VILLAGE OF VERSAILLES
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FOREWORD

This manual has been prepared to aid engineers in the preparation of subdivision plans and engineering design and to inform interested persons of the procedures and standards for the Village of Versailles, Ohio. It is also intended to be used during reconstruction or replacement of existing facilities or utility construction within the Village. The rules, standards, specifications, criteria, etc. are to supplement the Zoning Regulations and Subdivision Regulations of the Village.

It is not the intent of this manual to take away from the designing engineer any responsibility for the technical adequacy of this design or freedom to use his engineering judgment and discretion. It is recognized that matters of engineering design cannot be set out in writing to cover all situations, however, the design standards as set out herein represent good engineering practice. Any design methods or criteria different than that listed will receive consideration for approval, provided the proposed variances and the reasons for their use are submitted to the Village.

The Village, at any time during design or construction, shall have the authority to modify any engineering or construction detail, whenever required for the protection of the public interest.

Though the Village has no jurisdiction in areas outside of the corporation limits, the Village recommends that any subdivision constructed within close proximity of the Village be designed and constructed to these standards. This will help ensure that, if the subdivision is incorporated into the Village, the subdivision will be accepted by the Village without additional upgrades. If a subdivision or residence is annexed, all streets and utilities must be brought up to Village Standards at the Developer's or homeowner's expense. Also, if a subdivision or residence outside of the corporation limits of the Village will be connected to Village utilities, the utilities will be constructed to Village Standards and Specifications.

The Village, at its discretion, may request that infrastructure and utility facilities in any particular subdivision be installed to accommodate future expansion within the Village. If this were requested, the Village would pay the difference to oversize these particular items per the Village Subdivision Regulations.

REFERENCES

The Village of Versailles Design Criteria and Construction Standards and Drawings are to be used to supplement the following references. Whenever there are differences in these references and the Design Criteria and Construction Standards and Drawings, the more restrictive or higher standard shall apply as determined by the Village of Versailles.

- Ohio Department of Transportation (ODOT), latest versions
  - ⇒ Construction and Material Specifications
  - ⇒ Location and Design Manuals
    - Volume 1 - Roadway Design
    - Volume 2 - Drainage Design
  - ⇒ Standard Construction Drawings
  - ⇒ Standard Design Drawings
  - ⇒ Supplemental Specifications
  - ⇒ Traffic Control for Uniform Control Devices

- American Association of State Highway and Transportation Officials (AASHTO), latest version
  - ⇒ A Policy on Geometric Design of Highways and Streets

- Great Lakes Upper Mississippi River Board (GLUMRB) (Ten State Standards), latest version
  - ⇒ Recommended Standards for Wastewater Facilities
  - ⇒ Recommended Standards for Water Works

- American Water Works Association (AWWA)

- American Society for Testing and Materials (ASTM)

100.00
General Provisions

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100.00 GENERAL PROVISIONS

100.01 General

A. The Design Criteria and Construction Standards and Drawings along with 100% performance surety and 10% maintenance surety shall apply to all public improvement construction projects that will eventually be taken over by the Village of Versailles. The 100% performance surety and 10% maintenance surety shall follow the regulations in the Village of Versailles Subdivision Regulations even if a major subdivision is not applicable.

B. The Developer/Owner shall design and construct improvements not less than the standards outlined in the Village of Versailles Subdivision Regulations and this document. The work shall be done under the Village's supervision and shall be completed within the time fixed or agreed upon by the Village.

C. It is the responsibility of the Developer/Owner and his engineer to investigate local conditions that may require additional improvements.

D. In the event any conflicting standards are encountered, the most restrictive shall always apply as determined by the Village of Versailles.

E. Upon request of the Developer/Owner or his representative, the Village will evaluate requests to provide open excavation of existing utilities to allow accurate elevation information.

100.02 Construction Procedures and Materials

A. PRE-CONSTRUCTION MEETING

A pre-construction meeting with the Village is required. The Developer/Owner, his contractor, his engineer, and representatives from utility companies involved shall be present at the meeting. It shall be the Developer's responsibility to arrange the preconstruction meeting.

B. MATERIALS

All work and materials shall conform to the Ohio Department of Transportation, (ODOT) Construction and Material Specifications, and the Standards and Specifications of the Village of Versailles, Ohio.

C. INSPECTIONS

1. Definition

   Inspect, inspection is the visual observation or observation by instrument of construction to permit the Village or its representative to render his or her professional opinion as to whether the contractor is performing the services in a manner indicating that, when completed, the services will be in accordance with the Village of Versailles Subdivision Regulations, Construction Standards and Drawings, and Design Criteria. Such observations shall not be relied upon in any part as acceptance of the services, nor shall they relieve any party from fulfillment of customary and contractual responsibilities and obligations.

2. Periodic Inspection

   Periodic inspection during the installation of improvements shall be made by the Village to ensure conformity with the approved plans and specifications as required by these and other regulations. The Developer/Owner shall notify proper Village officials at least twenty-four (24) hours before each phase of the improvements is ready for inspection. The presence and/or absence of an inspector during construction shall not relieve the Developer/Owner and/or contractor from full responsibility of required improvements to the Village of Versailles Construction Standards and Drawings and to the satisfaction of the Village.

3. Inspections shall be as follows:

   a) Sanitary Sewer
      1) Sanitary pipe and manhole installation
      2) Lateral location
      3) Proper backfill installation
      4) Air test sanitary lines
      5) Vacuum test manholes
      6) Deflection test on PVC sewers

   b) Water Main
      1) Water main installation
      2) Valve installation
      3) Hydrant installation
      4) Restraining glands and/or blocking installation
      5) Service installation and location
      6) Pressure test
      7) Disinfection
      8) Proper backfill installation

c) Storm Sewer
   1) Storm sewer installation
   2) Manhole and catch basin installation
   3) Field tile connections
   4) Proper backfill installation
   5) Individual storm outlet location, if applicable

d) Roadway
   1) Subgrade preparation
   2) Subgrade undercutting
   3) Subbase installation
   4) Street coring operations
   5) Curbing installation
   6) Sidewalk and approach installation
   7) Prime coat application
   8) Asphalt installation

4. Weight and delivery tickets shall be furnished to the Village to substantiate the type, quantity, and size of material used.

D. RESPONSIBILITY

All work shall be under the control and supervision of the Developer/Owner until written final approval is given by the Village.

E. FINAL INSPECTION

Upon completion of all the improvements, the Developer/Owner shall request, in writing, a final inspection by the Village. The final inspection shall be performed by officials from the Village with the Developer. The Developer's engineer and the Developer's contractor will be present.

SUBDIVISION INSPECTION

SUBDIVISION _____

DATE _____ INSPECTOR _____

This list could vary depending upon the types of construction included in the project. This is a sample list (not all-inclusive) of items in which an inspector may utilize.

√	DESCRIPTION	REMARKS
A.	**PRIOR TO INSPECTION**	
	Review plans, special provisions, construction & material manuals and specifications that apply to your assigned duties.	
	Discuss your responsibility & authority with the project engineer.	
	Discuss notification, changes, connections, delays, rejections, and tolerances.	
B.	**PRE-CONSTRUCTION CONFERENCE**	
	Attendees: Village Representatives, Developer/Owner, Engineer, Contractor, Superintendent, Foreman, Utility Companies	
	Discuss phasing & schedules	
	Discuss materials	
	Discuss coordination	
	Discuss safety (public & job)	
	Discuss responsibilities	
C.	**SANITARY SEWER & LATERALS TO R/W**	
	Check pipe type & quality	
	Trench condition	
	Straight alignment & joints	
	Bedding	
	Proper initial backfill	
	Proper backfill	
	Prohibit groundwater from entering sanitary	
	Wye installation & location	
	Air test mainline & laterals	
	Mandral test on PVC	

√	DESCRIPTION	REMARKS

D.	**SANITARY MANHOLE**	
	Check type & condition	
	Steps condition & alignment	
	Cone type & condition	
	Risers precast/mastic	
	Casting - rim & lid	
	Proper pipe connection	
	Installation with O-rings	
	Installation on good base	
	Proper backfill, compacted granular under or near roadway	
	Exfiltration test	
	Rim & risers to proper finish grade	
	Chimney Seal	
E.	**WATER MAIN**	
	Type & condition	
	Valve type & condition	
	Hydrant type & condition	
	Trench condition	
	Pipe alignment & joints	
	Air release valves	
	Isolation Valve installation & location	
	Hydrant assemble installation & location	
	Restrained, as needed	
	Bedding	
	Initial backfill, compacted granular	
	Proper backfill, compacted granular under or near roadway	
	Pressure test	
	Purification test	
	Valve & hydrant operation	
	Laterals: Corp stop K-copper Curb stop Meter set Compacted granular backfill Proper backflow prevention Backflow prevention devices	

√	DESCRIPTION	REMARKS
F.	**STORM SEWER**	
	Check pipe type, size, & quality	
	Check catch basin & grate type, size, & quality	
	Check manhole type, size, & quality	
	Trench condition	
	Straight alignment & joint sealing	
	Bedding	
	Proper initial backfill	
	Proper backfill, compacted granular under or near roadway	
	Proper connection to catch basin & manholes	
	C.B. set in good horizontal & vertical alignment with curbs	
	Slope & grade: Review control stakes & adjacent terrain for drainage.	
	Field tile & other pipes reconnected & noted on plans	
G.	**ROADWAY**	
	Subgrade:	
	All topsoil removed in roadway	
	Compacted granular or clay fill only	
	Proper cross slope	
	Proper elevation	
	Free of roots, large stones, & excess dust	
	Proper compaction	
	Proofroll or density test, if soft undercut and/or underdrains.	
	Subbase:	
	Proper material	
	Compacted in appropriate layers	
	Density test, if soft	
	Protect subgrade from being rutted or damaged (back in over subbase & blade, if necessary)	
	Proofroll subbase before prime coat	
	Measure elevation & cross slope	
	Surface:	
	Appropriate moisture & temperature conditions	
	Visual inspection of material (be aware of acceptable temperature range of mix & compensation)	
	Proper distribution & roller	
	Proper prime coat	
	Lay in proper layer	
	Watch joints & overlaps	
	Seal against concrete curbs, etc.	

√	DESCRIPTION	REMARKS
	Measure elevation & cross slope	
	Keep traffic off for 24 hours, if possible	
H.	**FIXED STRUCTURES, CURBS, SIDEWALK, HEADWALL, ETC.**	
	Determine proper concrete mix	
	Appropriate moisture & temperature conditions	
	Check all underground portions	
	Check backfill, operation, & material	
	Check subgrade	
	Check subbase under curbs	
	Review requirements for reinforcing steel	
	Check all reinforcement	
	Check all dowels	
	Check for expansion joints	
	Be aware of time concrete was batched & allowable time for placement	
	Observe mix & placement	
	Observe finishing procedure	
	Needs curing material ASAP	
	If required, check cold weather protection	
	Needs saw joints ASAP	
	Note when forms are removed	
I.	**MISCELLANEOUS**	
	Keep daily logs	
	Pre-mark all existing utilities	
	Reconnect all existing utilities	
	Mark ends of all laterals in field-Contractor's responsibility	
	Mark ends of all laterals on plans	
	Restoration	
	Grade to drain	
	Check trench settlement	
	Seeding & Mulching	
	Erosion Control	
	Inlets	
	Outlets	
	Curb lines	
	Ditches	
	Basins	
	Final check for debris & flow	
	Sanitary sewer	
	Storm sewer, manhole, & catch basin	
	Curb lines	

100.03 Submission of Plans

A. CONSTRUCTION DRAWINGS

1. Complete construction drawings on 24" x 36" polyester film mylar, 4-mil thickness, double matte or other approved reproducible media signed and approved by a registered engineer shall be made for all new or reconstructed streets, utilities, and other improvements to be constructed in any subdivision in the Village. Said drawings are to be approved by the Village before any construction may begin and before the plat of said subdivision may be recorded.

2. Submission of plans shall comply with the Subdivision Regulations.

B. STANDARD TITLE BLOCK

All plan sheets shall display a standard title block containing the following:

1. Name, address, telephone number, and fax number (logo optional)
2. Plan sheet number
3. Subdivision name
4. Sheet title
5. Date
6. Revision block
7. Drawn by
8. Checked by

C. REQUIRED PLAN LAYOUT ORDER

1. Title Sheet
2. Final Plat
3. Schematic Plan
4. Typical Sections
5. General Notes
6. General Details
7. Site Grading Plan and Erosion Control Plan/Storm Water Pollution Prevention Plan
8. Erosion Control Details
9. Miscellaneous Details (example: Pump Station, Intersection Plan)
10. Plan and Profile
11. Cross-Sections
12. Detention Basin or Retention Pond Plan and Details
13. Off-site Utilities Plan and Profile (1" = 20' horizontal, 1" = 5' vertical)

*Other scales may be used with prior approval.

1. TITLE SHEET

   a) Title of Project, Village, County, Township, and State.
   b) Index of sheets and sheet numbering.
   c) Vicinity map with north arrow and project site call-out.
   d) Village standard drawings reference.
   e) Underground utilities note (O.U.P.S.).
   f) Signature and stamp.
   g) Date of finished plans.
   h) Project description.
   i) Approval plan signatures.
   j) Name, address, telephone number, and fax number of firm that plans are prepared by.

2. FINAL PLAT

   a) Copy of approved final plat.
   b) See Subdivision Regulations.

