Engineer.
- 2.2.9 Gate valves shall be spaced at a maximum of 800 feet intervals on distribution lines. They shall be spaced such that not more than four valves need to be turned off to isolate any section of the water main.
- 2.2.10 Sufficient valves shall be placed such that not more than 24 single family homes, 30 multiple family units or two (2) hydrants shall be out of service within a section of isolated water main.
- 2.2.11 Dead-end mains must end with a hydrant and a gate valve and well.
- 2.2.12 Gate valves should not be located under roadway pavement, bike paths, sidewalks or driveway approaches when possible, unless approved by the Township and/or their Engineer.
- 2.2.13 All gate valves 6" or larger shall be placed in a well with the exception of a hydrant shut off valve. A valve shall be placed in a box for water main smaller than 6". A stop box and rod is required for services up to 2" and a hydrant valve box is required for services less than 6". If the box falls within a paved area, a hydrant valve box is required for all service sizes.
- 2.2.14 In single family residential areas, hydrants shall be spaced along the water main a maximum of 500 feet. Commercial, industrial and multiple family spacing shall be a maximum of 250 feet.
- 2.2.15 Hydrants shall be located a minimum of 3 feet, or a maximum of 8 feet, behind the back of curb, unless approved by the Township and/or their Engineer.
- 2.2.16 Buildings shall be covered by a 250 feet radius of a hydrant. Hydrants shall be no closer than 2 times the height of the tallest part of the structure. There shall be a fire hydrant located within 100 feet of any building fire department connection.
- 2.2.17 Hydrants located in parking areas shall be protected with a six (6) inch (minimum) concrete curb or standard guard posts. A three (3) foot minimum clear space shall be maintained around the circumference of the hydrant.
- 2.2.18 When connecting to an existing water main, a tapping sleeve, gate valve and well will be required unless connection to the existing main can be made without interrupting service on the main.
- 2.2.19 The plans shall indicate the finish grades of all hydrants and valve box.

- 2.2.20 Water mains shall be located so as to provide a minimum of ten (10) feet horizontal clearance between the nearest edge of the water main and the nearest edge of any sanitary or storm sewer.
- 2.2.21 Water mains shall be located so as to provide a minimum of ten (10) feet horizontal clearance between the nearest edge of the water main and the nearest edge of any sanitary or storm sewer.
- 2.2.22 A minimum vertical clearance of 18 inches shall be maintained between the top or bottom of any water main and the top or bottom of any sewer or utility. Vertical clearance of less than 18 inches will require concrete encasement of the sewer or utility.
- 2.2.23 MEGALUG shall be placed at all valves, bends, tees, plugs, hydrants and mechanical fittings. Surrounding joints shall be restrained using U.S. Pipe Field Lok gaskets or approved equal and shall be per the manufacturer's joint restraining schedule and the latest editions of DIPRA's Thrust Restraint Design for Ductile Iron Pipe.
- 2.2.24 All public water main shall be centered within a minimum 20 foot wide easement, dedicated to Hartland Township. The Township has standard easement forms that can be used. These forms have been reviewed and approved by the Township's legal counsel. The developer/applicant can propose to utilize alternate forms, however they will need to be reviewed and approved by the Township's attorneys.

2.3 Materials

- 2.3.1 All water main 20" diameter and smaller shall be Ductile Iron pipe or concrete. HDPE water main may be permitted upon Township approval and it shall be manufactured as defined in ASTM D3350.
- 2.3.2 Hartland Township standard valve is East Jordan Iron Works, Flow Master, Left Hand Open. All valves shall be resilient seated and conform to AWWA C515 Standards.
- 2.3.3 Hydrants shall be East Jordan Iron Works 5-BR traffic model with 1-5" Storz nozzle and two 2-1/2" hose fittings.
- 2.3.4 Restrained joints are required in lieu of thrust blocks. Restrained joints for pipe sizes up to 16" shall be Fast Grip Gaskets, Mega-Lug or approved equal. Restrained joints for pipe sizes over 16" shall be American Ductile Iron Flex-Ring Joint Pipe or approved equal boltless system.
- 2.3.5 Water services up to 2" shall be either Type K soft copper or HDPE DR9 with tracing wire meeting the requirement of ANSI/AWWA C909 for a pressure class of 200 psi. If HDPE is used, a tracing wire shall be run from the meter set up to the curb box.

2.4 *Installation*

- 2.4.1 All water main shall have 6.0 feet of cover from finish grade, where possible. The maximum cover shall be 8.5 feet unless approved by the Township or its Engineer. When water mains must dip to pass under another utility, the sections which are deeper than normal shall be kept to a minimum length by the use of vertical bends, properly restrained.
- 2.4.2 The contractor will fill, disinfect and pressure test all new water main construction under the supervision of Hartland Township and/or its agent.
- 2.4.3 Before any water main will be accepted by the Township, it must pass bacteriological and pressure testing complying with the current specifications and procedures of the Township.
- 2.4.4 Water main shall not be placed closer than 20 feet (measured horizontally) from any building footing.

3. **SANITARY SEWER**

3.1 General

3.1.1 Since Hartland Township's sanitary sewer collection system is owned and operated by Livingston County Drain Commissioner's (LCDC) office, LCDC's current standards shall govern for all sanitary sewer improvements within the Township, except where modified herein. This shall include:

- Collection System
- Pumping Stations
- Force Mains
- Horizontal Directional Drilling
- Low Pressure Sewers

3.1.2 LCDC Sanitary Sewer Standard Detail sheets shall be attached to the proposed plans when applicable.

3.1.3 Sanitary sewer mains in new developments shall be installed from boundary to boundary in abutting road rights-of-way, on roads the project fronts, on interior streets and at other locations as may be deemed necessary by the Township for future extensions.

3.1.4 A grease interceptor will be required for all food service operations. No connections for domestic waste will be allowed to the interceptor.

4. STORM SEWER

4.1 *Design Requirements*

- 4.1.1 In no event will maximum design rate or volume of discharge exceed the maximum capacity of the downstream land, channel, pipe or watercourse to accommodate the flow. It is the applicant's obligation to meet this standard. Should a storm water system, as built, fail to comply, it is the applicant's responsibility to redesign, reconstruct, or make modifications at his/her expense to storm water management facilities. Such modifications or additional facilities will be subject to the Township's review and approval.
- 4.1.2 Storm drainage systems shall be designed for a ten year rainfall intensity. The Rational Method for arriving at storm sewer runoff shall be used. An "n" value of 0.013 shall be used for concrete pipe, 0.011 for High Density Polyethylene (HDPE) pipe and 0.022 for corrugated metal pipe.
- 4.1.3 The formula for a ten (10) year rainfall intensity shall be equivalent to $I = 175/(T+25)$ in which T is the time of concentration in minutes, and I is the rainfall intensity in inches per hour.
- 4.1.4 The initial T is 20 minutes for residential areas and 15 minutes for high runoff areas. The minimum value of time of concentration (T) shall be 15 minutes.
- 4.1.5 The consulting engineer shall use the following minimum values for "C", the runoff coefficient, in the "Rational Formula" of computing storm water flows ($Q = CIA$).

| | |
|--------------------------|----------|
| Impervious Hard Surfaces | C = 0.80 |
| Gravel Surface | C = 0.60 |
| Vegetated/Turf Surface | C = 0.20 |

Other values of the runoff coefficient may be used or required at the discretion of the Township and/or their Engineer for such areas as parks and open-spaces or unusual sites.

- 4.1.6 Sufficient capacity shall be provided in the storm sewer system to take fully developed upstream drainage into the system. When a storm sewer is designed to provide capacity for upstream areas, the hydraulic gradient shall remain in the pipe.
- 4.1.7 Storm sewer design calculations, including a drainage area map shall be submitted with the design plans. The storm district map shall show all on-site and off-site drainage districts. The district limits must be overlaid on a proposed grading plan for the site.

- 4.1.8 All storm sewers must be located in a public right-of-way or an easement. The minimum storm sewer easement shall be 12 feet wide. The easement size will vary as required for maintenance and access. Any storm sewer that accepts runoff from abutting property or public right-of-way must be placed in a minimum 12 foot storm sewer easement.
- 4.1.9 If a storm sewer is designed to take on-site drainage only, the hydraulic gradient must be no higher than one (1) foot below ground. When the hydraulic gradient is above the top of the sewer pipe, the design elevation of the hydraulic gradient shall be indicated on the profile at each manhole.
- 4.1.10 Storm water detention is necessary for all developments in the Township. See Section 5, Detention / Retention Facilities, for details.
- 4.1.11 Manholes shall be located as follows:
 - a. All changes in alignment
 - b. Points where the size of the sewer changes
 - c. Points where the grade of the sewer changes
 - d. The junction of sewer lines
 - e. Street intersections or other points where catch basins or inlets are to be connected.

4.1.12 Manhole spacing for storm sewers shall be as follows:

| <u>Diameter of Sewer</u> | <u>Maximum Manhole Spacing</u> |
|--------------------------|--------------------------------|
| 12" - 15" | 330 ft. |
| 18" - 30" | 350 ft. |
| 36" & 42" | 400 ft. |
| 48" | 450 ft. |
| 54" & 60" | 500 ft. |
| 66" & larger | 600 ft. |

- 4.1.1 All manholes and catch basins shall be 4' or 5' in diameter unless otherwise indicated on construction drawings. Larger diameter drainage structures (6', 7' 8', 10', and 12' diameter) may be needed for large storm sewer pipe or for situations where the angles between entering pipes require a larger diameter structure in order to maintain at least 6" of structure wall between the pipes. 2' diameter catch basins and inlets may be used where approved by the Township Engineer.
- 4.1.2 All catch basins and inlets shall be as specified by the Michigan Department of Transportation and shall be precast concrete. Special details will be required for manholes placed on pipe 48 inches in diameter and larger.
- 4.1.3 The minimum size of a public storm sewer is 12" diameter. 10" diameter

pipe will be allowed for sewer lines that pick up only footing drain or roof conductor drainage. No open covers will be permitted for a 10" diameter storm sewer.

