

NOTICE OF MEETING AND PLANNING COMMISSION AGENDA



CITY OF OSAGE BEACH PLANNING COMMISSION MEETING

1000 City Parkway
Osage Beach, MO 65065
573.302.2000
www.osagebeach.org

TENTATIVE AGENDA

REGULAR MEETING

June 11, 2024 - 6:00 PM
CITY HALL

**** Note:** All cell phones should be turned off or on a silent tone only. Complete meeting packets are available on the City's website at www.osagebeach.org.

CALL TO ORDER

PLEDGE OF ALLEGIANCE

ROLL CALL

APPROVAL OF MINUTES

- A. Motion to Minutes - March 12, 2024

NEW BUSINESS

- A. Motion to recommend to Board of Aldermen approval of Design Guidelines

REPORTS

ADJOURN

Remote viewing link:

Representatives of the news media may obtain copies of this notice by contacting the following:

Tara Berreth, City Clerk
1000 City Parkway
Osage Beach, MO 65065
573.302.2000 x 1020

If any member of the public requires a specific accommodation as addressed by the Americans with Disabilities Act, please contact the City Clerk's Office forty-eight (48) hours in advance of the meeting at the above telephone number.

**THE CITY OF OSAGE BEACH, MISSOURI
PLANNING COMMISSION MINUTES OF THE REGULAR MEETING**

CALL TO ORDER

Chairman Susan Ebling called the Planning Commission of the City of Osage Beach, Missouri to order at the regular meeting on March 12, 2024, at 5:30 pm at City Hall.

ROLL CALL

The following Commissioners were present: Bill Morgan, Alan Blair, Angie Schuster, Chad Kautz, Mayor Michael Harmison, Chairman Susan Ebling and Absent were Alderman Bob O'Steen and Bill Mackey .

NEW BUSINESS

Rezoning Case 423 WFO Watersports, LLC.

<u>Date:</u>	March 12, 2024	<u>Case Number:</u>	323
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Applicant: WFO Watersports, LLC.

Location: 4415 Sky Harbor Drive

Petition: Entertainment Overlay E-3 for the ability to rent personal watercraft on the property.

Existing Use: Vacant Commercial Property

Zoning: C-1

Tract Size: 1.09 acres

	<u>Surrounding Zoning:</u>	<u>Surrounding Land Use:</u>
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<u>North:</u>	LU Lake Use	Lake of the Ozarks
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<u>South:</u>	R-1b Residential	Vacant Residential
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<u>East:</u>	C-1 Commercial	Vacant Commercial
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<u>West:</u>	C-1 Commercial Lake Use	Mixed Uses
	R-1 Residential	

The Osage Beach Comprehensive Plan Designates this area as appropriate for: Heavy Traffic Commercial.

Citywide

May 1984

Utilities

Water: City **Gas:** none
Electricity: Ameren **Sewer:** City

Access: _____ Property has access off Sky Harbor Drive.

Analysis:

1. The applicants are the owners of the 1.09-acre parcel in question. The request is to allow the rental of personal watercraft from a new dock structure that will be attached to the property once approved by Ameren UE.
2. Recognizing past incompatibility problems with similar uses and less intense uses, the City adopted Ordinance 96.21, which regulates all uses with outdoor entertainment overlay zoning requirements.
3. Currently, the applicants use the property for boat rentals, which, by ordinance, does not require an entertainment overlay. The requested addition of personal watercraft rentals does, however, require the addition of an E Overlay.

Department Comments:

The primary intent of E-zones is to regulate outdoor activities that could adversely affect adjacent properties, both commercial and residential. My understanding of the reason that the City chose to require an E Overlay, for PWC rental back in 1996, was that the patrons who rented the PWC were more likely to stay close to the location where the rental took place. The ideology was that, because of this fact, PWC rentals could have a more adverse effect on that specific cove and the properties that fronted the lake within that specific area. The difference that we see now, as compared to 1996, is that this cove, like many others, is now a “No Wake” cove. This, of course, requires all watercraft to proceed through the cove at idle speeds. The “No Wake” requirement completely changes the impact that a PWC can have on the surrounding properties. Customers renting from the subject location will now take the PWC out to the main channel to take advantage of their time.