3. SCHEMATIC PLAN - LARGE SCALE LAYOUT OF SITE

   a) At a measurable scale to show the whole site on one sheet (max. scale 1" = 100').
   b) Show right-of-way, property lines and roadway, lot numbers, street names, and existing adjoining property lines and owners.
   c) Show proposed utilities and numbering of sanitary and storm manholes and catch basins.
   d) Stationing of intersections and streets.
   e) Multi-baseline legend, (sheet number, stationing, description, etc.)
   f) North arrow and scale.
   g) Benchmarks and locations.
   h) Centerline stationing.

4. TYPICAL SECTIONS

   a) Detailed labeling.
   b) Legend of pavement composition.
   c) Limiting stations for each section.
   d) Dimensioning, pavement, curb and gutter, curb lawn, sidewalk, right-of-way, and pavement slopes.

5. GENERAL NOTES

   All notes necessary for construction which are not defined clearly elsewhere within the plans.

6. GENERAL DETAILS

a) All details necessary for construction which are not represented by Village of Versailles Standard Drawings.
b) Modified Village of Versailles Standard Drawings shall be redrawn for approval.

7. SITE GRADING PLAN AND EROSION CONTROL PLAN/STORM WATER POLLUTION PREVENTION PLAN

Site Grading Plan

a) A final site grading plan must be included with the construction drawings and approved by the Village.
b) Proposed 1-foot contours showing all lots having proper drainage.

Storm Water Pollution Prevention Plan

A Storm Water Pollution Prevention Plan will be required to be included with the construction drawings and approved by the Village. This plan shall follow OEPA and NPDES permit requirements and shall be submitted to and approved by OEPA prior to construction.

a) Show and label existing and proposed 1-foot contours.
b) Proposed storm manholes, catch basins, pipes, etc., labeled and numbered.
c) Concentrated flows.
d) Property lines, right-of-way, lot numbers, and owners.
e) Proposed/existing roadways.
f) Proposed diversions and erosion control (Example: diversion ditches, fabric fence, straw bales, sediment basin).
g) Erosion control construction sequence list.
h) Limits of grading.
i) Proposed storm sewer pipe flows and capacities.
j) Sediment basin location.
k) North arrow scale.
l) At a measurable scale to show the entire site on one sheet (maximum scale 1" = 100').

8. EROSION CONTROL DETAILS

Any details necessary for construction which are not represented by Village of Versailles Standard Drawings.

9. MISCELLANEOUS DETAILS (Example: Pump Station, Intersection Plan, etc.)

Plans shall include a detailed drawing with all proper labeling and dimensions.

10. PLAN AND PROFILE

a) The plan and profile shall be at a scale of 1" = 20' horizontal, 1" = 5' vertical.
b) Plan and profile sheets shall show all necessary data in sufficient detail for the complete construction of all work and improvements to be made in the plat.
c) All grade elevations shall be based on U.S.G.S. and Village of Versailles datum.
d) Plan and profile sheets will be required for all off-site utility extensions.
e) More specifically, all plans and profile sheets must show and include the following items:

10A General - Plan

a) Show all proposed lots, streets, curbs, etc.
b) Show all existing pavements, headwalls, piers, utilities, mailboxes, trees, etc.
c) Typical street and curb sections.
d) Construction notes.
e) Structural details.
f) North arrow (preferably up or to the right) and scale (horizontal and vertical).
g) Street names.
h) Centerline stations and ticks every 100 feet (south to north and west to east where possible).
i) Easements for utilities and storm drainage.
j) Lot numbers, dimensions, and frontage.
k) Curb radius at intersections with back of curb elevations at quarter points (if not covered in separate intersection detail).
l) Curve data: radius, delta, chord length, chord bearing, arc length, station of PC, PT, PCC, PI, PRC.
m) Sheet reference.
n) Plat section lines (boundary lines) showing stations.
o) Dimension and station utility locations.
p) Centerline bearings and/or intersecting centerline angles.
q) Final monument box call-outs set at PC, PT, PCC, PI, PRC (in pavement) intersections.
r) Drive apron stationing and width call-outs.
s) Show all existing features within 50 feet of right-of-way.
t) Proposed electric, telephone, gas, cable locations, and easements.
u) Proposed light pole layout and electric feed.
v) Match lines with stationing.
w) Intersection elevation for proper storm water drainage.
x) Benchmarks.

10B General - Profile

a) Existing centerline and proposed centerline profile.
b) Label proposed centerline grades (minimum grade 0.50%).
c) Show all mainline existing utilities.
d) Existing and proposed grade elevations every 25 feet (existing elevation on bottom of sheet and proposed elevation on top of sheet. Note as to centerline or top of curb.)
e) Show and label all vertical curves (Stations, elevations, and length).

10C Storm Sewer - Plan

a) Show and station, with offsets, the proposed storm sewers: manholes, laterals, catch basins, headwalls, etc.
b) Label each pipe size and type.
c) Number proposed storm manholes and catch basins.

10D Storm Sewer - Profile

a) Show length of span, size, grade, and class and/or type of proposed pipe.
b) Label existing pipe size and type.
c) Existing and proposed storm.
    1) Label existing and proposed mainline storm water manholes, junction boxes, catch basins, etc., and show centerline of streets and stations of each.
    2) Show invert elevations of all pipe at manholes, headwalls, junction boxes, catch basins, etc.
    3) Show elevation on top of manhole or catch basin.
    4) Number proposed storm manholes and catch basins.

10E Water - Plan

a) Show and station with offsets the proposed waterline, laterals, deflection points, hydrants, valves, etc.
b) Label pipe size, tees, crosses, etc.
c) Station above items.

10F Water - Profile

a) Show length, size, depth, and class and/or type of pipe.
b) Show deflection points.
c) Show stations and any critical elevations for above items.
d) Label minimum coverage of water main.

10G Sanitary Sewer - Plan

a) Show sanitary sewers, manholes, laterals, cleanouts, etc. with station and offset labeled.
b) Label each pipe size.
c) Number proposed sanitary manholes and cleanouts.

10H Sanitary Sewer - Profile

a) Show length of span, size, grade, and class and/or type of proposed pipe.
b) Show existing and proposed sanitary.
c) Show invert elevation of all pipe at manholes.
d) Show top elevations of manholes.
e) Number proposed sanitary manholes and clean-outs.

11. CROSS-SECTIONS

a) The cross-sections shall be at a scale of 1" = 5' horizontal, 1" = 5' vertical.
b) Cross-sections shall be every 50 feet and at other critical areas.
c) Show all existing utilities with labels.
d) Show all proposed utilities with labels.
e) Show all proposed and existing roadway sections with existing and proposed centerline elevation.
f) Cross-sections at each drive and intersection roadway.

12. DETENTION BASIN OR RETENTION POND PLAN AND DETAILS

a) Detailed site plan including inlet and outlet elevations, top of bank elevations, and emergency overflow elevations.

13. OFF-SITE UTILITIES PLAN AND PROFILE

Refer to Page 11 Plan and Profile.

SUBDIVISION CONSTRUCTION PLANS CHECKLIST

SUBDIVISION _____ DATE _____

√	DESCRIPTION	REMARKS
	REQUIRED PLAN LAYOUT ORDER	
	Title Sheet	
	Final Plat	
	Schematic Plan	
	Typical Sections	
	General Notes	
	General Details	
	Site Grading and Erosion Control Plan	
	Erosion Control Details	
	Misc. Details (e.g. pump station, intersection plan)	
	Plan and Profile (1"=20' horizontal, 1"=5' vertical)	
	Cross-Sections (1"=5' horizontal, 1" = 5' vertical)	
	Detention Basin or Retention Pond Plan and Details	
	Off-Site Utilities Plan and Profile (1"=20' horizontal, 1" = 5' vertical)	
	GENERAL	
	Acceptable natural drainage and erosion control	
	Right-of-way widths meet minimum criteria	
	Pavement widths	
	Radius of curvature	
	Horizontal visibility	
	Vertical alignment and visibility	
	Grades	
	Cul-de-sacs	
	Turn around radius, right-of-way, and pavement	
	Dead-end streets	
	Alignment of intersection	
	Space of intersection relative to difference in road classifications	
	Avoidance of multiple intersection	
	Pavement and right-of-way of intersection	
	Streets for commercial subdivisions	
	Repair of pavements	

√	DESCRIPTION	REMARKS

	GENERAL (Con't)	
	Streets for industrial subdivision	
	Lengths of blocks meet minimum criteria	
	Crosswalks	
	Street Monuments	
	Subgrade	
	Base Course	
	Surface Course	
	Grading Plan	
	Storm drainage system type	
	Manholes	
	Catch basins	
	Headwalls	
	Sufficient easements for utilities or open drainage	
	Other utilities	
	Underground utilities	
1.	**TITLE SHEET**	
	Title of Project, Village, County, Township, State	
	Index of sheets and sheet numbering	
	Vicinity map with north arrow and project site callout	
	Village Standard Drawings reference	
	Underground utilities note (O.U.P.S.)	
	Signature and stamp	
	Date of finished plans	
	Project description	
	Approval plan signatures	
	Name, address, telephone number, and fax number of firm that plans are prepared by	
2.	**FINAL PLAT**	
	Copy of approved final plat	
	See Subdivision Regulations	

√	DESCRIPTION	REMARKS
3.	**SCHEMATIC PLAN - LARGE SCALE LAYOUT OF THE SITE**	
	At a measurable scale to show the whole site on one sheet (max. scale 1" = 100')	
	Show right-of-way, property lines, roadway, lot numbers, street names, and existing adjoining property lines and owners	
	Show proposed utilities and numbering of sanitary and storm manholes and catch basins	
	Stationing of intersections and streets	
	Multi-baseline legend, (sheet number, stationing, description, etc.)	
	North arrow and scale	
	Benchmarks and locations	
	Centerline stationing	
4.	**TYPICAL SECTION**	
	Detailed labeling	
	Legend of pavement composition	
	Limiting stations for each section	
	Dimensioning, pavement, curb and gutter, curb lawn, sidewalk, right-of-way, and pavement slopes	
5.	**GENERAL NOTES**	
	All notes necessary for construction which are not defined clearly elsewhere within the plans	
6.	**GENERAL DETAILS**	
	All details necessary for construction which are not represented by Village of Versailles Standard Drawings	
	Modified Village of Versailles Standard Drawings shall be redrawn for approval	

√	DESCRIPTION	REMARKS
7.	**SITE GRADING PLAN AND EROSION CONTROL**	
	A final site grading plan must be included with the construction drawings and approved by the Village	
	Proposed 1-feet contours showing all lots having proper drainage	
	A Storm Water Pollution Prevention Plan will be required to be included with the construction drawings and approved by the Village. This plan shall follow the OEPA and NPDES permit requirements and shall be submitted to and approved by OEPA prior to construction	
	Show and label existing and proposed 1-feet contours	
	Proposed storm manholes, catch basins, pipes, etc., labeled and numbered	
	Concentrated flows	
	Property lines, right-of-way, lot numbers, and owners	
	Proposed/existing roadways	
	Proposed diversions and erosion control (e.g. diversion ditches, fabric fence, straw bales, sediment basins.)	
	Erosion control construction sequence list	
	Limits of grading	
	Proposed storm sewer pipe flows and capacities	
	Sediment basin location	
	North arrow and scale	
	At a measurable scale to show the whole site on one sheet (Maximum scale 1" = 100')	
8.	**EROSION CONTROL DETAILS**	
	Any details necessary for construction which are not represented by the Village of Versailles Standard Drawings	
9.	**MISC. DETAILS (e.g. pump station, intersection plan etc.)**	
	Shall include a detail drawing with all proper labeling and dimensioning	

√	DESCRIPTION	REMARKS
10.	**PLAN AND PROFILE**	
	Use a scale of 1" = 20' horizontal, 1"=5' vertical	
	Show all necessary data in sufficient detail for the complete construction of all work and improvements to be made in the plat	
	All grade elevations shall be based on U.S.G.S. and Village of Versailles datum	
	Plan and profile sheets are required for all off-site utility extensions	
10A	**GENERAL - PLAN**	
	Show all proposed lots, streets, curbs, etc.	
	Show all existing pavements, headwalls, piers, utilities, mailboxes, trees, etc.	
	Typical street and curb sections	
	Construction notes	
	Structural details	
	North arrow (preferably up or to the right) and scale (horizontal and vertical)	
	Street names	
	Centerline stations and ticks every 100 feet (south to north and west to east where possible)	
	Easements for utilities and storm drainage	
	Pavements and right-of-way widths	
	Lot numbers, dimensions, and frontage	
	Curb radius and intersections with back of curb elevations at quarter points (if not covered in separate intersection detail)	
	Curve data: radius, delta, chord length, chord bearing, arc length, station of PC, PT, PCC, PI, PRC	
	Sheet reference	
	Plat section lines (boundary lines) showing stations	
	Dimension and station utility locations	
	Centerline bearings and/or intersecting centerline angles	
	Final monument box call-outs set at PC, PT, PCC, PI, PRC (in pavement) intersections	
	Drive apron stationing and width call-outs	
	Show all existing features within 50 feet of right-of-way	