- 4.1.4 Connection must be made at manholes, blind taps are not allowed.
- 4.1.5 The following information shall be indicated on the storm sewer profile:
 - a. Length of run between manholes.
 - b. Type, class, size and slope of pipe and leads.
 - c. Class of bedding.
 - d. Rim elevations of all manholes.
 - e. Existing and proposed ground elevations above the route of the sewer.
 - f. A logical numbering system for manholes shall be included.
 - g. Invert elevations of all sewers at manholes.
 - h. Locations and limits of sand backfill, where required.
 - i. Locations and elevations of crossing with other utilities
- 4.1.6 The following table of minimum slopes for storm sewers shall be adhered to:

Size and Minimum Slope

| | |
|-------------|-------------|
| 12" @ 0.48% | 42" @ 0.12% |
| 15" @ 0.36% | 48" @ 0.10% |
| 18" @ 0.28% | 54" @ 0.09% |
| 24" @ 0.17% | 60" @ 0.09% |
| 30" @ 0.15% | 66" @ 0.08% |
| 36" @ 0.12% | 72" @ 0.08% |

- 4.1.7 The minimum velocity may not be less than 3 feet per second in a pipe flowing full. The maximum velocity in storm sewers shall be ten (10) feet per second. The contents of a larger pipe will never be discharged into a smaller line even though the slope may be steeper for the smaller line. This principle does not apply, however, to a restricted opening or discharge.
- 4.1.8 Provide a minimum of three (3) feet of cover from the surface elevation immediately above the storm sewer to the top of any storm sewer pipe.
- 4.1.9 For subdivisions, storm sewers shall be located in the public road right-of-way or in easements adjacent to the public road right-of-way and shall be public sewer. Storm sewers shall not be located in rear yards except to pick up rear yard drainage or for sump pump discharge lines.
- 4.1.10 At all pavement catch basins and inlets, a minimum of forty (40) lineal feet (twenty in each direction) of 6" edge drain shall be constructed at the back of curb line in each direction, backfilled with pea gravel. Underdrain shall be constructed from catch basin to catch basin along

the back of curb where possible.

- 4.1.11 No more than 1.0 acre of area shall be tributary to one standard catch basin. Catch basins may be placed side by side in order to provide for additional capacity.
- 4.1.12 A maximum of 900 feet of drainage is allowed from two (2) directions. Detailed stormwater spread calculations shall be provided to ensure that proposed inlets can drain at an interval consistent with the design rain event.
- 4.1.13 Where lateral sewers are proposed, all new homes must be constructed with a discharge lead to an underground pipe connected to an underground storm sewer or an approved alternate storm drain. The sump pump discharge lead shall be a minimum of four (4) inch diameter. The lead shall be constructed at a minimum 1.0% grade.
- 4.1.14 The minimum grade for swales shall be 1%.
- 4.1.15 Where drainage is outletted to County drains or natural water courses, such outlets shall be so designed as to enter the drain or water course at an angle of 90 degrees or less, as determined by the upstream centerline. Headwall, pre-formed end sections, grouted rip-rap or specially designed outlet structures will be required.
- 4.1.16 The Township encourages the use of Best Management Practices (BMPs). The use of such will be reviewed and approved on a site by site basis by the Township and/or their Engineer.

4.1.17 *Materials*

4.1.18 Allowable pipe material for storm sewers shall be:

- a. All round reinforced concrete pipe (RCP) shall meet the requirements of ASTM C76 with modified tongue and groove joints with rubber gaskets manufactured to meet the requirements of ASTM C443. Storm sewers shall be Class IV RCP.
- b. The following will be only allowed in greenbelt areas:
 - I. HDPE pipe shall meet the requirement of AASHTO M294 and ASTM D3350 with push-on type joints meeting the requirements of ASTM D3212 and F477.
 - II. ADS pipe shall meet the requirements of AASHTO M294 and ASTM F2306 with joints meeting the requirements of AASHTO M252, M294, or F2306.

4.1.19 Sump Pump leads shall be (1) PVC Sch. 40 (2) PVC Truss Pipe, or (3) approved equal, with premium joints.

4.1.20 Installation

4.1.21 All RCP storm sewers shall be installed on Class II sand compacted to 95% of its maximum unit weight or better.

4.1.22 A pre-fabricated bar screen shall be installed on all storm sewers end sections eighteen (18) inch in diameter and larger.

5. DETENTION / RETENTION FACILITIES

- 5.1 Hartland Township follows the current version of the LCDC Detention/Retention Design Standards except where modified below.
- 5.2 Commercial and industrial developments using an underground detention system as their means of storm water detention must provide a storm water pre-treatment unit to minimize the potential of contaminants entering the detention system. These pre-treatment units will be reviewed on a site by site basis.
- 5.3 A Detention Basin Maintenance Agreement on the Township's standard form is required for all forms of storm water detention / retention. This document is required at the time of as-built plan reviews.

6. GRADING

6.1 *General*

- 6.1.1 A grading plan is required for all developments. Rear yard storm drainage systems are required for all residential projects.
- 6.1.2 The grading of the proposed development shall not create drainage problems, or make existing drainage problems worse, on adjacent property. If necessary, storm drains shall be extended to the adjacent property to alleviate drainage problems.
- 6.1.3 A land use permit shall not be issued by the Township until a grading plan has been submitted and approved by the Township's Engineer.

6.2 *Design Requirements*

- 6.2.1 First floor and basement (where applicable) elevations for each proposed structure or building shall be shown on the plans.
- 6.2.2 The grades of existing adjacent houses, buildings, drainage structures and streets shall be shown. The actual surveyed grades of existing adjacent ground and yards shall be shown on a grid pattern up to a minimum of 100 feet from the property line. The drainage pattern of all adjacent existing land shall be indicated.
- 6.2.3 The grading plan shall be designed to insure that if a failure or overflow occurs within the storm system, water will drain away in overland swales without flooding houses.
- 6.2.4 Finish grade shall be compatible with the grades of surrounding existing houses, yards, buildings and the existing ground at the proposed house/structure.
- 6.2.5 The finish building grade, defined as the ground surface elevation at the building exterior, shall be established and maintained at an elevation that will provide a minimum five (5) percent slope away from the building for a minimum distance of ten (10) feet, with the balance of the site graded to provide positive drainage from that point. Where a walkout or daylight basement is proposed, sufficient grades should be shown at the location of the walkout to indicate positive drainage away from the walkout. Additional spot grades at the house corners and rear yard should be shown. Changes to recommended configurations of basement openings should not be made without consent of the local building official having authority.
- 6.2.6 All existing and proposed ground grades are to be in tenths of a foot.

- 6.2.7 All existing and proposed ground grades are to be in tenths of a foot.
- 6.2.8 Rear yard swales shall be no longer than 400 feet before being intercepted by a catch basin and shall have a minimum grade of 1.0%.
- 6.2.9 The proposed side yard swale elevation shall be shown between all houses. This elevation must be a minimum of 0.5 feet below the lower adjacent house grade. The side yard swale must have a minimum slope of 1.0% to the front or rear.
- 6.2.10 General direction of flow of the rear yard drainage and swales must be indicated with arrows.
- 6.2.11 The maximum allowable grade shall be 1 vertical to 4 horizontal.
- 6.2.12 The maximum allowable slope on the driveway is 8.0%. The slope of the driveway shall be labeled on the plans.
- 6.2.13 All proposed retaining wall designs will require review by the Township's Engineer on an individual basis.

7. PAVING

7.1 *General*

- 7.1.1 Private roads and driveways shall meet the requirements of Hartland Township's Zoning Ordinance Article 30.00, unless amended herein.
- 7.1.2 Alternative paving designs may be submitted to the Township for consideration. They will be reviewed by the Township's Engineer and recommendation will be made to the Township. Such alternative paving designs shall only be acceptable in those instances where the Township finds that the proposed design will provide an equal or better level of serviceability, ease of maintenance and are consistent with other paving in similar areas elsewhere in the Township.
- 7.1.3 For roads under the jurisdiction of Michigan Department of Transportation or Livingston County Road Commission, all improvements within their jurisdiction shall be designed to meet their requirements.
- 7.1.4 The requirement of acceleration, deceleration and passing lanes will be at the discretion of the Township's Engineer.

7.2 *Design Requirements*

- 7.2.1 A boulevard section may be allowed in an enlarged right-of-way. Pavement widths shall be at least twenty-four (24) feet for all boulevard streets (back of curb to back of curb). The distance from the property line to curb shall be sixteen (16) feet on boulevards. The minimum island width shall be ten (10) feet and maximum sixteen (16) feet. The nose of the boulevard island shall be set back at least twelve (12) feet from the edge of pavement of the intersecting street.
- 7.2.2 Vertical curves are necessary when a change in grade of 1.0% or more occurs. The minimum length of vertical curve shall be 100 feet.
- 7.2.3 The maximum cross slope on a cul-de-sac is 3.0%.
- 7.2.4 All proposed roadways shall be profiled. The pavement profile view shall include:
 - a. Elevations at each station for the top of curb, or at centerline if not curbed.
 - b. Existing ground elevations at the center of the right-of-way, and 30 feet either side of the centerline.