With this property’s location in a cove that contains commercial uses and the properties current use as a watercraft rental facility, **staff would recommend that this request be approved subject to the following provisions and conditions:**

Permitted Uses: The ability to rent a maximum of six (6) personal watercraft from the subject property.

Parking: Any new parking facility required to accommodate the proposed use, will need to be built in conformance with City Code.

Signage: The applicant will be required to get a sign permit for any additional signage that will be needed.

Exterior Lighting: Any additional lighting proposed as part of this activity, must be shielded to direct light inward and not increase light intensity within adjoining properties.

Landscaping: A minimum of 5 percent of the areas devoted to parking must be left in open lawn or landscaped areas.

Final Development Plan: The site plan submitted with the application is sufficient for the final development plan.

Commissioner Morgan made a motion to recommend the approval of Rezoning Case 423 WFO Watersports, LLC. to the Board of Aldermen. This motion was seconded by Commissioner Blair. Motion passes with a roll call vote.

Adjourn

Chairman Ebling closed the meeting at 5:50pm.

I, Cary Patterson, City Planner for the City of Osage Beach, Missouri, do hereby certify that the above foregoing is a true and complete journal of proceedings of the regular meeting of the Planning Commission of the City of Osage Beach, Missouri, held on March 12, 2024.

Tara Berreth/City Clerk

Angie Schuster/Planning Commission Secretary

City of Osage Beach
Agenda Item Summary

Date of Meeting: June 11, 2024
Originator: Tara Berreth, City Clerk
Presenter: Mike Welty, Assistant City Administrator

Agenda Item:

Motion to recommend to Board of Aldermen approval of Design Guidelines

Requested Action:

Motion to Approve

Ordinance Referenced for Action:

Not Applicable

Deadline for Action:

Not Applicable

Budgeted Item:

Not Applicable

Budget Line Information (if applicable):

Not Applicable

Department Comments and Recommendation:

Comprehensive changes to all sections of the design guidelines that provide updates to construction processes and types of materials used that are preferred by the City and that meet industry standards. Attached you will find relined versions of all sections. Also, there is a document at the end that details everything that was removed and why.

We will have one of the City's engineers present at the meeting for questions concerning any of these changes.

I recommend approval.

City Attorney Comments:

Not Applicable

City Administrator Comments:

Not Applicable

Design Guideline
City of Osage Beach
SECTION 2 – WATER SYSTEM

(Revised 26 OCT 2004-JCB)

OVERVIEW

The City of Osage Beach is authorized to construct, operate, and maintain a water system to serve the inhabitants, business establishments, and infrastructure needs of the city by Title VII Utilities of the City Code. The city water system is operated under license of the Missouri Department of Natural Resources (MDNR), Drinking Water Division as authorized under 10 CSR 60-3 and 10 CSR –10 of the Missouri Safe Drinking Water Act and the Missouri Public Drinking Water Regulations. The purpose of this guideline is to establish design policy and guidance for the design and construction of the city water system.

The design, construction, and operation of the city water system will conform to the requirements of the MDNR regulations, standards, and policies, the City of Osage Beach Design Guideline, and the applicable provisions of the International Plumbing Code and the International Building Code and with reference to requirements of the International Fire Code and the recommendations of the Insurance Services Organization (ISO)

REFERENCED CITY ORINANCES

Chapter 400.110 Subdivision Regulations
Chapter 410.130 Contents (Location and design of water mains and appurtenances)
Chapter 410.190 Design Standards
Chapter 410.320 Waterlines
Chapter 505.010 Fire Protection Code
Chapter 705 Waterworks

GOALS AND OBJECTIVES

The basic goal of the City of Osage Beach is to provide an efficient, cost effective water system to supply the fire protection and drinking water needs of the city. This guideline will establish the basic parameters, design criterion, and material requirements for the system. The system will be designed to meet all of the appropriate standards for domestic water supply and to achieve a reasonable fire protection capability. The fire protection requirements will be developed in conjunction with the Osage Beach Fire Protection District.