√	DESCRIPTION	REMARKS
	Proposed electric, telephone, gas, cable locations, and easements	
	Proposed light pole layout and electric feed	
	Match lines with stationing	
	Intersection elevation for proper storm water drainage	
	Benchmarks	
10B	**GENERAL - PROFILE**	
	Existing centerline and proposed centerline profile	
	Label proposed centerline grades (minimum grade 0.50%)	
	Show all mainline existing utilities	
	Existing and proposed grade elevations every 25 feet (existing elevation on bottom of sheet and proposed elevation on top of sheet. Note as to centerline or top of curb.)	
	Show and label all vertical curves (stations, elevations, and length)	
10C	**STORM SEWER - PLAN**	
	Show and station, with offsets, the proposed storm sewers: manholes, laterals, catch basins, headwalls, etc.	
	Label each pipe size and type	
	Number storm manholes and catch basins.	
10D	**STORM SEWER - PROFILE**	
	Show length of span, size, grade, and class and/or type of proposed pipe	
	Label existing pipe size and type	
	Label existing and proposed storm water manholes, junction boxes, catch basins, etc., and show centerline of streets and stations of each	
	Show invert elevations of all pipe at manholes, headwalls, junction boxes, catch basins, etc.	
	Show elevation on top of manhole or catch basin	
	Number proposed storm manholes and catch basins	

√	DESCRIPTION	REMARKS
10E	**WATER - PLAN**	
	Show and station, with offsets, the proposed waterline, laterals, deflection points, hydrants, valves, etc.	
	Label pipe size, tees, crosses, etc.	
	Station above items	
10F	**WATER - PROFILE**	
	Show length, size, depth, and class and/or type of pipe	
	Show deflection points	
	Show stations and any critical elevations for above items	
	Label minimum coverage of water main	
10G	**SANITARY SEWER - PLAN**	
	Show sanitary sewers, manholes, laterals, cleanouts, etc. with station and offset labeled	
	Label each pipe size	
	Number proposed sanitary manholes and cleanouts	
10H	**SANITARY SEWER - PROFILE**	
	Show length of span, size, grade, and class and/or type of proposed pipe	
	Show existing and proposed sanitary	
	Show invert elevation of all pipe at manholes	
	Show top elevations of manholes	
	Number proposed sanitary manholes and cleanouts	
11.	**CROSS-SECTIONS**	
	Cross-sections shall be at a scale of 1”=5’ horizontal, 1”=5’ vertical	
	Cross-sections shall be every 50 feet and at other critical areas	
	Show all existing utilities with labels	
	Show all proposed utilities with labels	
	Show all proposed and existing roadway sections with existing and proposed centerline elevations	
	Cross-section at each drive and intersection roadway	

√	DESCRIPTION	REMARKS
12.	**DETENTION BASIN OR RETENTION POND**	
	Detailed site plan including inlet and outlet elevations, top of bank elevations, and emergency overflow elevations.	
13.	**OFF-SITE**	
	Refer to Page 11 Plan and Profile.	

100.04 Record Drawing Requirements

A. RECORD DRAWING REQUIREMENTS

1. At the completion of construction, the original shall be revised as necessary to provide "Record Drawings". This work shall be done by the Developer/Owner's engineer, who was responsible for setting grades and staking for improvements. The "Record Drawings" shall include the following information:

   a) Location of all water and sanitary services as well as storm outlets for each lot.

   b) Final elevations and locations of the following:

      1) Storm sewer inlets, outlets, and manholes with all inverts
      2) Drainage swales, detention basins including structures with all elevations, and capacity recalculated
      3) Sanitary sewer manholes, inverts, and lateral locations
      4) Curb, gutter, centerline elevations at locations where the roadway ends and the potential for future roadway expansion exists.

   c) Location of all light poles, conduits, and electric feed.

   d) Location of any changes in street, water, sanitary, or storm from design to completed construction.

   e) The original and any computer drawings shall be delivered to and shall become the property of the Village prior to the release of the Maintenance Surety.

200.00
Definitions

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200.00 DEFINITIONS

Interpretation of Terms or Words

Regardless of capitalization, definitions are standard for the intent of these Design Criteria.

AASHTO
American Association of State Highway and Transportation Officials

ANSI
American National Standard Institute

APHA
American Public Health Association

ASCE
American Society of Civil Engineers

ASTM
American Society for Testing and Materials

AVERAGE DAILY FLOW
The total quantity of liquid tributary to a point divided by the number of days of flow measurement.

AWWA
American Water Works Association

BEDDING
The earth or other materials on which a pipe or conduit is supported.

CATCH BASIN
A structure intended to collect surface runoff and direct it into the storm sewer system.

COLLECTOR SEWER
A sewer normally less than 15 inches in diameter that receives wastewater from the sanitary laterals and transports it to the interceptor sewer.

CORPORATION STOP
The fixture tapped into a water main to connect a service to the main.

CRITICAL DEPTH

The depth at which point the control for determining the headwater for culverts changes.

CROSS-CONNECTION

A. A physical connection through which a supply of potable water could be contaminated or polluted.
B. A connection between a supervised potable water supply and an unsupervised supply of unknown potability.

CULVERT
A structure which allows surface runoff to flow through a roadway fill or similar obstruction of open flow. Culverts may be corrugated metal pipe, reinforced concrete, etc.

CURB INLET
A specialized catch basin (see catch basin) designed to collect runoff from pavement with curbing.

DESIGN STORM
The expected frequency of the storm for which the capacity of a structure will be equaled or exceeded. The capacity of a storm sewer designed for a 10-year storm has a 1 in 10 chance of being equaled or exceeded in any given year.

DETENTION/RETENTION
The term detention/retention basin refers to the use of a storm water storage facility which will store storm water and release it at a given rate. The objective of a detention/retention facility is to regulate the rate of runoff and control the peak discharges to reduce the impact on the downstream drainage system.

Type of Storm Water Storage Facilities:

A. Detention Basin or Dry Basin - Dry basins are surface storage areas created by constructing a typical excavated or embankment basin.
B. Retention Basins or Ponds - Retention basins are permanent ponds where additional storage capacity is provided above the normal water level.
C. Parking Lot Storage - Parking lot storage is a surface storage facility where an inlet is undersized causing shallow ponding to occur in specific graded areas of the parking lot.
D. Subsurface Storage - Subsurface storage is a structure constructed below grade for the specific purpose of detaining storm water runoff.

DISCHARGE
The amount of flow carried by a sanitary sewer, culvert, or storm sewer, normally measured in cubic feet per second.

DRAINAGE AREA
The area, in acres, which drains to a particular catch basin, culvert, or similar structure.

DROP MANHOLE
A manhole installed in a sewer where the elevation of the incoming sewer considerably exceeds that of the outgoing sewer; a vertical waterway outside the manhole is provided to divert the wastewater from the upper to the lower level so that it does not fall freely into the manhole except at peak rate of flow.

EARTH-DISTURBING ACTIVITY
Any grading, excavating, filling, or other alteration of the earth's surface where natural or manmade ground cover is destroyed and which may result in or contribute to erosion and sediment pollution.

ENERGY GRADIENT
The slope of the energy line of a body of flowing water with reference to a datum plane.

ENERGY GRADIENT LINE
The line representing the gradient which joins the elevation of the energy head.

ENERGY HEAD
The height of the hydraulic grade line above the centerline of a conduit plus the velocity head of the mean velocity of the water in that section.

ENERGY LINE
A line joining the elevation of the energy heads; a line drawn above the hydraulic grade line by a distance equivalent to the velocity head of the flowing water at each section along a stream, channel, or conduit.

EROSION

A. The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep.
B. Detachment and movement of soil or rock fragments by wind, water, ice, or gravity.

C. Erosion includes:

1. Accelerated erosion: Erosion much more rapid than normal, natural or geologic erosion, primarily as a result of the influence of the activities of man.
2. Floodplain erosion: Abrading and wearing away of the nearly level land situated on either side of a channel due to overflow flooding.
3. Gully erosion: The erosion process whereby water accumulates in narrow channels during and immediately after rainfall or snow or ice melt and actively removes the soil from this narrow area to considerable depths such that the channel would not be obliterated by normal smoothing or tillage operations.
4. Natural erosion (geological erosion): Wearing away of the earth's surface by water, ice, or other natural environmental conditions of climate, vegetation, etc., undisturbed by man.
5. Normal erosion: The gradual erosion of land used by man which does not greatly exceed natural erosion.
6. Rill erosion: An erosion process in which numerous small channels only several inches deep are formed; occurs mainly on recently disturbed soils.
7. Sheet erosion: The removal of a fairly uniform layer of soil from the land surface by wind or runoff water.

EXFILTRATION
The quantity of wastewater which leaks to the surrounding ground through unintentional openings in a sewer. Also, the process whereby this leaking occurs.

FIRE HYDRANT
A fixture installed throughout urban water distribution systems to provide water for the fire fighting needs.

GRASSED WATERWAY
A broad or shallow natural course or constructed channel covered with erosion-resistant grasses or similar vegetative cover and used to conduct surface water.

HEADWALL
A structure placed at the ends of a culvert to prevent movement of the culvert and reduce erosion.

HEADWATER
The vertical distance from a culvert invert at the entrance to the water surface upstream from the culvert.

HOUSE CONNECTION
The pipe carrying the wastewater from the building to a common sewer. Also called building sewer, house sewer, or sanitary lateral. The house connection begins at the outer face of the building wall.

HOUSE SEWER
A pipe conveying wastewater from a single building to a common sewer or point of immediate disposal. (See House Connection)

INFILTRATION
The discharge of ground waters into sewers, through defects in pipe lines, joints, manholes, or other sewer structures.

INFILTRATION/INFLOW
A combination of inflow wastewater volumes in sewer lines with no way to distinguish either of the two basic sources, and with the same effect as surcharging capacities of sewer systems and other sewer system facilities.

INFLOW
The discharge of any kind of water into sewer lines from such sources as roof leaders, cellars, sump pumps and yard-area drains, foundation drains, commercial and industrial so-called "clean water" discharges, drains from springs and swampy areas, etc. It does not "infiltrate" into the system and is distinguished from such wastewater discharge, as previously defined.

INLET CONTROL
A situation where the discharge capacity of a culvert is controlled at the culvert entrance by the depth of headwater and the entrance geometry, including the area, shape, and type of inlet edge.

INTERCEPTOR SEWER
A sewer which receives the flow from collector sewers and conveys the wastewater to treatment facilities.

JOINTS
The means of connecting sectional lengths of sewer pipe into a continuous sewer line using various types of jointing materials with various types of pipe formations that make possible the jointing of the sections of the pipe into a continuous collecting sewer line. The number of joints depends on the lengths of the pipe sections used in the specific sewer construction work.

JURISDICTION
Any governmental entity, such as town, village, county, sewer district, sanitary district or authority, or other multi-community agency which is responsible for and operates sewer systems, pumping facilities, regulator-overflow structures, and wastewater treatment works.

MAIN
The large water-carrying pipe to which individual user services are connected. Mains are normally connected to each other in a grid-type system.

MAIN SEWER
In larger systems, the principal sewer to which branch sewers and submains are tributary, are also called trunk sewer. In small systems, a sewer to which one or more branch sewers are tributary.

MANHOLE
An opening in a sewer provided for the purpose of permitting a man to enter or have access to the sewer.

MANNING ROUGHNESS COEFFICIENT
The roughness coefficient in the Manning Formula for determination of the discharge coefficient in the Chezy Formula.

METER
The flow-measuring device installed at each service on a distribution system to measure the amount of water consumed by users at that service.

NSF
National Sanitation Foundation

NORMAL DEPTH
The depth at which water will flow in a pipe or channel by virtue of its slope and roughness, based on the Manning formula.

OEPA
Ohio Environmental Protection Agency

OUTLET CONTROL
A situation where the discharge capacity of a culvert is controlled by the barrel of the culvert, rather than the inlet.

OVERFLOW
A pipe line or conduit device, together with an outlet pipe, which provides for the discharge of a portion of sewer flow into receiving water or other points of disposal.

PEAK
The maximum quantity that occurs over a relatively short period of time. Also called peak demand, peak load.

RAINFALL INTENSITY
The amount of rain falling over a specified period of time. Rainfall intensity is usually measured in inches per hour.

RATIONAL FORMULA
The method used to determine the amount of runoff from a specified area of known surface characteristics.

RUNOFF COEFFICIENT
A coefficient used in the Rational Formula to express the ratio of runoff to rainfall.

SANITARY SEWER LATERAL
The sewer line extending from the public sewer to the nearest property line of the property to be served.

SANITARY WASTEWATER

A. Domestic wastewater with storm and surface water excluded.
B. Wastewater discharging from the sanitary conveniences of dwellings (including apartment houses and hotels), office buildings, industrial plants, or institutions.
C. The water supply of a community after it has been used and discharged into a sewer.
D. See Ordinance 72-19 dated November 20, 1972 for further explanation.

SEDIMENT
Solid material both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by wind, water, gravity, or ice, and has come to rest on the earth's surface above or below sea level.

SEDIMENT BASIN
Barrier, dam, or other suitable detention facility built across an area of waterflow to settle and retain sediment carried by the runoff waters.

SEDIMENT CONTROL PLAN
A written description, acceptable to the approving agency, of methods for controlling sediment pollution from accelerated erosion on a development area of 5 or more contiguous acres or from erosion caused by accelerated runoff from a development area of 5 or more contiguous acres.

SEDIMENT POLLUTION

Failure to use management or conservation practices to abate wind or water erosion of the soil or to abate the degradation of the waters of the state by soil sediment in conjunction with land grading, excavating, filling, or other soil-disturbing activities on land used or being developed for commercial, industrial, residential, or other purposes.

SERVICE
The pipe carrying water to individual houses or other users on a distribution system.