- c. Station and elevations of all high points, low points, grade-breaks and necessary information at vertical curves. Grades for vertical curves must be indicated at twenty-five (25) foot intervals.
 - d. The station and top of curb grade of all pavement catch basins and inlets.
- 7.2.5 The design speed and posted speed of the proposed roadway shall be indicated on the plans.
- 7.2.6 The pavement radius at all intersections of all roads shall be a minimum twenty-five (25) feet. Industrial developments will require a minimum radius of thirty-five (35) feet.
- 7.2.7 Finish grade of all structures shall be indicated in the plan and profile views.
- 7.2.8 Parking lots shall have a minimum slope of 1.0% for bituminous pavement and 0.40% for concrete pavement.
- 7.2.9 All sidewalk and sidewalk ramps shall meet the current MDOT ADA Standards.
- 7.2.10 The minimum sidewalk cross-section is four (4) inches of concrete on four (4) inches of Class II sand. For areas of vehicular crossings it shall be thickened to 6" of concrete including one sidewalk flag on either side of the drive approach. For commercial drives it shall be thickened to 8" of concrete.
- 7.2.11 Sidewalk ramps shall comply with MDOT's current R-28 details.

7.3 *Materials*

- 7.3.1 Surface material for shoulders and gravel private roads shall be 23 A limestone.
- 7.3.2 The base material for private roads and parking lots shall be 21AA limestone and/or crushed concrete.
- 7.3.3 The bituminous mix for parking lots and private roads shall consist of: leveling course – MDOT bituminous mixture No. 3C; leveling course – MDOT bituminous No. 4C; wearing course MDOT bit mix No. 5E1. Asphalt cement penetration grade 85-100 (PG 64-22) reclaimed asphalt pavement (R.A.P) shall be reviewed for approval by Hartland Township.

7.4 *Installation*

- 7.4.1 The installation of private roads and parking areas within the Township shall require observation by the Township's Engineer at the following stages:
- a. After the sub grade has been rough cut to the plan elevation.
 - b. After the placement of the aggregate base. (Confirm at this time that the aggregate base extends under any proposed curb.)
 - c. Full-time during the placement of the bituminous pavement.
 - d. After all the required vegetation has been established.

8. WELL HOUSES

8.1 *General*

- 8.1.1 These standards are intended to serve as a guide in the design and preparation of well house plans. These standard specifications and plans should facilitate improved operation and maintenance by providing standard maintenance parts and similar mechanical and electrical plans.
- 8.1.2 All construction work, materials and equipment shall comply with all applicable federal, state, and local laws, ordinances, and regulations or utility company rules.
- 8.1.3 Equipment and material brand names, types and sizes specified are an indication of design criteria. Other makes, styles, types and sizes may only be used with prior written approval of Hartland Township if they are considered equal to the item specified. All deviations must be approved by Hartland Township before any construction will be accepted.
- 8.1.4 An Engineering Review Fee Escrow Account will be created by the developer/builder to cover the cost of plan review and inspection by Hartland Township. Presently, the deposit required is **\$10,000**. This is subject to change without notice. Please check with the Township for the current fee required.
- 8.1.5 A hydro-geologic study shall be prepared of the site including drilling a test well. All geological formations encountered while drilling the test well shall be recorded in a well log including the depths at which they are found. A pump shall be placed in the test well and the well shall be pumped for a period of not less than 24 hours in order to determine the amount of water that can be withdrawn from the well for an indefinite period.
- 8.1.6 As a minimum the following data shall be recorded during the pumping test:
- a. Date, time and location of test.
 - b. Static level which is the distance from the ground surface to the water in the well measured after at least 12 hours without pumping.
 - c. Pumping rate at which the water is withdrawn from the well.
 - d. Pumping levels which are the distances from the ground surface to the water in the well measured every five (5) minutes for the first hour of pumping and every ½ hour thereafter for the duration of the test, which shall be at least 24 hours.
 - e. Recovery levels which are the distances from the ground surface to the water in the well measured every five (5) minutes for the first hour after the pumping stops and every ½ hour thereafter until no change in level is noted.

f. Towards the end of the pumping test, a water sample shall be taken by a qualified technician. The sample shall be delivered to a testing laboratory acceptable to the Township where it shall be tested for total coliform, metals, other inorganic chemicals, VOC, total trihalomethanes and any other compounds required to obtain approval from the State of Michigan Department of Public Health.

8.1.7 Plans shall be prepared and submitted for review on 24" x 36" drawings conforming to Hartland Township Engineering Design Standards. The plan cover sheet shall include project name, township name, town and range, section number, quarter section designation, full property description of the isolation radius or parcel to be deeded to Hartland Township, a site plan map with the well in the center at a scale of 1" = 200', a location map, the property address, the name and address of the developer, the name and address of the design engineer. All plans must bear the seal of a licensed professional engineer licensed to practice in the State of Michigan.

The second sheet of the plans shall contain a service district map drawn at a scale of 1" = 200' showing each lot or parcel to be serviced by this well. This sheet shall also show the calculation of the design peak water usage requirement for the entire service area. These calculations shall clearly identify the demand associated with each parcel in the district. The fire flow requirements or provisions of the well system shall be stated and approved by the Hartland Area Fire Department.

One, or more sheets of the plans shall be dedicated to and include the pump discharge curves; all well logs and sieve analyses; the diameter, size of opening, and length of the screens; the proposed settings for the screens and pumps; motor name plate data; proposed hydro-pneumatic tank sizing calculations and drawings; and reference to the hydro geologic study.

8.1.8 Prior to construction, a preconstruction meeting shall be scheduled by the Design Engineer. Attendees shall include Hartland Township, the Township's Engineering Consultant, the general contractor, the construction contractor, the well driller, and others as appropriate. Prior to final acceptance, a meeting of the same people shall be scheduled by the Design Engineer to address any outstanding punch list items.

8.1.9 All wells shall be properly disinfected by chlorination before being placed into service. After disinfection a water sample shall be submitted to a testing laboratory, satisfactory to the Township, for microbiological analysis. Results obtained shall be acceptable to the Michigan Department of Environmental Quality.

8.2 Construction

- 8.2.1 All applicable Township permits shall be obtained by the developer/builder, and all inspections performed and approved at the developer/builder's expense.
- 8.2.2 The pump house foundation footings and foundation walls shall be designed from soil boring data. The foundation shall be minimum 3500 psi. concrete. Foundation walls shall be of sufficient width for the required brick ledges and insulation. Township inspection is required at time of all concrete pours. Concrete trucks load slips shall be supplied to the Township at each pour. Block drains shall be installed at base of all outside walls to avoid moisture buildup in masonry walls.
- 8.2.3 All pump house walls shall be minimum 8" masonry block with ties for exterior facing. Exterior wall facings shall be brick or stone. Only 8" glass block window openings will be allowed. All exposed interior wall surfaces shall receive two coats of masonry paint. Foundation walls shall be a minimum of 14" wide to allow for 8" block, 2" insulation, and brick ledge for exterior facing. Soil boring data shall be utilized to ensure that foundation bearing loads are within acceptable limits.
- 8.2.4 Roofs shall be of frame construction and shall be hip or gable style. The roof shall consist of 300#, seal down, asphalt shingles, 15 lb. per square felt building paper and 5/8" exterior plywood. All roof trusses shall be 2" x 6" min. 24" on center, 6" x 12" pitch minimum. Ice shields shall be provided and shall comply with the current Michigan building code.
- 8.2.5 All other areas, such as soffit, fascia, frieze, etc., shall be either an approved vinyl, not less than .044" thick or aluminum with baked-on enamel finish. No exposed exterior woods will be allowed. Either gable attic ventilators with insect screens at each gable or screened ridge vents shall be provided soffit vents, gutters and down spouts shall also be provided. Venting shall meet the Michigan building code requirements.
- 8.2.6 Two part polyurethane sealants shall be used to seal all joints between exterior metal frames, siding, etc., and adjacent surfaces.
- 8.2.7 Insulation is required on the foundation walls, between the brick facing and the block back-up (2" foam between brick and block), and in the well house ceiling area. Insulation shall provide the following minimum value was:
- | | | |
|----|------------------|------|
| a. | foundation walls | R-10 |
| b. | building wall | R-11 |
| c. | ceiling | R-24 |

Insulation thickness and type of material shall be detailed on construction plans.