OVERALL WATER SYSTEM STANDARDS AND CRITERION

The initial water system was designed by Archer Engineers offices in Lee Summit and Springfield, Missouri. A Water Master Plan was developed that establishes the basic requirement for the system. Essentially Osage Beach has two separate water systems, one on each side of the Grand Glaize Bridge. Basic requirements for the supply system are as follows:

Design Guideline
City of Osage Beach
SECTION 2 – WATER SYSTEM

EAST SIDE SYSTEM

	<u>1999</u>	<u>2019</u>	<u>Ultimate</u>
Average Daily Demand, gpd	433,000	845,000	1,015,000
Fire Fighting Demand, gpd	240,000	240,000	240,000
Required Storage, gpd	673,000	1,085,000	1,291,000
Available Storage:			
Columbia College, gpd	500,000		
Parkview Bay, gpd	150,000		
Bluff Tower, gpd (Future)		800,000	1,300,000
Required Water Supply, gpm	451	880	1,094
Water Supply Available:			
Columbia College No. 1, gpm	250	250	250
Columbia College No. 2, gpm	550	550	550
Passover Well No. 1, gpm	260*	260*	260*
Bluff No 1, gpm (Future)		500	500
Bluff No. 2, gpm (Future)			500
Total Available, gpm	800	1,300	1,800
*limited Service Area			

WESTSIDE SYSTEM

	<u>1999</u>	<u>2019</u>	<u>Ultimate</u>
Average Daily Demand, gpd	992,000	1,563,000	1,840,000
Fire Fighting Demand, gpd	240,000	240,000	240,000
Required Storage, gpd	1,232,000	1,803,000	2,089,000
Available Storage:			
Woodland Tower, gpd	(150,000)*	0	0
Swiss Village Tower, gpd	1,500,000	1,500,000	1,500,000
Future, gpd		800,000	800,000
Total Available	1,500,000	2,300,000	2,300,000
*Out of service – remove from service			
Water Supply Available:			
Swiss Village Well No. 1, gpm	550	550	550
Swiss Village Well No. 2, gpm	550	550	550
Woodland Cove Well, gpm	OTS*	0	0
Future Wells, gpm		1,000	1,000
Total Available, gpm	1,100	2,100	2,100
*OTS = Out of Service			

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SECTION 2 – WATER SYSTEM

The master plan requires chlorination and fluoridation of the water system. No further treatment is proposed at this time. The system will be added to and/or modified as necessary to assure full compliance with MDNR Regulations.

WATER DISTRIBUTION – BASIC DESIGN CRITERION

A. Fire Demand and Supply

1. Industrial, commercial, and multi-unit residential structures:
 - a. Provide not less than 2000 gpm at a residual pressure of 20 psi at each building site.
 - b. Provide two fire hydrants within 300 feet of each structure.
 - c. Provide one hydrant within 125 feet of each fire main entrance into the structure.
 - d. Provide fire main service to each structure with indicating type valve at the water main. Minimum size fire service line is four inches.
 - e. Minimum static pressure at each structure shall be 35 psi.
2. Residential and Undeveloped
 - a. Provide not less than 1000 gpm at a residual pressure of 20 psi.
 - b. Provide not less than one fire hydrant within 300 feet.
 - c. In the case of a structure or residence that is not connected to city water a fire hydrant must be available within 850 feet.
 - d. In undeveloped areas a fire hydrant shall be installed every 600 feet.

B. Fire Main Connections to Structures

1. Where required by the Osage Beach Fire District, NFPA and/or International Plumbing Code a fire main shall be extended into each building as a separate fire main. This entrance main shall be only for fire protection system use. No meters or valves are allowed between main and the building except for an indicating shut-off valve at the main. Shut-off valves installed on fire mains shall be of the indicating type that clearly shows if the valve is open or closed.