TAILWATER
The vertical distance from a culvert invert at the outlet to the water surface downstream from the culvert.

TIME OF CONCENTRATION
The time for water to reach a certain point in the drainage area. In the case of gutter flow, the time of concentration includes the time to the gutter and the time of flow in the gutter to a specified point.

300.00
Roadways

300.01 General 31

300.00 ROADWAYS

300.01 General

All street design and layout shall follow the Village of Versailles Construction Standards and Drawings; ODOT Location and Design Manual, Volume One, Roadway Design, latest version; and AASHTO. The most restrictive shall apply as determined by the Village Engineer. These criteria cover design factors and provide guidelines for evaluations of plans and specifications by the political subdivisions having jurisdiction over the review of the plans and specifications. The design shall be consistent with the requirements of AASHTO and ODOT.

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600.00 STORM DRAINAGE

600.01 General

The following Design Criteria are summarized herein to establish practical uniform design of storm sewers for the Village. These criteria cover design factors and provide guidelines for evaluation of plans and specifications by the political subdivisions having jurisdiction over the review of plans and specifications. These Design Criteria are also intended to conform to the standard drawings for storm sewers. Storm sewer design should follow these criteria and Ohio Department of Transportation Location and Design, Volume Two, Drainage Design.

600.02 Storm Sewer and Inlet Grate Design

An adequate storm drainage system shall be constructed for all proposed developments. Natural drainage areas should be closely followed.

Outlets for the storm water runoff for development upstream of the proposed development must be provided. All storm sewer calculations must be submitted to the Village before any approvals will be given.

Storm runoff from urban areas may constitute a large volume of flow. The rational method is the preferred method for estimating storm runoff for areas less than or equal to 200 acres. Once the runoff is determined, the Manning Formula is the preferred method to calculate the capacity of the storm sewer pipes. Storm sewer shall be designed based on the full flow capacity of all pipes being able to carry at least the runoff from a 5-year storm event.

Also, the Hydraulic Grade Line (HGL) should be checked to ensure that a 25-year storm event will not cause ponding water at catch basins and manholes.

The Rational Formula used to compute the runoff that reaches a storm sewer inlet consists of the following:

$$Q = CiA$$

Q = Peak rate of runoff in cubic feet per second (cfs)
C = A coefficient expressing the ratio of runoff to the average rainfall rate during the time of concentration
i = Intensity of rainfall, in inches per hour
A = Drainage area, in acres

Other methods for determination of peak runoff rates may be used upon approval from or by request of the Village.

TABLE 6.1
RUNOFF COEFFICIENT - C

Predominant Land Use	
Business:	
Downtown Area	.80
Neighborhood Area	.70
Residential:	
Single-Family Areas	.40
Multi-Family Areas	.60
Industrial:	
Light Areas	.70
Heavy Areas	.80
Parks, Cemeteries	.30
Playgrounds	.35
Railroad Yard Areas	.35
Row Crops or Open Land	.25
Surface Characteristics	
Street:	
Asphalt	.90
Concrete	.90
Drives and Walks	.90
Roofs	.85
Lawns	
Flat -- 2% or less	.25
Average -- 2% to 7%	.35
Steep -- 7% or greater	.40

Table 6.1

Lists values of "C" for several land uses and surface characteristics. If more than one land use is present in a particular drainage area, a composite "C" value should be computed to represent the site.

Figure 6.1
Time of Concentration Worksheet
(to be utilized when overland flow is less than 1,000 feet)

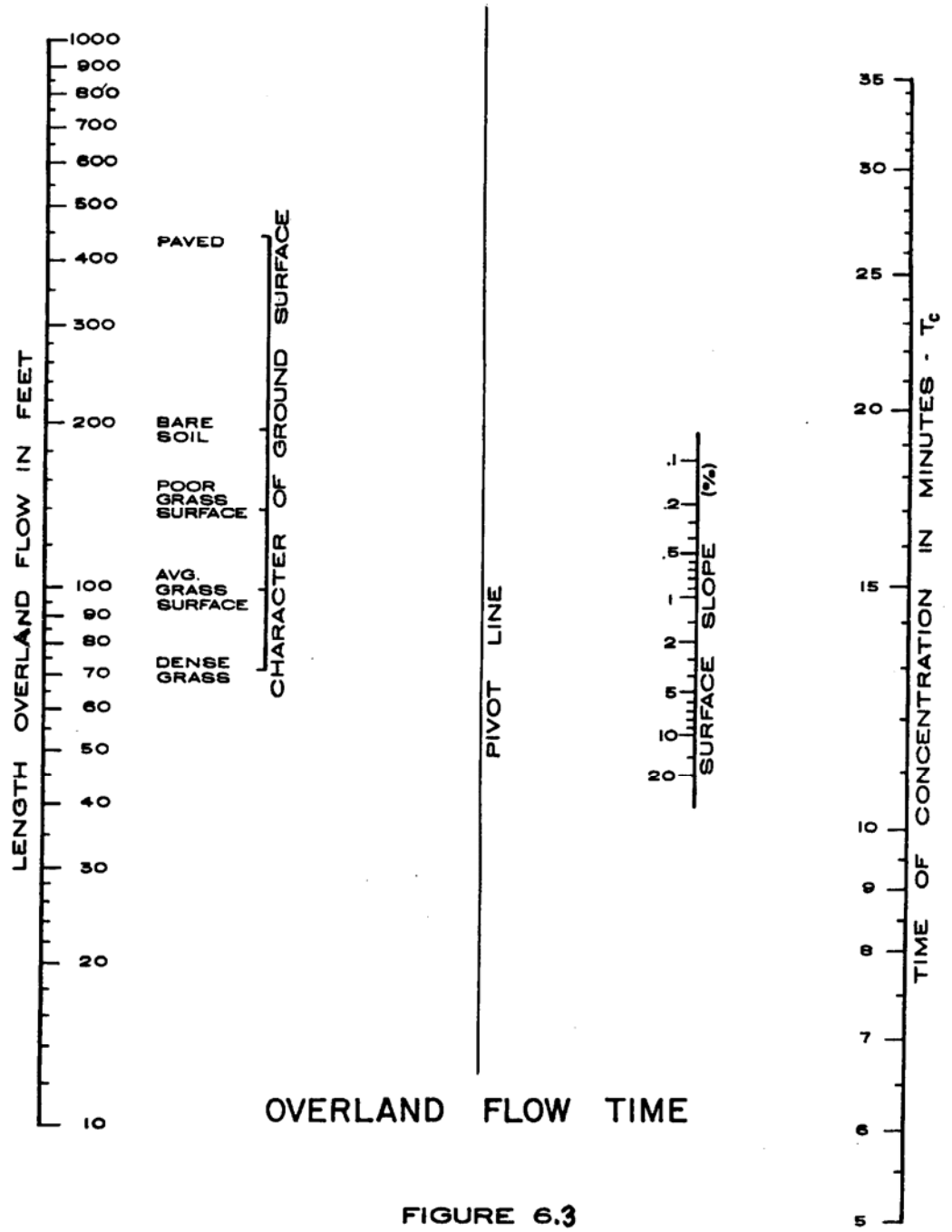


FIGURE 6.3

Figure 6.2
Time of Concentration Worksheet, Derived from TR-55
(to be utilized when overland flow is greater than 1,000 feet)

Project: _____ By: _____ Date: _____
Location: _____ Checked: _____ Date: _____
Circle one: Present Developed _____
Circle one: T_c T_t through subarea _____
NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Overland (Sheet) flow (Applicable as part of T_c computation only) Segment ID					
1. Surface description: paved or unpaved					
2. Manning's roughness coeff., n (See Figure 6.3).....					
3. Flow length, L (total L≤ 300 ft for unpaved, L≤ 100 ft for paved) ..... ft					
4. Two-yr 24-hr rainfall, P_2..... in	2.16	2.16			
5. Land slope, s .....ft/ft					
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$ Compute T_t .....hr		+		=	
Shallow concentrated flow Segment ID					
7. Surface description: paved or unpaved.....					
8. Flow length, L..... ft					
9. Watercourse slope, s .....ft/ft					
10. Average velocity, $V_{unpaved} = 16.1345(s)^{0.5}$, or $V_{paved} = 20.3282(s)^{0.5}$. ft/s					
11. $T_t = \frac{L}{3600\,V}$ Compute T_t..... hr		+		=	
Channel flow Segment ID					
12. Cross sectional flow area, a .....ft^2					
13. Wetted perimeter, p_w..... ft					
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ..... ft					
15. Channel slope, s .....ft/ft					
16. Manning's roughness coeff., n.....					
17. $V = \frac{1.49\,r^{2/3}s^{1/2}}{n}$ Compute V ..... ft/s					
18. Flow length, L..... ft					
19. $T_t = \frac{L}{3600\,V}$ Compute T_t..... hr		+		=	
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr					

Figure 6.3

Surface Description	n[1] Coeff.
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated Soils:	
Residue cover < = 20%	0.06
Residue cover > = 20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses[2]	0.24
Bermuda grass	0.41
Range (natural)	0.13
Woods:[3]	
Light underbrush	0.40
Dense underbrush	0.80

[1] The n values are a composite of information compiled by Engman (1986).
[2] Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
[3] When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

Source: *TR-55, Urban Hydrology for Small Watersheds,* U.S. Dept. of Agriculture, Soil Conservation Service, Engineering Division, June 1986.

Table 6.2
Intensity – Duration – Frequency Table

Hours	Minutes	Return Frequency – Rainfall Intensity (in/hr)					
		2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
.08	5*	4.15	5.54	6.25	7.12	7.82	8.54
.17	10	3.35	4.51	5.08	5.87	6.20	6.97
.25	15	2.90	3.81	4.37	5.08	5.57	6.08
.33	20	2.50	3.29	3.81	4.46	4.80	5.36
.50	30	1.86	2.54	2.97	3.50	3.86	4.28
.75	45	1.40	1.88	2.20	2.60	2.88	3.22
1	60	1.12	1.52	1.78	2.10	2.34	2.61
2	120	0.68	0.91	1.08	1.27	1.42	1.55
3	180	0.50	0.675	0.80	0.94	1.05	1.16
6	360	0.30	0.40	0.48	0.56	0.62	0.68
12	720	0.16	0.23	0.27	0.37	0.36	0.39
24	1440	0.09	0.13	0.15	0.18	0.20	0.22

* Minimum Time of Concentration
** Interpolation is acceptable to obtain values not provided in the above table.

Table 6.2

This can be used to determine values of "I" for several storm frequencies.

The Manning Formula, used to compute flow in open conduits, consists of the following:

$$Q = \frac{1.486}{n} R^{2/3} S^{1/2} A$$

Q = Flow in cubic feet per second (cfs)
n = Coefficient of conduit roughness (n = 0.013)
R = Hydraulic radius, ratio of flow area to wetted perimeter in feet
S = Channel or pipe slope, in feet per feet
A = Area of Cross-section of flow in square feet

The design of storm sewers in the Village of Versailles shall be outlined as follows.

A. Prepare a contour map of the drainage area including the surrounding area, drainage limits, and direction of surface flow.

B. Divide the area into the subareas tributary to the proposed sewer inlets. These inlets should be located at reversals of road grade from negative to positive and at street intersections. A maximum distance of 300 feet between catch basins will be allowed along long street grades.

C. Determine the acreage and imperviousness of each area.

D. Calculate the required capacity of each inlet using the appropriate time of concentration, the tributary area and the rational method.

E. Beginning at the highest elevation, compute the flow to be carried by each line. The time of concentration for each line other than the first in a series is the sum of the time of concentration to the inlet next upstream and the flow time in the connecting pipe. Where more than two lines meet, the time of concentration to be used for the succeeding line is the longest time in the lines meeting. Each line will thus require calculation of time of concentration, tributary area (all upstream areas), and flow.

F. Select tentative pipe sizes and grades using the Manning Formula. Each line must be selected in order since the time of concentration for subsequent lines will be dependent upon the time of flow in all upstream lines.

G. Minimum cover requirements specified by ASTM specifications must be met.

H. Figure 6.4, Computation for Storm Sewer Design, may be used for storm sewer calculation.

Figure 6.4

COMPUTATION FOR STORM SEWER DESIGN

MANNING FORMULA: n _____ Project: _____ Date _____ Sheet No. _____

Manhole No.	Begin/ End Sta.	Δ "A"	"C"	Δ "CA"	Sum "CA"	Δ "T"	Sum "T"	"I" ___YR	"I" ___YR	"Q" Disch ____ YR	"Q" Disch ____ YR	"L" FT.	Slope Ft./Ft.	Pipe Dia. In.	"V" FPS	CAP CFS	Flow Line Elev. Inlet/ Outlet

600.03 Minimum Diameter

The minimum diameter of storm sewer pipe shall be 12 inches. The diameter shall be increased as necessary according to the design analysis.

600.04 Minimum Cover

The minimum cover over storm sewer pipe shall be 2 feet unless otherwise approved by the Village Engineer. Cover is measured from the top of pipe to the finished grade directly above the pipe.

600.05 Minimum Slope

The minimum recommended slope for storm sewers shall be 0.10 foot per 100 feet, unless a greater slope is required to obtain the minimum mean velocity. Culverts may be installed on flatter grades as approved by the Village Engineer.

600.06 Minimum Velocity

The absolute minimum mean velocity for all storm sewers shall be 2.0 feet per second when flowing full based on Manning's Formula using an "n" value of 0.013. Use of other "n" values will be considered if deemed justifiable on the basis of extensive field data. The desirable minimum velocity is 3.0 feet per second based on the same criteria.