- 8.2.8** The finished floor shall be 3500 psi. concrete six inches thick reinforced with not less than 6" x 6", W7 x W7 welded wire fabric with a four inch sand base compacted to 95% density and thoroughly moistened (plastic vapor barrier shall be used) before pouring. The floor shall pitch 2" per 10' to the building wall opposite the doors, shall be finished smooth. A floor drain trough for the full length of well house floor 4" wide and 4" deep shall be installed 6" from the building wall opposite the doors. This trough shall drain to a 4" diameter ductile iron pipe at the center of the trough length with a screened free fall gravity outlet to the outside. Finish floor elevation shall be a minimum of 12" above finish grade.
- 8.2.9** Where the water system supply main exits through the pump house floor, there shall be a 24" x 24" floor opening filled with pea gravel.
- 8.2.10** Removable roof hatches with Township approved lockable covers shall be provided through the pump station roof and ceiling. These hatches shall be designed to facilitate all well, pump and motor maintenance. Hatches shall be "Bilco" type hinged perpendicular to the roof ridge. Latches shall be operable from the inside of the well house only.
- 8.2.11** Internal pump house ventilation shall be provided by closable, ceiling registers connected by minimum 6" diameter sheet metal duct work to low profile, roof vents. A minimum of two (2) vents shall be provided, one per 4000 cu. ft. of interior building size. In addition an approved through the wall propeller exhaust fan with a aluminum gravity damper in combination with an approved motorized aluminum air intake damper with blade edge and joints seals shall be provided in the vicinity of any planned chemical area. Approved storm proof aluminum louvers shall be provided on the building exterior at the fan and damper locations.
- 8.2.12** Two "thru-wall" brick vents (minimum size 8" x 16") shall be installed six inches above the finish floor in the wall behind the hydro-pneumatic tank. "Thru-wall" bricks vents shall have cast iron grilles or 5/8" diameter steel rod guards. Insect screen, water stop and interior register with damper control. . A minimum of two (2) vents shall be provided, one per 4000 cu. ft. of interior building size.
- 8.2.13** A 1/2" exterior grade, plywood or painted Oriented Strand Board (OSB) ceiling shall be provided at the top of the block wall and secured to the underside of ceiling framing with screws and adhesive. The ceiling section under the hatches may be readily removable on hinges with the insulation sandwiches between the ceiling and another layer of 3/8" exterior grade plywood. The generator room ceiling shall have a layer of one hour fire rated damp proof drywall applied over the plywood ceiling.
- 8.2.14** Doors shall be 1-3/4" thick, 16 gage, insulated, with no cardboard fillers, minimum of 36" x 80" size of-G60 galvanized metal flush type swing doors without louvers or windows as manufactured by Ceco, Inc.,

complete with frame, hardware, and threshold. Door frames shall be 14 gage, manufactured from G-60 galvanized metal with mortar-filled jambs. Doors shall be completely weather-stripped and weather-sealed with adjustable metal door sills. All doors shall open to the outside. Locks shall be Corbin/Russwin Mortise Lock ML2000 with 26D finish and cylinder keyed for master-keying. Hydraulic door closures with hold open arms shall be installed on all doors.

8.2.15 A one-half ($\frac{1}{2}$) inch minimum expansion joint shall be installed completely around all concrete tank cradles, pump bases, and well house perimeter.

8.2.16 Splash pads, 4' x 10' x 4" with curbs 3 sides 6" high (to direct flow) of 3500 psi. concrete, construction shall be installed outside of the well house centered and extending ten (10) feet from blow off pipe discharge end. Ground shall be swaled in such a fashion as to direct all flow away from building area with the first 6ft being formed from natural stone rip-rap. Air relief valve and pressure relief valve exterior discharges shall be directed away from pedestrian areas, and pressure relief valve discharge shall also be directed to a splash pad or paved area. Air relief valve shall discharge to the south or east of the building.

8.2.17 Adequate consideration shall be given to the quantity of water that may be discharged during maintenance, testing, or blow off. Suitable drainage shall be provided away from building proper.

8.3 *Electrical*

8.3.1 All electrical work shall meet local, state, and federal requirements and shall conform to the National Electrical Code.

8.3.2 All electrical equipment shall be as manufactured by Allen Bradley, Square D, Cutler-Hammer, General Electric, AC Technology Corporation, Ametek, Automation & Process Technologies (BW Controls), Diversified Electronics or approved equal that has a local stocking agency.

8.3.3 The utility service shall enter the building at a main service entrance switch. The main service entrance switch shall be heavy duty, fused type with solid neutral and ground lug. The switch shall have switch blades that are visible when the switch is in the OFF position and the switch door is open. Switch shall be UL listed for use with aluminum or copper conductors. The switch shall utilize Class R fuses. The switch shall have a quick-break operating mechanism. Operating handle and mechanism shall be an integral part of the enclosure (not mounted on the cover). The switch shall have dual cover interlock to prevent unintentional opening of the switch door when the switch is in the ON position or turning the switch ON with the door open. A cover interlock bypass shall be provided. Handle position shall positively indicate if switch is ON or OFF. All terminals or lugs shall be 75°C rated for copper conductors.

The main service entrance switch shall be service entrance rated with NEMA 1 enclosure and shall be Cutler-Hammer Type DH, Square D H222N, General Electric, or equal.

- 8.3.4** When a permanent back-up generator is not required as part of the original well house construction, a three-way (utility-off-generator) manual transfer switch shall be wall mounted inside the pump house. Also an Appleton receptacle (AJA 200 34250RS) for portable generator hook-up shall be installed whenever a generator is not provided. The generator receptacle shall be installed on an interior wall adjacent to the generator parking area. A 6" x 6" through wall double doored access hatch shall be provided adjacent to the receptacle to permit passage of the generator cord. The access hatch doors shall be lockable from the interior of the well house only.
- 8.3.5** All distribution and control equipment shall be mounted in one location, as practical, to 4' x 8' x 3/4" sheet(s) of exterior grade, pressure treated plywood securely lagged to the wall three feet above the floor. All electrical equipment must be minimum of 24" above finished floor level. A minimum of 3' - 6" clear work space shall be maintained in front of all electrical equipment mounted to the plywood. All heavy electrical equipment such as transformers shall be lag bolted through the plywood into the block wall.
- 8.3.6** Distribution of three phase power shall be from a distribution panelboard. The distribution panelboard shall be NEMA Type 12 rated and shall have an overall door. The door shall be equipped with flush hinges and cylinder lock. The panelboard shall have a ground bus for terminating ground conductors. The panelboard shall be of the circuit breaker type and shall be designed for the applied service voltage. All panelboard bus work shall be copper and all terminals or lugs shall be 75°C rated for copper conductors. The circuit breakers shall be of the molded case type with thermal magnetic trip and shall be quick-make, quick-break with indicating and 25,000A interrupting capacity minimum. Each circuit breaker shall be provided with a padlockable handle lock hasp. Panelboard shall be Cutler-Hammer Pow-R-Line 4B, Square DI-Line Type HCM, or General Electric Type CCB.
- 8.3.7** All loads that are not within sight of or within 50 feet of the distribution panelboard or their associated controller, shall be supplied with a disconnect switch. Disconnect switches for 480 volt loads shall be 600 volt rated, NEMA Type 12 or NEMA Type 4 enclosed and shall be Cutler-Hammer, Square D, or General Electric and shall have auxiliary contacts to interrupt the motor control circuit. Disconnect switches for 120 VAC, 240 VAC, or 208 VAC single phase loads and fractional horsepower motors shall be similar to 2 pole manual motor starters, except without overloads, Square D Class 2510, Cutler-Hammer, Arrow Hart, or equal. All disconnect switch terminals or lugs shall be 75°C rated for copper conductors. Fused switches shall utilize Class R fuses.

8.3.8 Each motor shall be controlled by a NEMA rated magnetic motor starter and fusible disconnect of proper size. The starter shall be provided with a built-in switch to provide "Manual", "Off" and "Automatic" control and shall be as manufactured by Allen Bradley with non-adjustable overload relays. All pump motors 40 h.p. and above shall have reduced voltage starting of the part winding auto-transformer or delta-wye types only. This is to reduce generator size and cost. Allen-Bradley Smart motor controllers or a unit of equal design as approved by the Township are also acceptable where a slow start and stop are required.

8.3.9 Variable Frequency Drives (VFD) shall be provided for all water booster pumps and ground storage tank pumps. The drives shall be MCH Series as manufactured by AC Technology Corporation (Uxbridge, MA), Eaton (Cutler-Hammer), or Rockwell (Allen-Bradley). The drives shall include a door interlocked disconnect, AC line reactor, and current limiting fuses (equivalent to Bussmann Type KTK-R and rated 200,000 AIC). The variable frequency drives shall be furnished by a single vendor, who has actively been manufacturing drives (VFDs) for a period of at least five (5) years. The drives shall be UL and CSA certified and shall comply with the latest applicable standards of ANSI, IEEE, and NEMA. As a minimum, the full load output current of the drives shall be equal to the equivalent motor horsepower as listed by the National Electrical Code Table 430.150. The variable frequency drive manufacturer shall maintain, as part of a national network, engineering service facilities within 250 miles of project, to provide start-up service, emergency service calls, repair work, service contracts, maintenance, and troubleshooting training of customer personnel. The VFDs shall be rated for operation at the facility's nominal utilization voltage. The units shall tolerate a 10% overvoltage and 15% undervoltage, a line frequency between 48-62 Hz, and have a 100% load rating. The VFDs shall operate at 100% rated capacity, without derating, up to 3,300 feet MSL. The unit shall operate in environments of 0-95% non-condensing humidity, at an ambient temperature between 0-40°C (32°F to 104°F). The VFDs shall have a displacement power factor of >0.96 and shall have >97% efficiency over the entire speed range. The VFDs shall output a sine-coded pulse width modulation power output to the load over a frequency range of 0-400 Hz. The VFDs shall have a frequency regulation of ±0.4% of maximum output frequency. The VFDs shall have the following protective features: phase-to-ground or 3-phase short circuit, undervoltage, overvoltage, drive overcurrent, high and low line voltage, overtemperature, inverse time, electronic thermal overload, open terminals for external fault conditions, input line noise suppression 0.5 second (30 cycles) power loss control circuit ride through. The drives shall have a human interface module through which operator personnel can manually start/stop drive, manual control speed, jog drive motor, and adjust drive parameters.

8.3.10 Automatic alternating control of starting of pumps shall be provided by means of B/W Controls electrodes and a Diversified Electronics

alternator. The electrodes for these controls shall be installed on the front of the tank with gate valves, and unions so electrodes can be removed for cleaning with the tank pressurized.