C. Water Distribution Mains

1. Water distribution mains shall be looped to the maximum extend feasible.
2. The MDNR standard for a minimum size main is eight inches. The city standard allows for six inch mains in residential areas where a fire flow of 1000 gpm at a residual pressure of 20 psi can be maintained.

Design Guideline
City of Osage Beach
SECTION 2 – WATER SYSTEM

3. The minimum size main allowable for domestic residential service is two inches so long as the main is less than 600 feet long, serves less than ten residences and fire protection is available within 300 ft.
4. The minimum static pressure for domestic service shall not be less than 35 psi.
5. A fire hydrant or blow-off valve shall be installed at the end of all water mains.
6. The maximum design flow velocity shall be 8 fps.
7. An isolation valve shall be installed at not less than every 1250 feet and:
 - a. At each branch main with one valve on the downstream main and one on the branch main.
 - b. At loop connections on each leg of the connecting loop.

Isolation valves shall be of the same nominal size as the main in which they are installed.

DOMESTIC SUPPLY CONNECTIONS AND METER POLICY

A. General Requirements for Customer Service Lines

1. City meter assemblies for single family residents and all 5/8 in. meter installations will not have a city owned backflow device installed.
2. Industrial and commercial connections and all meter installations of 1 in and larger shall have a city owned dual check device installed. This backflow device is exclusive of and specifically not intended for use in lieu of backflow devices required by the customer's use.
3. Materials used for customer service lines shall conform to materials specified herein.
4. All domestic services shall be metered.
5. Meters shall be sized in accordance with the following unless specifically directed otherwise by the City Engineer:

<u>Meter size</u>	<u>Meter Demand</u>	<u>Requirements</u>
5/8"x 3/4"	1 to 20 gpm	Single family residence with 2-1/2 baths, small commercial offices or retail establishments. Maximum continuous flow 10 gpm.
1"	3 to 50 gpm	Large residences, swimming pools, lawn irrigation for lawns less than 6000 SF, apartments and condos with less than 10 units, motels of less than 15 units, small to

Design Guideline
City of Osage Beach
SECTION 2 – WATER SYSTEM

		medium restaurants, commercial uses with maximum continuous demand less than 25 gpm.
1-1/2"	5 to 100 gpm	Apartments and condos of less than 30 units, motels of less than 35 units, commercial uses with maximum continuous demand of less than 50 gpm.
2"	8 to 160 gpm	Apartments and condo of less than 60 units, hotels with less than 70 units, commercial uses with maximum continuous demand less than 80 gpm.
3"	4 to 320 gpm	Commercial applications with continuous demand of less than 160 gpm
4"	6 to 500 gpm	Commercial use less than 250 gpm continuous flow (Compound Meter)
	10 to 1200 gpm	Municipal Use Only (Turbine Meter)
6"	20 to 2500 gpm	Municipal Use Only (Turbine Meter)

B. Meter Connection Policy

1. Single Family Residential, and small commercial connections
 - a. Each individually owned residence or business shall be connected through one meter and receive one billing. Generally single family residences and small businesses will be setup with a 5/8 inch meter. Individual owners shall confer with the City Engineer to determine appropriate size to meet their requirements.
 - b. Billing will be at the established monthly rate based upon water usage.
2. Multi-Family Residential Units
 - a. The general rule shall be one property, one billing. Multi-family residential units are billed on the basis of the number of units times the basic monthly rate plus the water usage over the base amount.
 - b. All multi-unit residential buildings that require a separate fire main and sprinkler system shall be constructed with a separate metered domestic supply line and a non-metered fire main entrance. The meter shall be sized to meet the demand requirements of the individual building. On properties with more than one building, each building shall be metered separately