600.07 Maximum Velocity

The maximum velocity of all storm sewers shall be 10 feet per second. If the velocity is greater than 10 feet per second, provisions should be made to protect against displacement and erosion of the pipe.

600.08 Maximum Headwater

The maximum allowable headwater depth for culverts shall be 2 feet below pavement surfaces and/or finish floor elevations.

600.09 Manholes

Manholes shall be installed at the end of each line, at all changes in grade, size, alignment, and at all pipe intersections. Manholes shall be installed at distances not greater than 400 feet. Intervals of more than 400 feet may be approved in sewers 42 inches and larger. Manholes may be either poured in place or precast concrete. Concrete construction shall conform to ASTM C-478.

The flow channel through manholes should be made to conform in shape, slope, and smoothness to that of the sewers.

All manhole covers shall be adjusted to grade by the use of no more than 12 inches of precast adjusting collars.

Manholes shall be consistent with those shown in the standard drawings.

600.10 Manhole Minimum Diameter

Manholes shall be constructed large enough to allow access to all sewers. The minimum diameter of manholes shall be 48 inches. Where large sewers require the use of manholes diameters greater than 48 inches, the manhole shall be returned to the 48-inch diameter as soon as practical above the sewer crown. Manhole openings of 24 inches or larger are recommended for easy access with safety equipment and to facilitate maintenance.

600.11 Catch Basins

Curb inlets shall be placed at all low points, points of change to a flatter street grade, the dead end of descending streets, and at the Point of Curvature and Point of Tangency of all intersection radius curves where the street grade descends toward the radius curve and at all intersections. The basis for the design and spacing of curb inlets shall conform to the Bureau of Roads Hydraulic Engineering Circular No. 12, “Drainage of Highway Pavements”.

Under normal conditions, curb inlets shall be placed on both sides of the street at intervals indicated by the street grade. Approximate spacing ranges from 150 feet to 300 feet maximum under normal conditions for the spread of flow-in gutters.

Catch basins not placed in the street shall be selected and placed so that they blend with the surrounding and not appear unsightly.

Curb inlets shall be placed on the property lines if at all possible.

Catch basin types shall be consistent with the types shown in the standard drawings.

600.12 Basis of Culvert Design

The basis of design for highway culverts shall be the Bureau of Roads Hydraulic Engineering Circular No. 5, "Hydraulic Charts for the Selection of Highway Culverts". Design shall be based on a 25-year storm for full flow capacity and an overtopping capacity of at least a 100-year storm.

600.13 Open Drainage Ditches

The basis of design for drainage ditches shall be the Manning Formula, as defined in Section 600.02. Figure 6.2 may be used to determine the value of "n", Manning's Roughness Coefficient, to be used in the calculations. These calculations of open ditch capacity should be provided to the reviewing agency along with the construction drawings.

TABLE 6.3

CHANNEL MATERIAL	n
Vitrified clay	0.014
Cast iron pipe	0.015
Smooth earth	0.018
Firm gravel	0.023
Corrugated metal pipe	0.022
Natural channels in good condition	0.025
Natural channels with stones and weeds	0.035
Very poor natural channels	0.060

600.14 Channel Protection

Channel protection material shall be placed at pipe outlets and other areas of high velocity flow to prevent erosion. The type, location and depth of the protective material shall be reviewed and approved by the Village.

600.15 Storm Water Detention Basin/Retention Pond Size Requirements

It is recognized that the outlets for storm water runoff in the Village are very limited. These outlets do not have the capacity to receive and convey the increased runoff resulting from rapid development around the Village.

Developer/Owners must participate in providing detention storage to eliminate the excessive runoff during heavy storm periods. Where impervious areas are planned or contemplated, it is the intent that detention be provided as required by the provisions hereinafter set forth. It is proposed that well maintained landscaped areas would be provided to act jointly as detention reservoirs and recreation facilities as aesthetic focal points in new developments. Other control methods to regulate the rate of storm water discharge which may be acceptable, include detention on parking lots, streets, lawns, underground storage, oversized storm sewers with restricted outlets, etc. However, these methods must be approved by Village officials.

It is recognized that in order to better serve the long-range interests of the Village and the surrounding area, comprehensive basin-wide planning for runoff control should be formulated, adopted, and implemented. Comprehensive planning is far more beneficial than small, on-site detention areas, although on-site detention does provide protection and is acceptable for compliance.

Detention of storm water shall be required for all developments and proposed development which would alter storm runoff as to flow, velocity or time of concentration. These basins are required to detain the peak post-developed runoff which exceeds the runoff created by a 5-year storm under predeveloped condition. The Village reserves the option to require more stringent detention requirements based upon the estimated capacity of the existing storm sewers. All calculations must be submitted to the Village for approval. Calculations must include a profile of the existing storm sewer from the proposed connection point to a point 500 feet downstream or the first outfall structure nearest to or beyond the required 500 feet. The calculated full flow capacity of the existing storm water outfall shall also be provided.

Design of storm water detention facilities shall be based on the following:

A. The Village suggests that runoffs and capacities are to be computed using the Rational Method and Manning Formula as determined in Section 600.02 of this document for areas less than 200 acres.

B. The release rate shall not be greater than the storm runoff created by the pre-developed site during a five-year frequency storm. The allowable outflow rate used in Figure 6.5 “Computation Worksheet for Detention Storage Using Rational Method” is derived using a C coefficient of 0.2 and a rainfall intensity of 3.81 inches based on 5 years with a duration of 15 minutes. Consideration may be given for different intensity and coefficient based on the situation.

C. Storage volume shall not be less than the storm runoff created by the post-developed site during a 100-year storm event. The storage volume may be computed by using Figure 6.5, "Computation Worksheet for Detention Storage Using Rational Method".

The percentage of impervious area is used to calculate detention required. Generally 30% may be used for single-family residences, 50% for multi-family residences, 70% for industrial sites, and 90% for commercial property. If another percentage would be more appropriate for the individual site, the more appropriate number should be used.

The Runoff Coefficient C for various storm durations is given in Table 6.4 for each land use.

Table 6.4

Storm Duration t_d (hrs)	30% of Impervious Area	50% of Impervious Area	70% of Impervious Area	90% of Impervious Area
0.17	0.28	0.36	0.44	0.51
0.33	0.36	0.45	0.53	0.61
0.50	0.42	0.50	0.59	0.67
0.67	0.46	0.54	0.63	0.71
0.83	0.49	0.57	0.66	0.74
1.0	0.51	0.59	0.68	0.77
1.5	0.56	0.65	0.73	0.82
2.0	0.59	0.69	0.76	0.84
3.0	0.64	0.72	0.79	0.86

D. Outlet size shall be determined by using the orifice equation as defined by:

$$Q = CA\sqrt{2gH}$$

C = 0.6
A = Area in square feet
g = 32.2 ft./s^2
H = height from the center of the pipe to the top of the water surface

E. Special detention consideration may be given by the Village Engineering Department for high impervious areas that are smaller than 2 acres in size.

An emergency overflow from the basin to a major storm system must be provided to protect the facility and adjacent properties. The designer should investigate the capacity of the downstream drainage facilities to determine if they will be adequate to handle the design

flow from this particular development. If the downstream facilities are inadequate, it may be necessary to provide on-site retention or ponding basins to limit the flow to an amount which the downstream system can accept.

Figure 6.5

COMPUTATION WORKSHEET FOR DETENTION STORAGE USING RATIONAL METHOD

Project Information

Project _____

Designer _____

Determination of Allowable Outflow Rate

Watershed Area (A) _____ acres

Allowable Outflow Rate (O) _____ cfs

Storm Duration t_d (hrs)	Runoff Coefficient C ____% Impervious	Rainfall Intensity i (inches/hr)	Post Inflow Rate (100 year) $I(t_d)$ (CiA) (cfs)	Pre Allowable Outflow Rate (5 year) O (.2)(3.65)(A) (cfs)	Storage Rate $I(t_d)$-O (cfs)	Required Storage $[I(t_d)-O]t_d/12$ (acre-ft)
0.17		6.97				
0.33		5.36				
0.50		4.28				
0.67		3.58				
0.83		3.05				
1.0		2.61				
1.5		2.01				
2.0		1.55				
3.0		1.16				

600.16 Detention Basin/Retention Pond Guidelines

A. RECOMMENDATIONS FOR DRY DETENTION BASINS

1. Where water quality during dry weather periods in a small basin would be a potential problem due to lack of adequate dry weather flow, direct pollution from surface water runoff, or high nutrients in the flow; the basin should be designed to remain dry except when in flood use.

2. Dry detention basins shall be designed to minimize the wetness of the bottom so that water does not remain standing in the bottom; thereby harboring insects and limiting the potential use of the basin. This shall be accomplished by means of a concrete low flow channel between inlet and outlet structures. Minimum slope shall be no less than 0.4 percent. A possible alternative upon Village approval to a concrete low flow channel would be an underdrain. In this case, a minimum of 1 percent slope shall exist between inlet and outlet structures and the surface above the underdrain shall be grass sod.

3. The detention basin should be designed to have a multi-purpose function. Recreational facilities, aesthetic qualities, etc,. as well as flood water storage should be considered in planning the basin.

4. Side slopes shall be 3 to 1 or flatter.

5. There shall be a minimum of a 3-foot berm at 2 percent between right-of-way and top basin slopes.

B. RECOMMENDATIONS FOR BASINS CONTAINING PERMANENT WATER

1. In order to provide better management for water quality, retention basins containing permanent lakes should have a water area of at least one-half acre. The lake area should be an average depth of 5 feet to inhibit weed and insect growth, and should have no extensive shallow areas. A system to augment storm flows into the lake with water from other sources should be provide to enhance the water quality, if necessary. These systems would include the use of public water supplies or wells on site.

2. In excavated lakes, the underwater side slopes in the lake should be stable.

3. A safety ledge 4 to 6 feet in width is recommended and should be installed in all lakes approximately 18 to 24 inches below the permanent water level to provide a footing if people fall into the water. In addition, there shall be a minimum of a 5-foot berm at 2 percent slope beginning at least 1 foot above normal pond elevation. The slope between two ledges should be stable and of a material which will prevent erosion due to wave action (see Figure 6.6). Walkways consisting of a non-erosive material should be provided in areas where extensive population use tramples growth. One

area in particular would be along the shoreline of a heavily fished lake. Side slopes above the berm shall be 3 to 1 or flatter.

4. Side slopes of the pool shall be 2 to 1 or flatter.

5. To obtain additional recreational benefits from developed water areas and provide for insect control, ponds may be stocked with fish. For best results, stocking should follow recommendations for warm water sport fishing by the Ohio Department of Conservation, Division of Fisheries, or similar organizations.

6. Periodic maintenance will be required in lakes to control weed and larval growth. The basin should also be designed to provide for the easy removal of sediment which will accumulate in the lake during periods of basin operation. A means of maintaining the designed water level of the lake during prolonged periods of dry weather is also recommended. One suggested method is to have a water hydrant near the pond site.

7. No rubble or construction refuse shall be disposed of at any time.

8. No pond with a permanent water elevation shall be placed within one mile of a runway approach or landing approach to an airport.

C. RECOMMENDATIONS COMMON TO EITHER DRY DETENTION BASINS OR RETENTION BASINS WITH PERMANENT WATER

1. A 20-foot-wide Village easement shall be provided for access to all storm water storage ponds.

2. All basins shall have an emergency overflow.

3. All excavated spoils should be spread so as to provide for aesthetic and recreational features such as sledding hills, sports fields, etc. Slopes of 4 horizontal to 1 vertical are recommended except where recreation uses call for steeper slopes. Even these features should have a slope no greater than 3 horizontal to 12 vertical for safety, minimal erosion, stability, and ease of maintenance.

4. When conduits are used for the outlet of the reservoir, they shall be protected by bar screens as approved by the Village or other suitable provisions so that debris or similar trash will not interfere with the operation of the basin.

5. Safety screens should also be provided for any pipe or opening to prevent children or large animals from crawling into the structures. For safety, a suggested maximum opening is 6 inches.

6. Grass or other suitable vegetative cover should be maintained throughout the entire reservoir area. Grass should be cut regularly no less than five times a year.

7. Debris and trash removal and other necessary maintenance should be performed after each storm to assure continued operation in conformance to the design.