- 8.3.11** In general, all conductors or cable shall be 600 volt, 98 percent conductivity copper with code types "THHN, or THWN" for control and code types "XHWW, THHN or, THWN" for power and type MTW for control panel wiring, insulated per National Board of Underwriters. All wire shall be run in rigid steel, hot dipped galvanized conduit below grade or in concrete floors, walls, block, etc. with necessary expansion joints provided. Electrical metallic tubing (thin wall), or SCH 40 PVC conduit may be used above grade except for building exterior where only rigid steel galvanized conduit and fittings may be used. Flexible liquid tight metallic conduit may be used where rigid conduit is impractical and shall be Sealtite or others approved by Underwriter's Laboratories. All motors shall be hooked up with a 24" section of liquid tight flexible conduit directly adjacent to the motor. Conduit for pump motors shall be cast into concrete floor and brought up to motors. The generator connector shall be wired with type "G" cable to allow freedom of movement of the connector pins.
- 8.3.12** All electrical panels, starters, and switches shall be identified by permanent ½" letters as to the equipment they serve and applicable voltage. All wiring shall be numbered, and a corresponding as-built electrical ladder diagram for all electrical shall be provided. This ladder diagram shall be complete showing all switches, relays, etc. per well house installation. Attached to the electrical diagram shall be an equipment listing giving brand names and model or part numbers. Manufacturer's diagrams are not acceptable. Ladder diagram and list shall be provided on one 24" x 36" mylar sheet suitable for reproduction. The contractor shall provide three (3) copies of all operations manuals for all equipment bound in three ring binders to the Township.
- 8.3.13** Two natural gas unit heaters with blowers shall be ceiling, swivel mounted in each pump house with BTUH rating adequate to maintain 55 degree F. minimum inside temperature at outside temperature of -20 degrees F. Heating shall be controlled by a built-in low range thermostat (minimum setting of 50 degree F. must be possible) calibrated in degrees. Unit heaters shall be all gas with electric spark ignitions. Generator room shall have electric unit heaters with fans and built-in low range thermostats.
- 8.3.14** Lighting:
- a. Inside: All building indoor lighting shall be with fluorescent open strip fixtures equipped with electronic ballasts and 2-T8 energy saving cool white bulbs in each location. Minimum 6 in main building, 2 in generator room. Generator room lights shall be

switched at all entrance doors. Switches for the inside lighting shall be provided at all building entrances.

- b. Outside: One (1) each 150 watt HPS fixture and lamp with photo cell at each building entry door, controlled through 3- or 4- way switch, as needed from inside of each door. Light fixtures will have vandal-resistant lens covers, Lexan or equal material.

- 8.3.15** As a minimum, a duplex, wall-mounted 120 volt, 20 amp. electrical duplex outlet shall be provided at or immediately adjacent to each pump, in the vicinity of hydro-pneumatic tank controls, at the control panel, and at each doorway. All utility outlets shall have ground fault protection.
- 8.3.16** Running time meter shall be installed in the electrical panel with readings available from the panel face for each pump. The read out should be in hours and tenths, Cramer 635K or equal.
- 8.3.17** A 120V A.C. electric clock shall be provided and mounted with the electrical equipment.
- 8.3.18** Each 3 phase motor shall be protected by a phase monitor as manufactured by Diversified Electronics, Model #SLA 440-ALE.
- 8.3.19** A programmable time delay relay such as diversified electronics TDU-120 AKA or Omron H3CA-A shall be provided to delay pump motor start after pre-lube solenoid activation. Motors shall be protected from phase problems due to switch over from gen/normal power with time delay in transfer unit that will allow sufficient time for phase to stabilize before motors are restarted.
- 8.3.20** A liquid level sensor such as "Flygt ENH-10" shall be installed inside the pump house to interrupt all electrical service from a water level 1' - 0" above finished floor level. A liquid level sensor bypass shall be installed in the control panel. This will also shut down the generator unit.
- 8.3.21** The pump house shall be provided with a secondary lightning arrestor such as Square D SDSA-3650.
- 8.3.22** An electrical duplex outlet energized with the pump motor for each well shall be provided on the pump house wall opposite the electrical control panels for the operation of future chemical injection pumps.
- 8.3.23** If the well house is required to be equipped with a permanent standby generator, it shall be sized and equipped to automatically operate all well pumps and all associated equipment during any electrical power failure. This will be a permanently mounted unit sized to operate all equipment and loads necessary to keep facility at 100% operation.

- 8.3.24** The well house shall be equipped with a telemetering system approved by Hartland Township. An indicating pilot light for each incoming utility power leg shall be located on the control panel visible from the auxiliary power receptacle. The indicating lights shall be of the transformer type with low voltage lamps. Allen Bradley model 800T or equal.
- 8.3.25** An automatic transfer switch/exerciser shall be provided for generator and shall be set up to exercise generator with or without load. Transfer switch shall be equipped with a means of preventing out of phase transfer of loads such as Programmed Transition or an in-phase monitor.
- 8.3.26** Pilot devices shall be full size NEMA 13 with engraved name plates. Indicator lights shall be push to test, transformer type with low voltage lamps. Selector switches shall have standard operators and replaceable contact blocks. Allen Bradley 800T or equal.
- 8.3.27** Pressure switches shall be of the sealed mercury type as manufactured by Honeywell and shall be type L404A for add air and low pressure alarm and type L404B for void air control.
- 8.3.28** Solenoid valves shall be Nema 4 pilot operated with forged brass bodies as manufactured by ASCO or equal.

8.4 *Mechanical*

8.4.1 **Pumps**

- a. Pumps shall be capable of delivering water at 90 psi. Pumps shall be Peerless, Layne, Deming, or other Township approved deep well turbines, 1750 RPM, with water lubricated bearings open or semi-open impellers. Clearance between impellers and bowls shall be adjusted by a nut on top of motor. Closed impeller pumps are not acceptable. The pumps shall be equipped with a close coupled shaft with anti-reversing ratchets. Manufacturer's certified test curves and physical dimension sheets shall be furnished for approval. Pumps shall be subject to field testing to assure performance in accordance with specifications. Motors shall be G.E., Reliance, or U.S. with final horsepower requirements determined after analysis of manufacturer's curves. No aluminum windings will be allowed in motors.
- b. Stainless steel or nylon altimeter lines with direct reading altitude gauges, and air valves shall be installed at the elevation of the discharge pipe centerline for each well. The altimeter gauges on each pump shall be supplied with air by means of a nylon 3/8" O.D. 200 psi. line, valved at hydro-pneumatic tank and valved at altimeter gauge. This line shall be capable of providing sufficient air to drive altimeter line for accurate readings. A valved connection shall also be provided at each pump to permit

the use of a hand operated pump. One hand operated air pump shall be provided. This line is required on deep well vertical turbines as well as all submersibles. No tail pieces allowed on pumps. Pump bowl shall be set 5' above top of screen.

- c. A capped 3" observation pipe is required, mounted on a 45 degree upward angle on each well casing cap. This cap shall contain a minimum 1" vent mounted with the screen pointed down; a brass foot valve minus the check flapper is suitable for this application. This shall protrude from the base a sufficient length to permit easy removal of the cap. This may not be under pipes or in the aisle-way.
- d. Sample cocks shall be installed at each pump and in discharge piping from storage tank. All sample cocks shall be ½" corporation stop with ½" 90 degree copper elbow attached. Chemical injection taps and necessary sampling points shall be provided for each well. The water main sampling tap shall be located five feet beyond the well house outside wall with a direct one inch corporation tap (no saddles allowed) to the water main. A one inch, type K copper line shall be run a minimum of five feet deep under the well house foundation to a typical sample cock located three feet above the pump house floor.
- e. A permanently installed eye wash and separate sample sink shall be installed at each well house. Drains from these fixtures may discharge to the building exterior.
- f. Each pump shall have four stainless steel ½" diameter minimum (set 6" into pedestal) anchor bolts installed on concrete pump foundation. The well casing shall extend one inch above the concrete pump foundation. Each pump shall be grouted at pump base after installation.

8.4.2 Pressure Tank

- a. The pressure tank shall have minimum 1/4" steel plate sides and 5/16" plate ends. All tanks shall have a minimum acceptable certified 150 psi. test by manufacturer and shall be tagged with ASME code. The tank shall be lined with an epoxy lining, NSF approved for use in potable water supplies.
- b. A minimum of two 11" x 15" manholes (one on side near end and one on opposite end) and sufficient taps for sight glasses, controls, relief valves, compressor, etc. shall be located in the front end of tank. One (1) 2" diameter capped opening shall be provided at the top of the tank.

- c. A 6" bottom drain and gate valve shall be located near the rear end of the tank in the bottom and piped to outside the pump house. No stand pipes inside tank will be allowed. Tanks over 10,000 gallons shall have 8" drains.
- d. All openings in the tank including those required for sight glasses and controls, except the manhole, shall have a gate valve immediately adjacent to the tank. All pressure gauges shall have snubber valves in front of them. All gauges shall be liquid filled with stainless steel case and brass movements. All valves 3" and larger shall be flanged.
- e. A minimum 4" Terice, Ashcroft, or Wika pressure gauge, 0-150 psi. range with gauge lock for pressurized gauge removal shall be installed in the top of the front face of the tank.
- f. A minimum of four steel, properly sized saddles shall be provided on each tank. Saddles shall be set on reinforced concrete stub walls. Steel saddles shall be set on non-shrink grout on top of stub walls.
- g. An adequate air pressure relief valve shall be provided at the pressure tank. This shall be vented to the outside at ceiling height and a suitable muffler installed to reduce the noise level below 55db at the property line. A gate valve shall be provided to isolate the relief valve from the tank for maintenance purposes. A typical setting shall be 10 psi. above the high operating pressure, generally 80 psi. Void air pressure switch shall control a solenoid valve which will open at high air level to void all excess air.
- h. An air compressor of adequate size shall be securely wall mounted above the floor, equipped with self unloader, as a Quincy, Gardner-Denver, or Township approved alternate compressor, with 3/4 h.p., 3-phase, 480 V.A.C., motor, with minimum of 3 C.F.M. at 100 psi required ratings. Located 3-4 feet above floor.
- i. Generally, the operating pressure range shall be 60 psi to 80 psi. However, considerable ground elevation variation throughout the system will require the pressure range to be adjusted accordingly.
- j. Pressure tank size shall be such that a minimum three minute running cycle for the production well is provided. Calculations showing running cycle for the largest production well and corresponding tank water levels shall be provided for tank size to be approved. Tank sizing from the "Recommended Standards for Water Works", Great Lakes-Upper Mississippi River Board of State Sanitary Engineers is also acceptable. Controls for tank shall be wall mounted and not on tank face.