D. INSPECTION OF BASINS

1. Record drawings will be required for all basins to assure compliance with all applicable requirements.

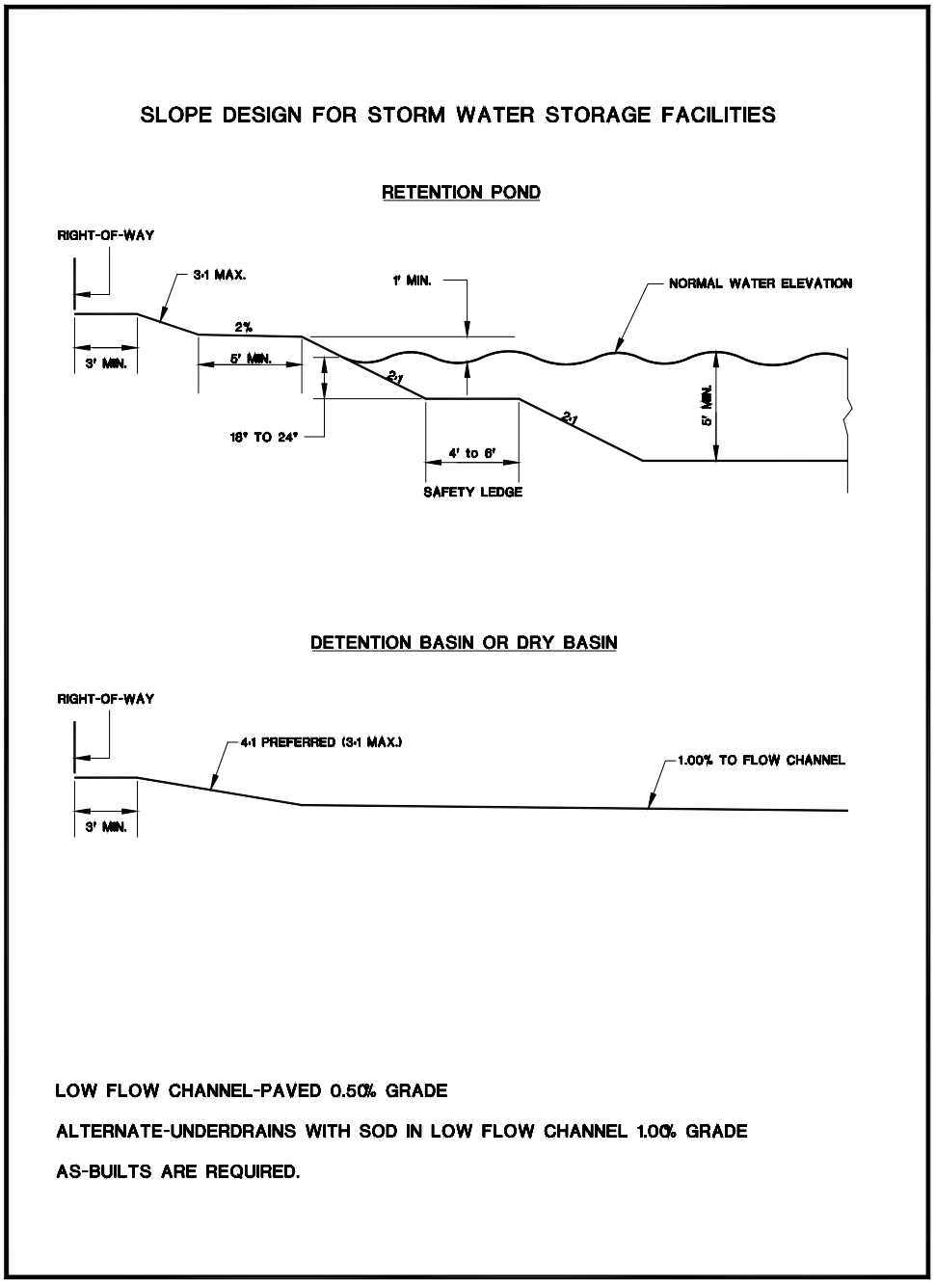
2. The Village may inspect all private detention basins and if problems exist, report these to the owner. The owner shall be given a reasonable amount of time to correct the problem, weather permitting.

3. The Village shall perform such work as it deems necessary and charge owner if the owner fails to correct the problem.

E. DETENTION BASIN OWNERSHIP

1. Detention basin maintenance and ownership shall remain private unless the Village accepts ownership through approval by the Village Council.

Figure 6.6


SLOPE DESIGN FOR STORM WATER STORAGE FACILITIES
RETENTION POND
RIGHT-OF-WAY
3:1 MAX.
1' MIN.
NORMAL WATER ELEVATION
2%
3' MIN.
5' MIN.
2:1
2:1
5' MIN.
18" TO 24"
4' to 6'
SAFETY LEDGE
DETENTION BASIN OR DRY BASIN
RIGHT-OF-WAY
4:1 PREFERRED (3:1 MAX.)
1.00% TO FLOW CHANNEL
3' MIN.
LOW FLOW CHANNEL-PAVED 0.50% GRADE
ALTERNATE-UNDERDRAINS WITH SOD IN LOW FLOW CHANNEL 1.00% GRADE
AS-BUILTS ARE REQUIRED.

600.17 Site Grading

A. SITE GRADING PLAN

Site grading plans shall be prepared with 1 foot existing and proposed contours showing all lots or lots having proper drainage. Site grading plans for developments shall also have proposed building pad elevations to ensure proper drainage of the development. Individual site plans within a development must conform to the subdivision drainage site plan.

B. CUTS AND FILLS

No land shall be graded, cut, or filled so as to create a slope exceeding a vertical rise of 1 foot for each 3 feet of horizontal distance between abutting lots, unless a retaining wall of sufficient height and thickness is provided to retain the graded bank. Major cuts, excavation, grading, and filling, where the same material changes the site and its relationship with surrounding areas, shall not be permitted as such excavation, grading, and filling will result in a slope exceeding a vertical rise of 1 foot for each 3 feet of horizontal distance between abutting lots or between adjoining tracts of land, except where adequate provision is made to prevent slides and erosion by cribbing and retain walls.

C. COMPACTION OF FILL

All fill shall be compacted to a density of 90% or greater. Inspection of fill shall be conducted by the Village Engineer.

D. RETAINING WALLS

Retaining walls may be required whenever topographic conditions warrant or where necessary to retain fill or cut slopes within the right-of-way. Such improvements shall require the approval of the Village Engineer.

E. FILLING OF EXISTING AREAS

No existing area shall be filled or graded to adversely affect adjoining properties as determined by the Village Engineer.

600.18 Responsibility for Maintenance of Private Storm Water Facilities and Drainage on Private Property

A. Any owner or possessor of private property upon which storm water drainage facilities, whether man-made or natural, exist for the purpose of collecting, conveying, retaining, or detaining storm water within that property and which are not public facilities, shall be responsible for the maintenance of these facilities to ensure proper operation.

B. The Village shall not be responsible for resolving drainage problems on private property where such problems pose a nuisance, do not impact the operation of the overall storm water management system of the Village, or do not involve the function of public facilities. Private property owners bear the responsibility to remedy these types of problems.

C. The Village may cooperate with private property owners to extend public facilities of the storm water management system to the private property, to enable the resolution of these drainage problems if the Village Council decides that suitable resources are available, the project can be accommodated within the context of the Village's overall Capital Improvement Plan, and the Village Engineer determines that the Village's storm water management system is capable of handling any additional flows that may be placed in the system as a result of implementing the proposed solution.

600.19 Runoff from Upstream Drainage Areas

The runoff from drainage areas upstream of the proposed development or improvement must be provided with an unobstructed outlet and an emergency overflow. The outlet should provide the capacity needed to carry the runoff from a
5-year storm in its existing land use condition.

600.20 Runoff onto Contiguous Properties

All site drainage shall be contained on-site. No land altering activity shall disperse runoff into areas adjacent to the area experiencing development.

600.21 Soil Sediment Pollution Control Regulations

A. The purpose of the regulation is to prevent the undue polluting of public waters by sediment from accelerated soil erosion and accelerated storm water runoff caused by earth-disturbing urban areas. Control of such pollution will promote and maintain the health, safety and general well-being of all life and inhabitants herein the Village.

B. SCOPE

This shall apply to earth-disturbing activities on areas of land used or being developed for commercial, industrial, residential, recreational, public service or other non-farm purposes which are within the Village unless otherwise excluded within or unless expressly excluded by state law.

C. DISCLAIMER OF LIABILITY

Neither submission of a plan under provisions of this article nor compliance with provisions of these regulations shall relieve any person from responsibility for damage to any person or property otherwise imposed by law, nor imposed any liability upon the Village or its appointed representative for damage to any person or property.

D. SEVERABILITY

If any clause, section, or provision of this resolution is declared invalid or unconstitutional by a court of competent jurisdiction, validity of the remainder shall not be affected thereby.

E. REQUIREMENTS

No person shall cause or allow earth-disturbing activities on a development area except in compliance with the standards and criteria and the applicable item listed below:

1. When a proposed development area consists of five (5) or more acres and earth-disturbing activities are proposed for the whole area or any part thereof, the responsible person shall develop and submit for approval a sediment control plan prior to any earth-disturbing activity. Such a plan must contain sediment pollution control practices so that compliance with other provisions of this resolution will be achieved during and after development. Such a plan shall include specific requirements established by regulation.

2. When a proposed development area involves less than five (5) acres, it is not necessary to submit a sediment control plan; however, the responsible person must comply with the other provisions of these regulations. All earth-disturbing activities shall be subject to surveillance and site investigation to determine compliance with the standards and regulations.

F. STANDARDS AND CRITERIA

In order to control sediment pollution of water resources, the owner or person responsible for the development area shall use conservation planning and practices to maintain the level of conservation established by one or more of the following standards:

1. Timing of Sediment-Trapping Practices - Sediment control practices shall be functional throughout earth-disturbing activity. Settling facilities, perimeter controls, and other practices intended to trap sediment shall be implemented as the first step of grading and within seven (7) days from the start of earth disturbing activities. They shall continue to function until the upslope developed area is restabilized.

2. Stabilization of Denuded Areas - Denuded areas shall have soil stabilization applied within seven (7) days if they are to remain dormant for more than forty-five (45) days. Permanent or temporary soil stabilization shall be applied to denuded areas within seven (7) days after final grade is reached on any portion of the site, and shall also be applied within seven (7) days to denuded areas which may not be final grade, but will remain dormant (undisturbed) for longer than forty-five (45) days.

3. Settling Facilities - Concentrated storm water runoff from denuded areas shall pass through a sediment-settling facility. The facility's storage capacity shall be 67 cubic yards per acre of drainage area.

4. Sediment Barriers - Sheet flow runoff from denuded areas shall be filtered or diverted to a settling facility. Sediment barriers such as sediment fence or diversions to settling facilities shall protect adjacent properties and water resources from sediment transported by sheet flow.

5. Storm Sewer Inlet Protection - All storm sewer inlets which accept water runoff from the development shall be protected so that sediment-laden water from soils that are not permanently stabilized will not enter the storm sewer system without first being filtered or otherwise treated to remove sediment, unless the storm sewer system drains to a settling facility.

6. Working in Crossing Streams

    a. Streams including bed and banks shall be restabilized immediately after in-channel work is completed, interrupted, or stopped. To the extent practicable, construction vehicles shall be kept out of streams. Where in-channel work is necessary, precautions shall be taken to stabilize the work area during construction to minimize erosion.

    b. If a live (wet) stream must be crossed by construction vehicles regularly during construction, a temporary stream crossing shall be provided.

7. Construction Access Routes - Measures shall be taken to prevent soil transport onto surfaces where runoff is not checked by sediment controls, or onto public roads.

8. Sloughing and Dumping

    a. No soil, rock, debris or any other material shall be dumped or placed into a water resource or into such proximity that it may readily slough, slip, or erode into a water resource unless such dumping, or placing is authorized by the approving agency, and, when applicable, the U.S. Army Corps of Engineers, for such purposes, including but not limited to, constructing bridges, culverts, and erosion control structures.

    b. Unstable soils prone to slipping or land sliding shall not be graded, excavated, filled or have loads imposed upon them unless the work is done in accordance with a qualified professional engineer's recommendations to correct, eliminate, or adequately address the problems.

9. Cut and Fill Slopes - Cut and fill slopes shall be designed and constructed in a manner which will minimize erosion. Consideration shall be given to the length and

steepness of the slope, soil type, upslope drainage area, groundwater conditions, and slope stabilization.

10. Stabilization of Outfalls and Channels - Outfalls and constructed or modified channels shall be designed and constructed to withstand the expected velocity of flow from a post-development, 10-year frequency storm.

11. Establishment of Permanent Vegetation - A permanent vegetative cover shall be established on denuded areas not otherwise permanently stabilized.

12. Disposition of Temporary Practices - All temporary erosion and sediment control practices shall be disposed of within thirty (30) days after final site stabilization is achieved or after the temporary practices are no longer needed, unless otherwise authorized by the approving agency. Trapped sediment shall be permanently stabilized to prevent further erosion.

13. Maintenance - All temporary and permanent erosion and sediment control practices shall be designed and constructed to minimize maintenance requirements. They shall be maintained and repaired as needed to assure continued performance of their intended function. The person or entity responsible for the continued maintenance of permanent erosion controls shall be identified to the satisfaction of the approving agency.

The standards are general guidelines and shall not limit the right of the approving agency to impose additional, more stringent requirements, nor shall the standards limit the right of the approving agency to waive individual requirements.

Erosion and sediment control practices used to satisfy the standards shall meet the specifications in the current edition of water management and sediment control for urbanizing areas (Soil Conservation Service, Ohio).

G. MAINTENANCE

The property owner shall assume responsibility for maintenance of structures and other facilities designed to control erosion.

600.22 Railroad and Highway Crossing

When boring is required, the casing pipe shall be designed to meet the requirements of the authority having jurisdiction and in compliance with the Village of Versailles Construction Standards and Drawings. The size of the casing pipe shall be at least 4 inches greater than the largest outside diameter of the sewer pipe, joints, or couplings.

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Water Distribution

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800.00 WATER DISTRIBUTION

800.01 General

The following Design Criteria are summarized herein to establish practical, uniform design of water distribution systems for the Village. These criteria cover design factors and provides guidelines for evaluation of plans and specifications by the political subdivision having jurisdiction over the review of plans and specifications. These Design Criteria are also intended to conform to the construction standards and drawings for water systems and the regulations of the OEPA.