8.4.3 Piping

- a. Steel "Dresser" couplings with 5/8" minimum tie rods shall be used on discharge lines from both pumps and from the pressure tank. Where uni-flange style pipes and fittings are used, tie rods ½" minimum diameter are required across all joints. Middle rings at dresser couplings shall be sandblasted and coated with epoxy suitable for use in potable water systems. Ridge victaulic style grooved couplings are also acceptable.
- b. Propeller type meters as manufactured by Sparling or Water Specialties with readings in gallons shall be installed on the discharge piping of each pump. A straight length of pipe recommended by the manufacturer shall be installed on each side of the meter. One blank plate/cover (to factory specifications) for each water meter in building shall be provided to allow for continued operation of plant while meters are out for repair.
- c. Check valves shall have externally weighted arms, as manufactured by Crispin, M&H, Apco or Valve and Primer, with brass trim. Check valves 8" and larger shall have a soft style stop or anti-slam device.
- d. Underground water main shall be in accordance with the Township's water main specifications. Pump house water main shall be all flanged joint. Steel pipe shall be ASTM spec. A-53, schedule 40. Ductile iron water main shall extend a minimum of ten feet outside the pump house foundation wall. One fire hydrant shall be located in an isolation area beyond the well house isolation valves.
- e. Pumping equipment, piping, and all appurtenances shall be arranged with a minimum of 48" clearance from walls, except minimum 36" clearance from back side of hydro-pneumatic tank to back wall. Clearance from floor to bottom of tank shall be a minimum of 24" and clearance from ceiling to top of tank shall be a minimum of 18", for tank maintenance. All 4" through 8" plumbing shall be kept at the same plane except blow-off lines to outside.
- f. A minimum 2" air relief valve for deep wells as Crispin D 210 or Apco Series 140 shall be provided between the check valve and pump. Minimum 2" air relief piping shall be sloped to an easterly or a southerly building elevation, at 7'-6" minimum elevation with a brass screen fitting pointing downward one foot from the pump house exterior wall. Air release shall have a defuser mounted internally to reduce slam.

- g. All blow-off lines and hydro-pneumatic tank drains shall have exterior pipe caps installed. Exterior pipe caps shall have four, minimum 1/4" diameter holes for freezing protection. The water pressure relief line shall have a flap valve at discharge and outside of building.
- h. All valves on 4" and larger piping shall be flanged end cast iron, bronze trimmed, solid resilient wedge gate valves meeting the requirements of AWWA standard C-515. A fusion bonded epoxy coating conforming to AWWA C-550 shall be applied to the interior and exterior ferrous surfaces of the valves. The coating shall be NSF approved for drinking water use. Valves shall be as manufactured by East Jordan, US Pipe, Mueller, M&H, or American Series 2500.
- i. Vertical discharge piping through the floor of the pump house shall be tied with four 5/8" minimum diameter stainless steel rods and thrust.
- j. Adequate pipe supports shall be provided on minimum ten foot spacing, under bends, under all valves, under heaving fittings or as required by the Township. Concrete pedestals shall be provided under check valves and water meters 12" diameter and larger.
- k. A 1/2" copper tubing pre-lube system with gate valves shall be installed to the pressure side of the check valve for each well. Pump pre-lube shall be activated 15 seconds to 2 minutes before pump motor start through a solenoid valve in the pre-lube piping.
- l. A Terrice, Ashcroft, or Wika pressure gauge, 0-100 psi range, minimum 4" diameter dial and snubber valve shall be installed by tapping the top of the pipe adjacent to each well before the check valve.

8.5 *Painting*

8.5.1 The tank and all piping and blow-off lines shall be given one prime coat of 769 Damp-Proof Red Primer, one second coat of 960 Zinc Chromate Primer, and one third coat of color coded piping enamel as manufactured by Rust-Oleum Corporation.

8.5.2 The floor shall be provided with a non-skid finish.

8.5.3 The color coded scheme shall be:

- a. Pressure Tank - Green
- b. Water Piping - Blue
- c. Water Valves - Red

- d. Water Blow-Off, Piping - Orange
- e. Air Blow-Off Piping - Gray

8.5.4 The pump house interior walls and ceiling must receive prime and finish coats of paint. Paint color shall be semi-gloss white or light gray.

8.6 *Well Isolation Area*

8.6.1 The well isolation area including access road if any shall be deeded to Hartland Township.

8.6.2 No construction or buildings are allowed on isolation areas per state requirements. No sanitary or storm sewers may intersect the isolation area radius.

8.6.3 The entire well isolation area shall be properly graded, minimum 3" top soil provided, fertilized and seeded or sodded. The pump site shall be landscaped with bushes and/or trees to be compatible with the proposed development.

8.6.4 A 12-foot wide drive shall be provided with a minimum of 8" compacted 21AA limestone road base with 4" asphalt from the existing road to the well house. This drive shall be properly drained and have a maximum grade of (7%). Culverts shall be installed across all drainage ditches. An asphalt parking area shall be provided adjacent to pump house and well maintenance hatches. A turn around shall be provided with sufficient space to permit a generator pulled by a stake truck to conveniently enter and exit the well isolation area, while parking the generator adjacent to the well house.

8.6.5 The drive shall be secured by a 4" diameter post on each side with a minimum 3/8" cable ready for padlock by Hartland Township. Posts to be set in 12" x 12" x 36" deep concrete bases.

8.7 *Generator Requirements*

8.7.1 Natural gas driven units are preferred. Diesel units may be supplied only where natural gas is not available. **Generator sizing data indicated in this section shall be provided by the Developer for each specific well house.**

8.7.2 The maximum dip allowed when equipment is activated will be 20%. All data shall be supplied by company supplying unit. This data must confirm the engineering data supplied by project design firm.

8.7.3 Entire unit must come with a full 100% warranty for not less than five full years from date of acceptance. Parts and labor inclusive.

- 8.7.4** Only liquid cooled units are allowed. Each unit shall have a thermostatically operated block heater to maintain unit at starting temperatures. The critical ambient outside temperature shall be -20 degrees F.
- 8.7.5** The natural gas fuel system shall include all required components and accessories including but not limited to the following:
- a. Primary and Secondary Regulators
 - b. Low Gas Pressure Switch
 - c. Solenoid Valve
 - d. Fuel Filter
 - e. Supply Line Flexible Connector
- 8.7.6** Propane and diesel driven units shall have a minimum (72) seventy-two hours of fuel in storage tank calculated at 50% load. Diesel units shall have a double-wall, steel storage tank. The tank shall meet MDEQ standards as well as any local codes and shall include a leak alarm sensor. Minimum tank size is 450 gallons with fuel level indicator. A screened, 2" outside fuel tank vent and an outside emergency vent shall be provided. The fuel tank shall have an outside 2" fill port with pad lockable spill containment.
- 8.7.7** To maintain environmental quality, the engine shall be equipped with suitable emission control equipment to meet, as a minimum, current Environmental Protection Agency specifications for stationary, industrial engines. Verification of the ability to meet these emission specifications shall be provided by the engine manufacturer.
- 8.7.8** Units shall be equipped with critical silencing mufflers. Battery charger shall be permanently mounted and hard wired into unit.
- 8.7.9** All louvers and shutters on generator air intake shall be mechanically operated, mounted on interior of building. The exterior of building shall be provided with fixed storm proof louvers with screens to prevent insects and bug infestation of room proper. These are to cover intake and exhaust louvers entirely.
- 8.7.10** A complete instrument package shall be provided on engine monitoring board. All engine monitoring gauges shall be affixed to main generator unit or an adjacent wall within reach of unit. When available, gauges shall be supplied in lieu of lights. Minimum instrument package shall include: engine temp., water temp, engine RPM, gen hz., oil pressure, voltage of battery, exciter voltage and current, auto/man operator switch, panel lights, latching type unit, trouble lights with acknowledge switch. Field circuit breaker and all normal systems operations shall be monitored in such a fashion that they will protect unit from failure. Include overcrank, overspeed, and overrun circuitry for shut down.

- 8.7.11** Maximum RPM on engine shall not exceed 1800 RPM. Gear boxes to reduce engine/to/generator RPM are not acceptable under any circumstances.
- 8.7.12** Import units are acceptable only if a local distributor is available and that distributor has original equipment parts for entire unit in stock as well as factory authorized service and factory trained personnel on full time staff. Local distributor is defined as one in Greater Detroit Metropolitan area. Distributor must also provide 24 hour emergency service.
- 8.7.13** Four sets of parts and service manuals shall be supplied and turned over to Hartland Township before unit is to be accepted, in addition to warranty documents and as built drawings.
- 8.7.14** Load test will be conducted at developer's expense. This will consist of 3 hours at full load. Developer will supply manpower and all necessary fuels. This test shall be witnessed by a Hartland Township representative with not less than 72 hours notification to Township authorized representative.
- 8.7.15** Diesel and other fuel tanks, propane, etc. shall be turned over to Hartland Township full of fuel before final acceptance of facility will be given.
- 8.7.16** All generator units shall be mounted on skid rails and shall have sufficiently large vibration isolators to put as little vibration to building floor as possible.
- 8.7.17** Generator units shall be mounted no less than 16" above finished floor. Remainder of electrical equipment shall be mounted no less than 24" above finished floor to bottom of panel or any other electrical device. Adequate room shall be provided to service unit including the draining of oil pans. Oil pans on engines shall be provided with a drain plumbed to outside perimeter of unit where oil can be captured in a container.
- 8.7.18** Concrete floor beneath generator unit shall be 6 sack 3,500 psi concrete.
- 8.7.19** Unit-Mounted Radiator Cooling:
- a. Duct work should be as short, straight, and as unobstructed as possible. Static pressure of more than ½ inch (1.27 cm) water column on the fan from inlet or exhaust restrictions will reduce air flow to the point of limiting maximum power and/or ambient temperature at which overheating will occur, and will not be allowed.
 - b. The connection from the radiator duct flange to the duct work shall be heavy canvas or similar flexible material to prevent noise

and vibration transmission. In general, the outlet duct shall have an unrestricted area 150% greater than that enclosed by the radiator duct flange. The inlet opening shall be at least as large and preferably 50% larger than the outlet. If screens, louvers, or filters are used in the inlet or outlet openings, the openings shall be increased in size to compensate for restriction. In general, when louvers are used, increased by 50%; when insect screening is used, the opening area shall be increased by 80%; when furnace filters are used, the opening area shall be increased by 120%.

- c. Air inlet and outlet locations shall be chosen to prevent air recirculation inside or outside the enclosure. Consideration should also be given to prevailing winds, facing inlets into the expected winds, and outlets on the down wind side where possible. Inlets and outlets shall be located where they will not be blocked by accumulated snow or any other obstruction. The bottom of any air intake or exhaust louvers shall be located not less than 16" above floor level to prevent snow intrusion.
- d. Any temperature controlling louvers shall be designed so that inlet air is not restricted to the point that pressure inside the building is reduced. The generator room and well house shall be designed to permit the generator to be removed from the building without major building demolition.

8.7.20 It is the intent of this specification to secure an emergency generator system that has been prototype tested, factory built, production tested, site tested, of the latest commercial design, together with all accessories necessary for a complete installation as shown on the plans and drawings and specified herein. The equipment supplied and installed shall meet the requirements of the National Electric Code and all applicable local codes and regulations. All equipment shall be new, of current production by a national firm which manufactures the generator, controls, and transfer switch; and assembles the generator set as a matched unit. The intent of this requirement is to provide the owner with one-source responsibility for warranty, parts and service through a local representative with factory-trained service personnel. Generator sets shall be as manufactured by Kohler, Cummins, Caterpillar, or Township approved alternate.

8.7.21 SUBMITTAL: Submittal shall include specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number each required interconnection between the generator set, the transfer switch, and other remote devices if included elsewhere in these specifications.

8.7.22 TESTING: To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer shall be

responsible for design prototype tests as described herein: Components of the emergency system, such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes which will not be sold, shall be used for these tests. Prototype test programs shall include the requirements of NFPA-110 and the following:

- a. Maximum power (kw).
- b. Maximum starting (kva) at 35% instantaneous voltage dip.
- c. Alternator temperature rise by embedded thermocouple and by resistance method per NEMA MG1-22.40 and 16.40.
- d. Governor speed regulation under steady-state and transient conditions.
- e. Voltage regulation and generator transient response.
- f. Fuel consumption at 1/4, 1/2, 3/4 and full load.
- g. Harmonic analysis, voltage waveform deviation, and telephone influence factor.
- h. Three-phase line-to-line short circuit test.
- i. Cooling air flow.
- j. Torsional analysis testing to verify that the generator set is free of harmful torsional stresses.
- k. Endurance testing.

8.7.23 WARRANTY: The emergency generator system shall be warranted by the manufacturer for five years or 1,000 hours, whichever occurs first, from the date of the site start-up. Parts and labor included.

8.7.24 The standby generator set shall be rated continuous standby (defined as continuous for the duration of any power outage) __ volts, __ phase, wire, .8 power factor, kw, kva, amperes at 1,000 feet altitude, 104 degrees Fahrenheit. Vibration isolators shall be provided between the engine-generator and welded steel base or between the base and the floor.

8.7.25 Final Production Tests: Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:

- a. Single-step load pickup.
- b. Transient and steady-state governing.

- c. Safety shutdown device testing.
- d. Voltage regulation.
- e. Rated power.
- f. Maximum power.

8.7.26 Upon request, arrangements to witness this test will be made or a certified test record will be sent prior to shipment.

8.7.27 ENGINE: The_____cubic inch displacement engine shall deliver a minimum of hp at a governed speed of 1800 rpm. The engine shall be equipped with the following:

- a. Fuel supply equipment as specified hereinbefore.
- b. Isochronous governor capable of 0.25% steady-state frequency regulation.
- c. 12 or 24 volt positive engagement solenoid shift-starting motor.
- d. 35-ampere minimum automatic battery charging alternator with solid-state voltage regulation.
- e. Positive displacement, full pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.
- f. Dry-type replaceable air cleaner elements.

Note: Engines requiring glow plugs will not be acceptable.

- g. A unit-mounted radiator, blower fan, water pump, thermostat, and radiator duct flange (unhoused only) shall properly cool the engine with up to 0.5 inches water external static pressure on the cooling system.

8.7.28 GENERATOR

- a. The alternator shall be salient-pole, reconnectable 12 lead, self-ventilated or drip-proof construction with amortisseur rotor windings, made from copper and skewed for smooth voltage waveform. The insulation material shall meet the NEMA standard (MGI-22.40 and 16.40) for Class H and be vacuum impregnated with epoxy varnish to be fungus resistant per MIL I-24092. Temperature rise of the rotor and starter shall be limited to NEMA Class F. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator with

adjustable Volts-per-Hertz operation capable of maintaining voltage within + or -0.5% at any constant load from 0 to 100% or rating. The regulator shall be sealed from the environment and isolated from the load to prevent tracking when connected to SCR loads.

- b. On application of any load up to the rated load, the instantaneous voltage dip shall not exceed 10% and shall recover to + or - 0.5% of rated voltage within one second.
- c. The generator shall be capable of sustaining at least 250% of rated current for at least 10 seconds under a 3 phase symmetrical short by inherent design or by the addition of an optional current boost system.
- d. The generator shall be capable of delivering KVA, kw with a maximum instantaneous voltage dip of 20% when loads are started as specified elsewhere or on the drawings.
- e. A resettable line current sensing circuit breaker with inverse time versus current response shall be furnished and shall not automatically reset preventing restoration of voltage if maintenance is being performed. This breaker shall protect the generator from damage due to its own high current capability and shall not trip within the 10 second specified above to allow selective tripping of down-stream fuses or circuit breakers under a fault condition.
- f. The generator, having a single maintenance-free bearing, shall be directly connected to the flywheel housing with a semiflexible coupling between the rotor and the flywheel.

8.7.29 CONTROLLER: Set-Mounted controller capable of facing right, left, or rear shall be vibration isolated on the generator enclosure. The microprocessor control board shall be moisture proof and capable of operation from -40°C to 85°C. Relays will only be acceptable in high current circuits. Circuitry shall be of plug-in design for quick replacement. Controller shall be equipped to accept a plug-in device capable of allowing maintenance personnel to test controller performance without operating the engine. The controller shall include:

- a. Fused DC circuits.
- b. Complete two-wire start/stop control which shall operate on closure of a remote contact.
- c. A speed sensing system and a second independent starter motor disengagement system shall protect against the starter engaging

with a moving flywheel. Battery charging alternator voltage will not be acceptable for this purpose.

- d. The starting system shall be designed for restarting in the event of a false engine start, by permitting the engine to completely stop and then reengage the starter.
- e. Cranking cyler with four 15-second ON and OFF cranking periods.
- f. Overcrank protection designed to open the cranking circuit after 105 seconds, if the engine fails to start.
- g. Circuitry to shut down the engine when signal for high coolant temperature, low oil pressure, or overspeed are received.
- h. Engine cool down timer factory set at five minutes to permit unloaded running of the standby set after transfer of the load to normal.
- i. Three-position (Automatic - OFF - TEST) selector switch. In the test position, the engine shall start and run regardless of the position of the remote starting contacts. In the automatic position, the engine shall start when contacts in the remote control circuit close and stop five minutes after those contacts open. In the off position, the engine shall not start even though the remote start contacts close. This position shall also provide for immediate shutdown in case of an emergency. Reset of any fault lamp shall also be accomplished by putting the switch to the off position.
- j. Indicating lights to signal:
 - 1) Not-in-auto (flashing red)
 - 2) Overcrank (red)
 - 3) High engine temperature/low coolant level (red)
 - 4) Overspeed (red)
 - 5) Air damper (red)
 - 6) Battery charger malfunction (red)
 - 7) Low battery voltage (red)
 - 8) *Low fuel (red)
 - 9) System ready (green)
 - 10) Pre-alarm high engine temp. (yellow)
 - 11) Pre-alarm low oil pressure (yellow)
 - 12) Low coolant temp. (red)
 - 13) *Fuel tank leaking (red)

*for diesel units only

- k. Test button for indicating lights.
- l. Alarm horn with silencer switch per NFPA-110.
- m. Terminals shall be provided for each signal in j. above for connection to remote monitoring devices.