800.02 Basis of Design

The basis of design for water distribution systems shall be the Hazen-Williams Equation, an empirical formula for estimating pipe flow:

$$V = 1.318CR^{0.63}S^{0.54}$$

V = Velocity in feet per second
C = Roughness Coefficient
R = Hydraulic Radius (pipe diameter in feet for pipes flowing full) in feet
S = Head loss per unit length of pipe

Distribution systems shall be designed for the estimated maximum day rate of flow, or the fire flow plus the estimated average day rate of flow, whichever is more demanding.

800.03 Minimum Pressure

The minimum allowable pressure in the water distribution system, at times of no fires, shall be 50 pounds per square inch in all mains and 8 pounds per square inch at the most remote house fixture in the system. The minimum fire flow for design purposes shall be 600 gallons per minute at a residual pressure of 20 pounds per square inch.

800.04 Maximum Velocity

The maximum velocity of the water in the system shall be 10 feet per second.

800.05 Water Mains

The value of C to be used in the Hazen-Williams Equation shall be C=140. The minimum size of water mains shall be 6 inches in diameter. Dead-ending mains shall be minimized by looping of all mains. Where dead-ends occur, they should be provided with a fire hydrant for flushing purposes.

The minimum depth of water mains shall be 4 feet 6 inches from the top of the pipe to the finished grade elevation. The maximum depth of water mains shall be 5 feet and 6 inches

from the top of the main to the finished grade elevation, except where utilities must be underpassed or as directed by the Village.

800.06 Water Service Lines

The value of C to be used in the Hazen-Williams Equation shall be C = 130. The minimum diameter of service lines shall be 3/4 inch, unless the distance from the main to the meter exceeds 120 feet, where the minimum service line diameter shall be 1 inch. Table 8.1 lists required minimum service sizes as determined by residential population. Fire hydrant services shall have a minimum diameter of 6 inches, but shall be no larger than the water main. For services larger than 2 inches, a tapping sleeve and valve must be installed. Table 8.2 shows the maximum size of service taps allowed for various sizes of water mains.

TABLE 8.1

MINIMUM SIZE -- WATER SERVICES AND METERS
RESIDENTIAL AREAS

No. of Families	Service Size (inches)	Meter Size (inches)
1	3/4	5/8 x 3/4
2-5	1	1
6-8	1-1/2	1 1/2
9-12	2	1 1/2
13-20	2	2
21-50	4	3
51-115	4	4

TABLE 8.2

MAXIMUM SIZE - WATER SERVICE TAPS

Pipe Diameter (inches)	6	8	10	12
Tap Sizes (inches)	1	1-1/4	1 1/2	2

The minimum depth of service lines shall be 3 feet and 6 inches from the top of the line to the finished grade elevation. The maximum depth of service lines shall be 5 feet from the top of the line to the finished grade elevation, except where utilities must be underpassed.

A curb stop and curb box shall be installed between the curb and sidewalk or between the walk and right-of-way line where there is not a curb lawn for each house and apartment unit unless otherwise approved the Village. The curb stop box shall be plumbed and centered over the curb stop and shall be free of debris. House service installations shall conform to the Standard Drawings.

800.07 Restraining and Concrete Blocking for Water Mains

All water main bends of more than 5 degrees shall be securely blocked against movement by using concrete blocking placed against undisturbed earth. Dimensions and quantities of blocking shall be as shown on the Standard Drawings. All mechanical bends, tees, etc. shall be restrained using mechanical restraining joints.

800.08 Fire Hydrants

Fire hydrants shall be placed at all intersections and never more than 500 feet apart.

Fire hydrants shall be installed with a break flange located approximately 2 inches above the ground level to protect against flooding in case of impact to hydrant. Fire hydrants shall be consistent with the Standard Drawings.

A valve must be installed on all fire hydrant service lines. All connections between the main and the hydrant shall be restrained by anchoring pipe, tie bolts, or retainer glands.

800.09 Meter Installation

Meter installation for individual services shall be consistent with the Standard Drawings. Table 8.3 lists required meter sizes as determined by Maximum Flow Demand for Commercial-Industrial applications. Meters must be installed prior to connecting the service to the main and before service starts. No common meters will be approved. All meters must have remote readers.

TABLE 8.3

METER SIZE FOR COMMERCIAL-INDUSTRIAL APPLICATIONS

Maximum Flow Demand (GPM)	Meter Size (inches)
20	5/8 x 3/4
30	3/4
50	1
100	1 1/2
160	2
320	3
500	4
1000	6

800.10 Valves

Valves shall be located at all branches of cross and tee intersections and at intervals not to exceed 800 feet in residential districts and 500 feet in commercial and industrial districts.

800.11 Backflow Prevention

All commercial, industrial, and other OEPA required users shall provide adequate backflow prevention between the public water system and the customer's system. These devices shall be approved by OEPA and the Village prior to installation. These devices shall be tested and inspected annually. These devices shall be repaired or replaced if they do not meet the testing requirements. An annual report shall be submitted to the Village detailing the testing procedures and results.

800.12 Railroad and Highway Crossings

When boring is required, the casing pipe shall be designed to meet the requirements of the authority having jurisdiction and in compliance with the Village of Versailles Construction Standards and Drawings. The size of the casing pipe shall be at least 4 inches greater than the largest outside diameter of the sewer pipe, joints, or couplings.

900.00
Sanitary Sewers

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900.00 SANITARY SEWERS

900.01 General

The following Design Criteria are summarized herein to establish practical, uniform design of sanitary sewers within the Village. These criteria cover design factors and approved guidelines for evaluation of plans and specifications by the political subdivisions having jurisdiction over the review of plans and specifications. These design factors are consistent with the requirements of the OEPA. If these Design Criteria should conflict in the future with the requirements of the OEPA, these criteria shall be modified to conform to their requirements. These Design Criteria are also intended to conform to the Village Standard Drawings for sanitary sewers.

900.02 Basis of Design

The basis of design shall be the Manning Formula. This is used to calculate the capacity of a pipe flowing full:

$$Q = \frac{1.486}{n} R^{2/3} S^{1/2} A$$

Q = Flow in cfs
A = Area of cross section - square feet
n = Coefficient of roughness (n = 0.013)
R = Hydraulic Radius - feet
S = Slope in ft/ft

900.03 Maximum Depth of Flow

Recommended design practices limit the depth of flow in a sanitary sewer. The maximum depth of flow should be equal to or less than 0.8 of the diameter of the pipe.

900.04 Average Daily Flow

The average daily flow shall be 100 gallons per capita per day and includes normal infiltration.

900.05 Population Density

The average household consists of 4 persons. Therefore, for design purposes, there would be 4 capita per equivalent single-family dwelling.

900.06 Peak Design Flow

Sanitary sewers shall be designed on a peak design flow basis using one of the following methods:

1. The ratio of peak average flow (ADF).

2. Values established from the infiltration/inflow study approved by the OEPA.

3. Values obtained from the flow records of a similar facility over a period of time sufficient to establish with a reasonable degree of reliability the relationship between average dry weather flow and peak design flow.

4. Peak flows as determined by the Great Lakes Upper Mississippi River Board (GLUMRB) (Ten States Standards), latest version.

Use of other values for peak design flow will be considered, if justified, on the basis of extensive documentation.

SUGGESTED SEWAGE FLOW GUIDE

ESTIMATED SEWAGE FLOW (ADF)

WASTEWATER SOURCE	GALLONS PER DAY	LITERS PER DAY
Airports		
Per Employee	20	76
Per Passenger	5	19
Apartments		
One Bedroom	250	947
Two Bedrooms	300	1,137
Three Bedrooms	350	1,326
Assembly Halls		
Per Seat	2	8
Bowling Alleys (no food service)		
Per Lane	75	284
Camps		
Individual bath units - per units	50	189
Central Bathhouse - per person	35	133
Car Wash (per car, no recycling)	80	304
Churches		
Small - per sanctuary seat	3-5	11-19
Large with kitchen-per sanctuary seat	5-7	19-27
Country Clubs (including food service)		
Per member	50	189
Dance Halls		
Per person	2	9
Factories		
No showers - per employee	25	95
With showers - per employee	35	133
Family Dwellings		
Per person	100	379

*Food Service Operations

Ordinary Restaurant		
(not 24 hour) per seat	35	133
24-hour Restaurant	50	189

*The listed estimated sewage flows are to be used for the design of sewers and should not be used for the design of treatment units.

Banquet Rooms - per seat	5	19
Restaurant along freeway - per seat	100	379
Tavern (very little food service) per seat	35	133
Curb Service (drive in) - per car space	50	189
Vending Machine Restaurants - per seat	35	133
Highway Rest Areas		
Per Car	1-9	4-34
Hospitals		
No resident personnel - per bed	300	1,137
Institutions		
Residents - per bed	100	379
Laundries		
Coin operated - per machine		
(Standard size machine)	400	1,137
Motels		
Per Unit	100	379
Nursing and Rest Homes		
Per patient	150	568
Per resident employee	100	379
Office Buildings		
(exclusive of cafeteria or kitchen)		
Per employee per shift	20	76
Parks		
With toilet facility - per person	5	19
With showers, bathhouse, toilets- per person	10	38

Schools		
Elementary		
(not incl. showers or cafeteria) - per pupil	10	38
High and Junior High		
(not including showers or cafeteria)		
- per pupil	15	57
Add for cafeteria - per pupil	5	19
Add for showers - per pupil	5	19
Service Stations		
First bay	1,000	3,789
Each additional bay	500	1,895
Shopping Centers		
(without food service or laundries)	0.2 per	8 per
-per area of floor space	sq. ft.	sq. meter
Stores		
Per toilet per shift	400	1,516
Swimming Pool		
(average with hot water shower)		
- per swimmer (design load)	3-5	11-19
Theaters		
Drive-In Movies - per car space	5	19
Movie - per seat	5	19
Trailer Parks		
Per trailer space	300	1,137
Travel Trailer Dumping Stations		
At service station	Consult District Office of OEPA	
Travel Trailer Parks and Camps		
- Per trailer or tent space	125	474
Vacation Cottage		
- Per person	50	189
Youth and Recreation Camps		
- Per person	50	189

900.07 <u>Minimum Velocity</u>

All sanitary sewers shall be designed to give a mean velocity of at least 2.0 feet per second, when flowing full, based on Manning's Formula using an "n" value of 0.013. Use of other "n" values will be considered, if deemed justifiable, on the basis of extensive field data.

900.08 Maximum Velocity

The maximum velocity shall be 15 feet per second. If the velocity is greater than 15 feet per second, provisions should be made to protect against displacement.

900.09 Minimum Grades

All sanitary sewers shall be designed to give a mean velocity of at least 2.0 feet per second when flowing full based on Manning's Formula. Values of "n" to be used with the Manning Formula vary from 0.010 to 0.015 with 0.013 recommended. Use of "n" values other than 0.013 may be considered, if justified. Use of formulas other than Manning's Formula may be accepted. If plans are recommended for approval with a slope less than the minimum, the consulting Engineer must show justification for the recommendation and obtain approval from OEPA. See Table 9.1.

TABLE 9.1

REQUIRED MINIMUM SLOPE

Based on "n" Value of 0.013
Sewer Sizes - 8 through 36 inches

Sewer Size	Minimum Slope in Feet Per 100 Feet
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24	0.08
27	0.067
30	0.058
36	0.046

900.10 Sanitary Sewers

In general, the minimum size of sanitary sewers shall be 8 inches. However, 6-inch sanitary sewers may be used as private lateral sewers for apartments, camps, schools, restaurants, and other semi-public operations, provided their hydraulic capacity is not exceeded because of short run-off periods (high peak flows).

The lateral connections shall be premium joint construction and should be made of the same material as the street sewer whenever possible to minimize infiltration from the connection between the street main and house lateral. When joint material and/or dimensions are not compatible, a commercial adapter shall be provided.

900.11 House Laterals

Minimum of 4-inch sewer pipe may be used for house connections. The cover over the lateral coming out of the house shall be a minimum 3-foot depth. The house connections shall be of premium joint construction and made of PVC schedule 40 pipe or SDR 35. Cleanouts are required outside all structures or units and at property lines. In multi-tenant buildings, individual services shall be provided to a common pipe, then to the main. Individual water meters shall be used for separate sanitary sewers. When joint material and/or dimensions are not compatible, a commercial adapter shall be provided. A copy of an ordinance or regulation requiring this type of construction must be on file with OEPA district office or submitted with all sewer plans to receive approval.

900.12 Invert Drop in Manhole

When a smaller sewer discharges into a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient. An approximate method for securing this result is to place the 0.8 depth point of both sewers at the same elevation or matching the top elevation of the pipes. When a larger sewer discharges into a smaller, the invert of the smaller should not be raised to maintain the same energy gradient.

900.13 Illegal Connections

Roof drains, foundation drains, sump pumps, yard drains, and all other clear water connections to the sanitary sewer are prohibited.

There shall be no physical connection between a public or private potable water supply system and a sewer or appurtenances thereto which would permit the passage of any sewage or polluted water into the potable supply.

900.14 Horizontal Separation

If possible, sanitary sewers and sewage force mains should be laid with at least a 10-foot horizontal separation from any water main.