8.7.30 INSTRUMENT PANEL: A set mounted instrument panel shall include:

- a. Dual range voltmeter, 3-1/2 inch., + or -2% accuracy.
- b. Dual range ammeter, 3-1/2 inch, + or - 2% accuracy.
- c. Volt meter-ammeter phase selector switch.
- d. Lights to indicate high or low meter scale.
- e. Direct reading pointer-type frequency meter, 3-1/2 inch, + or - 5% accuracy, 45 to 65 Hz scale.
- f. Panel illuminating lights.
- g. Battery charging meter.
- h. Coolant temperature gauge.
- i. Oil pressure gauge.
- j. Running time meter.
- k. Voltage adjust rheostat (+ or - 5% range).
- l. A solid state instrument panel with selectable digital displays is also acceptable.

8.7.31 ACCESSORIES: The following accessories shall be provided:

- a. Overvoltage protection which shall shut down the unit after one second of 15% or more overvoltage.
- b. Battery rack, battery cables, 12-volt battery(ies) capable of delivering the minimum cold-cranking amps required at zero degrees Fahrenheit per SAE Standard J-537.
- c. Gas proof, seamless, stainless steel, flexible exhaust connector(s) ending in pipe thread.
- d. Flexible fuel line(s) rated 300 degrees F and 100 psi ending in pipe thread.

- e. Engine exhaust silencer, coated to be temperature and rust resistant, rated for critical applications. Exhaust noise shall be limited to 85 dba as measured at 10 feet in a free-field environment.
- f. Block heater of proper wattage and voltage, thermostatically controlled to maintain engine coolant at 90 degrees Fahrenheit (32 degrees Celsius) to meet the start-up requirement of NFPA-99 or NFPA-110 Regulations.
- g. 10-Ampere automatic float and equalize battery charger with +-1% constant voltage regulation from no load to full load over +-10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambients from -40 degrees C to +60 degrees C, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected. Optional alarm circuit board to meet the requirements of NFPA-110 for low battery voltage, high battery voltage, and battery charger malfunction shall be provided.
- h. 16 - light remote annunciator shall monitor all controller functions described in the controller section plus line power and generator power monitoring. An integral lamp test and horn silence switch shall be included that meets NFPA-110.

8.7.32 EXECUTION:

- a. The equipment shall be installed as shown on the plans, in accordance with the manufacturer's recommendations and all applicable codes.

8.7.33 SITE TESTS: An installation check, start-up, and building load test shall be performed by the manufacturer's local representative. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:

- a. Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations under the environmental conditions present and expected.
- b. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. This shall include: engine heaters, battery charger, generator strip heaters, remote annunciator, etc.
- c. Start-up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement

during starting and stopping, vibration during running, normal and emergency line-to-line voltage and phase rotation.

- d. Automatic start-up by means of simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper systems coordination. Engine temperature, oil pressure and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test.
- e. Labor, fuel, and load bank for 3 hour test shall be supplied at developer's/builder's expense.

8.8 Supervisory Control and Data Acquisition (SCADA)

8.8.1 SCADA Equipment

- a. Each well house or booster station shall be provided with a SCADA System Remote Terminal Unit (RTU), and a radio modem with antenna. The system shall meet the Township standards and be compatible with any existing SCADA equipment.

9. RECORD DRAWINGS

9.1 General

- 9.1.1 All projects within the Township which go through site plan review shall be required to submit record drawings. The drawings will need to be reviewed and approved by the Township's Engineer prior to final acceptance of the project by Hartland Township. The record drawings requirements are contained in the checklist at the end of this section.
- 9.1.2 The initial submittals shall be of two (2) sets of black line prints providing the applicable information shown on the attached checklist. The minimum scale shall be 1"=50' and shall bear the seal of a registered professional engineer or surveyor licensed to practice within the State of Michigan. All record lengths and elevations must be labeled as record.
- 9.1.3 After the record drawings have been approved by the Township's Engineer, the applicant shall submit two (2) paper copies of the approved drawings. A CD shall also be provided which contains a .pdf version of each sheet of the record drawing plan set.



HARTLAND TOWNSHIP – AS-BUILT REQUIREMENTS CHECKLIST

| SANITARY SEWER – IN PLAN & PROFILE SHOW: | N/A | OUTSTANDING | COMPLETED |
|--|------------|--------------------|------------------|
| All invert & rim elevations to USGS Datum | | | |
| Actual laying length between structures | | | |
| Type of pipe used | | | |
| Actual slope of pipe | | | |
| Size of pipe | | | |
| Tie down all structures via coordinates | | | |
| Lead information (distance from downstream manhole, riser length, depth, tie down end, etc.) | | | |

| STORM SEWER – IN PLAN & PROFILE SHOW: | N/A | OUTSTANDING | COMPLETED |
|--|------------|--------------------|------------------|
| All invert & rim elevations to USGS Datum | | | |
| Actual laying length between structures | | | |
| Type of pipe used | | | |
| Actual slope of pipe | | | |
| Size of pipe | | | |
| Tie down all structures via coordinates | | | |
| Lead information (distance from downstream manhole, depth, tie down end, etc.) | | | |

| WATER MAIN – IN PLAN VIEW SHOW: | N/A | OUTSTANDING | COMPLETED |
|--|------------|--------------------|------------------|
| Valve rim elevations | | | |
| Size & type of pipe | | | |
| Length of pipe | | | |
| Tie down all structures and hydrants via coordinates | | | |
| Call out actual offset from pavement | | | |

| DETENTION POND | N/A | OUTSTANDING | COMPLETED |
|---|------------|--------------------|------------------|
| Letter required by the design engineer stating that the pond is properly sized according to approved plans and the outlets are properly located and sized | | | |

| PAVEMENT | N/A | OUTSTANDING | COMPLETED |
|--|------------|--------------------|------------------|
| Sidewalk/bike path spot elevations every 50 feet | | | |
| Curbing and sidewalk ramp spot elevations | | | |

| SUBMITTALS | SUBMIT DOCUMENTS TO TOWNSHIP | SUBMIT WITH REVISIONS NOTED ABOVE | APPROVED - SUBMIT TO TOWNSHIP |
|--|-------------------------------------|--|--------------------------------------|
| Public easements, including sketch, description, and cover sheet | | | |
| Two (2) Paper Copies of Record Drawings | | | |
| Electronic Version (.pdf) of Record Drawings | | | |

Additional specific information per site may be required at the discretion of the Engineer.

10. PLAN REVIEW AND OBSERVATION COSTS

- 10.1 Refer to the fee schedule outlined in the Land Use Permit Process for the engineering fees required for site plan review and construction plan review.
- 10.2 At the time of submittal for construction plan review, a detailed estimate of cost must be provided for any proposed development, subdivision, site condominium project, or road development. This estimate will be used in determining the required amount to be deposited into escrow for construction plan review.
- 10.3 Prior to the project proceeding to the construction phase, the applicant shall deposit with the Township a percentage of the total contract price for on-site construction observation. See the fee schedule outlined in the Land Use Permit Process for the required amount to be deposited into escrow.

The following items shall be included within the construction costs which must be observed by the Township; roadways (curbs, roads, etc.), on-site paving, storm sewer (manhole, pipe, etc.), sanitary sewer (manhole, pipe, etc.), water supply systems (hydrants, well house, mains, etc.), sidewalks and storm water retention/detention facilities.

- 10.4 The Township requires that separate escrow accounts be established for planning and landscaping reviews and observation, in addition to the above engineering costs.
- 10.5 A minimum of four (4) hours will be charged to the subject project if the observer keeps a scheduled observation appointment and the Contractor does not work. All costs incurred for consulting services will be billed against this account.
- 10.6 The actual fee for observation shall be borne by the applicant, and shall be on the basis of the actual costs incurred by the Township’s Engineers. Any unused amount of the deposit following observation and approval shall be returned to the applicant. If at anytime the Township is of the opinion that the deposit is not sufficient to cover the services that are being provided, the developer shall be notified in writing as to the estimated deficiency, and the deposit shall be immediately increased accordingly.
- 10.7 The fees and charges specified in this section, shall be in addition to those charged for debt service charges, connection charges, and other charges or fees for sanitary sewer and water supply.
- 10.8 Prior to construction of a subdivision or other site improvement covered by the Township’s Ordinances, the proprietor or contractor shall procure and maintain during the life of any contract or agreement for such construction, insurance protecting the Township, its officers, employees and consultants from any claim or damages, real, personal or otherwise, in such amounts as established by the Township Board.

- 10.9 Prior to acceptance of improvements by the Township, a one year maintenance bond in an amount set by and acceptable to the Township shall be posted by the applicant/proprietor.
- 10.10 If an applicant requests a certificate of occupancy prior to completion of the required proposed site improvements, the Township Board may also require surety deposits or bonds, to assure completion of the improvements and payment of any additional fees, not paid in advance. When a deposit or bond is required, the applicant shall file with the Township a cash deposit, certified check, irrevocable bank letter of credit or surety bond acceptable to the Township. The Township may also accept, at its discretion, a bond or other guarantee furnished by a subcontractor or a lending institution when the Township is listed as an interested body of such a guarantee. The amount of such bond shall cover the cost of all remaining improvements. Monies may be released to the applicant in proportion to work completed on the different elements after inspection of work and approval of the Township. Any partial release of funds shall be less ten (10%) percent which shall be retained by the Township until all work has been completed and subsequently inspected and approved by the Township.