900.15 Vertical Separation

Sewers (or sewage force main) may be laid closer than 10 feet to a water main if it is laid in a separate trench and elevation of the crown of the sewer (or sewer force main) is at least 18 inches below the bottom of the water main. If it is impossible to maintain the 18-inch vertical separation when the sewer is laid closer than 10 feet to the water main, the sanitary sewer should be constructed of (or encased in) water main type materials which will withstand a 50 psi water pressure test.

If a sewage force main is laid closer than 10 feet to a water main, in no case should the sewage force main be laid such that the crown of the sewage force main is less than 18 inches below the water main.

900.16 Crossing Utilities

Whenever a sanitary sewer and water main must cross, the sewer shall be laid at such an elevation that the crown of the sewer is at least 18 inches below the bottom of the water main. If it is absolutely impossible to maintain the 18-inch vertical separation, the sanitary sewer should be constructed of (or encased in) water main type material which will withstand a 50-psi water pressure test for a distance of 10 feet on both sides of the water main.

Whenever a sewage force main and water main must cross, the sewage force main shall be at least 18 inches below the bottom of the water main.

900.17 Parallel Installation

Sanitary sewers and manholes should be laid with at least 10 feet, measured from edge to edge, horizontal separation from any water main. If separation can not be maintained, the sanitary sewer shall be constructed to water main standards.

900.18 Manholes

Manholes shall be installed at the end of each line; at all changes in grade, size, and alignment; and at all pipe intersections. Manholes shall be installed at a distance not greater than 400 feet. Greater spacing may be allowed in larger sewers and in those carrying a settled effluent.

Manholes may be either poured in place or pre-cast concrete. Concrete construction shall conform to ASTM C-478 with joints between sections conforming to ASTM C-443.

The flow channel through manholes should be made to conform in shape, slope, and smoothness to that of the sewers.

All manhole covers shall be adjusted to grade by the use of no more than 12 inches of pre-cast concrete adjusting collars. In areas outside the pavement, the manhole casting should be adjusted so that the top is slightly above grade to prevent the entrance of the surface water.

900.19 Manhole Minimum Diameter

Manholes shall be constructed large enough to allow access to the sewer. The minimum diameter of manholes shall be 48 inches. Where manhole diameters of greater than 48 inches are used to accommodate the sewer pipes, the manhole shall be returned to 48-inch diameter as soon as practical above the sewer crown. Manhole openings 24 inches or larger are required for easier access with safety equipment to facilitate maintenance.

900.20 Manhole Water Tightness

Manholes shall be constructed to permit casting adjustments by use of cast-in-place or pre-cast concrete adjusting collars not to exceed 12 inches in height. Solid manhole covers shall be used in all pavement locations. In other areas, the manhole casting shall be adjusted so the top of the manhole cover is slightly above grade to prevent the entrance of the surface water. In areas subject to flooding, secured watertight and solid manhole covers should be used. All manhole covers, seating frames, and adapter rings shall be machined to a firm and even bearing to provide a true fit into the frames. Manholes shall be installed with chimney seals and water tight dishes.

Inlet and outlet pipes should be joined to the manhole with a gasketed and/or flexible watertight connection meeting ASTM Specification C-443. Where three or more manholes in sequence are to be constructed with solid, watertight covers, adequate ventilation shall be provided.

900.21 Flow Channel

The invert of the lowest pipe entering a manhole shall be at least 3 inches (75 mm) above the top of the base slab so that the sewer flow channel maybe installed and shaped when channel is not precast. The flow channel through the manholes should be made to conform in shape, slope, and smoothness to that of the sewers.

Cut pipe shall not extend beyond the inside face of the manhole wall. Concrete placed inside the manhole to form the channel through the manhole shall not be placed between the pipe and the opening so as to interfere in any way with the flexibility of the joint.

900.22 Drop Manholes

Drop manholes shall be used when the invert of the inflow sewer is 2.0 feet or higher than the manhole invert. When this difference of elevation is less than 2.0 feet, the manhole invert shall be filled and channeled to prevent solids deposition.

Due to the unequal earth pressure that would result from the backfilling operation in the vicinity of the manhole, the entire outside drop connection shall be encased in concrete.

Drop manholes shall be constructed with outside drop connection, except where such connections are not practical. Inside drop connection to be used only with the approval of the Village. Manholes located in isolated areas should be provided with bolted covers for safety and to discourage vandalism.

900.23 Test Inspection

The leakage and deflection tests are to be carried out by the contractor and witnessed and certified by the Village officials and/or their representative.

All pipe which does not meet the testing requirements must be repaired and retested until it meets the requirements.

900.24 Railroad and Highway Crossings

When boring is required, the casing pipe shall be designed to meet the requirements of the authority having jurisdiction and in compliance with the Village of Versailles Construction Standards and Drawings. The size of the casing pipe shall be at least 4 inches greater than the largest outside diameter of the sewer pipe, joints, or couplings.

900.25 Stream Crossings

A. Location of sewers in streams

1. Cover depth

The top of all sewers entering or crossing streams shall be at a sufficient depth below the natural bottom of the streambed to protect the sewer line. In general, the following cover requirements must be met:

a) One foot of cover where the sewer is located in rock.
b) Three feet of cover in other material. In major streams, more than 3 feet of cover may be required.
c) In paved stream channels, the top of the sewer line should be placed below the bottom of the channel pavement.

Less cover will be approved only if the proposed sewer crossing will not interfere with the future improvements to the stream channel. Reasons for requesting less cover shall be provided in the project proposal.

2. Horizontal Location

Sewers located along streams shall be located outside of the streambed and sufficiently removed therefrom to provide for future possible stream widening and to prevent pollution by siltation during construction.

3. Structures

The sewer outfall, headwalls, manholes, gate boxes, or other structures shall be located so they do not interfere with the free discharge of flow through the stream.

4. Alignment

Sewer crossing streams should be designed to cross the stream as nearly perpendicular to the stream flow as possible and shall be free from change in grade. Sewer systems shall be designed to minimize the number of stream crossings.

B. Construction

1. Materials

Sewers entering or crossing streams shall be constructed of ductile iron pipe with mechanical joints; otherwise they shall be constructed so they will remain watertight and free from changes in alignment or grades. Material used to backfill the trench shall be stone, course aggregate, washed gravel, or other materials which will not readily erode, cause siltation, damage pipe during placement, or corrode the pipe.

2. Siltation and Erosion

Construction methods that will minimize siltation and erosion shall be employed. The design engineer shall include in the project specifications the method(s) to be employed in the construction of sewers in or near streams. Such methods shall provide adequate control of siltation and erosion by limiting unnecessary excavation, disturbing or uprooting trees and vegetation, dumping of soil or debris, or pumping silt-laden water into the stream. Specifications shall require that cleanup, grading, seeding, and planting or restoration of all work areas shall begin immediately. Exposed areas shall not remain unprotected for more than seven days.

900.26 Sewage Pumping Stations

A. General

1. When sewage pump stations are required, they shall be designed and installed per the following standards:

   a) Great Lakes Upper Mississippi River Board (GLUMRB) (Ten States Standards) "Recommended Standards for Wastewater Facilities", latest version.
   b) OEPA's latest requirements.
   c) Village of Versailles Design Criteria and Standard Construction Drawings.
   d) All other applicable codes and regulations.

2. Flooding

   The wastewater pumping station structures and electrical and mechanical equipment shall be protected from physical damage by the 100-year flood. Wastewater pumping stations should remain fully operational and accessible during the 25-year flood. Regulations of state and federal agencies regarding floodplain obstructions shall be followed.

B. Pump Station Type & Standard Requirements

Listed below are the standard requirements for pump stations in the Village. However, it is realized that certain situations may require other types of pump stations. It is highly recommended that early preliminary pumping station plans be submitted to the Village for their approval prior to beginning final engineering.

1. Type

   Submersible Pump Stations with separate wet well and valve chamber are preferred by the Village.

2. Pump Type

   Submersible explosion-proof pumps manufactured by Barnes Pumps Inc. capable of pumping raw, unscreened sewage, 3-inch spherical solids, and stringy materials typical of domestic sewage will be required. Multiple pumps shall be provided.

3. Electrical Installation

   a) All electrical installations and components shall be designed and installed per the National Electric Code (NEC) and all other electrical codes.
   b) All equipment and components shall be housed in NEMA 4X stainless steel enclosures.

c) Controls and other equipment shall be Cutler-Hammer, or equivalent, as approved by the Engineer.
d) The cabinet shall be provided with a removable backplate on which all the components shall be mounted, with the exception of the H-O-A switches. The pump run lights shall be located on the outside door of the enclosure.
e) The pump control panel shall contain a circuit breaker, magnetic starter, hand-and-off-auto-selector-switch, run light, and seal leak indicating light for each pump.
f) There shall be furnished atop the control panel enclosure, a high-water alarm flashing red light.

4. Liquid Level Control

The pumps are to be controlled by four mercury float switches, with brackets fastened inside the wet well.

5. Alarm Appurtenances

a) Alarm signal shall be initiated by liquid level control system which shall be connected to a telemetering alarm system.
b) Power failure relay: Provide relay with N.O. contacts for hook up to a telephone line to be de-energized and contacts closed when power to station is interrupted.
c) High wet well level alarm: Provide high-water alarm for hook up to the telemetering system.

6. Guide System

a) System Design

1) Permit removal of pumping units for inspection or service without dewatering wet well or interrupting operation of other pump equipment.
2) Pumps, when lowered into place, to be automatically connected to discharge piping with positive seal.
3) Incorporate fabricated aluminum access frame with provisions for mounting guide rails and hooks to retain pump cables.

b) Guide Rails

Two lengths of stainless steel pipe with pilots; 2-inch Schedule 40, stainless steel (304) size per pump manufacturer's recommendation. Top and bottom pilots shall be Class 30 cast iron with flake glass/polyester coating.

c) Pump Guides

1) Fabricated from bronze for spark proof operation.
2) Attached to pump volute with 316 stainless steel hex head cap screws.

d) Lift Chain

Lift chain shall be 304 stainless steel, size to support pump with 4 to 1 safety factor.

7. Valve Pit

a) Valve pit structure (minimum 6-foot diameter) shall be constructed of pre-cast concrete sections conforming to ASTM C-478.

b) Valve Pit Access

1) An aluminum access door and frame assembly shall be installed in the top slab. Minimum size shall be 36" x 36" unless larger is required by the Village.
2) The door shall have a handle, latch in the open position, and have a hasp for a padlock. Surface shall be non-skid, diamond tread.

c) Valve Pit Drain

The valve pit floor shall be sloped to drain with a 3-inch drain pipe and check valve at the wet well as shown on the plans.

8. Wet Well Structure

a) The wet well (minimum 6-foot diameter) shall be constructed of precast concrete sections conforming to ASTM C-478.

b) Wet Well Access

The door shall be of aluminum construction and have a handle, latch in the open position, and have a hasp for padlock. Surface shall be non-skid, diamond tread. Minimum size shall be 36" x 36" unless larger is required by the Village.

c) Vent

A vent with screen shall be installed in the top slab.

d) Hoist Stand

A hoist stand to fit existing pump hoist shall be mounted to the top slab to assure easy pump removal.

9. Piping and Valves

   a) Materials

      All piping and fittings beginning after the hydraulic sealing flange unit shall be 4-inch diameter ductile iron pipe with flanged joints. Pipe joints shall be flanged and conform with ANSI Specification A21.10 (AWWA C110) for cast iron pipe flanges and flanged fittings, Class 125.

   b) Valves

      1) Check valves to be 4 inch with outside lever and weight. Valves to be rated for 175 psi water working pressure and 350 psi hydrostatic test pressure.
      2) Eccentric plug valve to be 4 inch, specifically designed for sewage applications with 100% port opening. Valve to have cast iron with Buna-N rubber coating to minimize wear and corrosion. Seat rings to seal at 175 psi. Valves to have flanged ends (ANSI B16.1) and nut operator.
      3) A guide disconnect assembly as shown on the plans shall be installed in the valve pit.

900.27 Force Mains

A. Velocity and Diameter

At design pumping rates, a cleansing velocity of at least 2 feet per second should be maintained. The minimum force main diameter for raw wastewater shall be 4 inches.

B. Air and Vacuum Relief Valve

An air relief valve shall be placed at high points in the force main to prevent air locking. Vacuum relief valves may be necessary to relieve negative pressures on force mains. The force main configuration and head conditions should be evaluated as to the need for and placement of vacuum relief valves. Force mains shall be installed to keep high points and low points to a minimum.

C. Termination

Force mains should enter the gravity sewer system at a point not more than 2 feet above the flow line of the receiving manhole.

D. Pipe and Design Pressure

Pipe and joints shall be equal to water main strength material suitable for design conditions. The force main, reaction blocking, and station piping shall be designed to withstand water hammer pressures and associated cyclic reversal of stresses that are expected with the cycling of wastewater pump stations.

E. Design Friction Losses

Friction losses through force mains shall be based on the Hazen and Williams formula or other acceptable methods. When the Hazen and Williams formula is used, the value of "C" shall be 100 for unlined iron or steel pipe for design. For other smooth pipe materials such as PVC, lined ductile iron, etc., a higher "C" value not to exceed 120 may be allowed for design.

F. Identification

Where force mains are constructed of material which might cause the force main to be confused with potable water mains, the force main shall be appropriately identified.

G. Leakage Testing

Leakage tests shall be required per the water main testing requirements as shown in the Village of Versailles Standard Construction Drawings.

H. Cleaning of the Force Main

All force mains shall include sealed cleanouts for cleaning purposes at a maximum spacing of 600 feet or as approved by the Village.