Design Guideline
City of Osage Beach
SECTION 2 – WATER SYSTEM

3. Duplex Residential Units – Multiple Single Family Rental Units on one Property
 - a. The general rule is one owner of the property one meter. If there are multiple duplex or single family units on one property and individual fire service mains are not required to any of the buildings then the one owner – one meter rule applies. The billing shall be at the established monthly rate per unit plus the gallons used over 1000 gal. per unit billed at the established rate per 1000 gal.
 - b. In the case where each unit is individually owned then each unit shall be individually billed and metered. This specifically intended for duplex and single family cluster homes only.
4. All Non-Residential Properties with Fire Sprinkler Systems
 - a. At all locations where the structures require a separate fire main to the building each building shall have a separate, metered, domestic supply main.
 - b. One commercial property with multiple overnight lodging units (a motel or hotel) not requiring fire mains shall be metered by one-meter assembly and billed on the water use.
 - c. One commercial property with multiple commercial units without fire mains, with individual tenants, may be metered with one meter, or individually, as mutually determined by the owner and the City Engineer.
 - d. One property with mixed residential long term, overnight rental, and commercial enterprises, may be metered on one-meter assembly, or multiple meters, as determined by the City Engineer. Billing will be on a water use basis.
 - e. Where there are multiple buildings on one property that require fire main services, each building's domestic supply will be metered. All meters will be billed to the property owner.

C. Fire Main Connections

1. Fire main connections are required for all sprinkled buildings and structures. The owner/developer shall submit appropriate drawings and computations by a Registered Professional Engineer for approval. The owner/developer shall furnish all valves, fittings, and incidentals required to make the connection and shall employ a city approved contractor to perform the work.
2. Indicating shut-off valves shall be installed at the fire main connection to the water main.

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City of Osage Beach
SECTION 2 – WATER SYSTEM

D. City Ordinance 98.41 - Owner Furnished Backflow Preventer Assembly

1. Owner furnished backflow assemblies shall be licensed, furnished, installed, and maintained by the owner at the locations specified in City Code 705.470. Most of these will be for lawn sprinkler systems and the like.

Note: These units are required in addition to any dual check assembly installed by the city at the meter installation.

MATERIALS FOR WATERLINES AND APPURTENANCES

A. Water Mains

1. Mains four inches and larger:
 - a. Ductile Iron Pipe, AWWA C150 and C151, Class 350
 - 1) Cement mortar lined per AWWA C104
 - 2) Joints:
 - a) For buried pipe: push-on joints per AWWA C111
 - b) For exposed or interior: Flanged joints
 - b. PVC, AWWA C900 or C905, DR 14, Class 200
 - 1) Joints shall be push-on type rubber gasket
2. Mains 1-1/2 inches to three inches:
 - a. PVC, ASTM 2241, SDR 21, Class 200
 - 1) Joints shall be push-on type with rubber gasket
 - b. Schedule 40 PVC
 - 1) Joints shall be solvent welded

B. Water Meter Service Lines and City Service Lines two inch and less

1. HDPE AWWA C901, PE 3408, IDR 7, Class 200 for I.D. pipe, or DR 9, Class 200 for O.D. pipe.

C. Water Service Lines from meter to building (Privately Owned Lines Only)

1. These lines shall conform to the requirements of the International Plumbing Code.
2. Materials may be of the owner choice.

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City of Osage Beach
SECTION 2 – WATER SYSTEM

D. Water Fittings and Adapters Ductile Iron and PVC

1. 4 inches and Larger:

a. Fittings:

- 1) Ductile iron fittings, cement mortar lined, conforming to AWWA C150 or C151.
- 2) All buried or flooded locations shall use mechanical joint pipe and fittings.
- 3) Flanged fittings shall be provided for flanged pipe (above ground installations only). Faces shall be coated with rust Protective coating.
- 4) Cement mortar lined pipe and fittings shall be coated with coal tar epoxy paint a minimum thickness of 24 mils.

b. Flanged Coupling Adapters:

- 1) Shall be Ford 193, Smith-Blair 913, Rockwell 913, or approved equal.
- 2) Bolts shall be Stainless Steel, Type 216.
- 3) Minimum rated operating pressure to match the line in which installed.

c. Joint Restraints:

- 1) Shall be Ford Style FR, Uni-Flange 1300 Series, or approved equal.
- 2) Approved concrete thrust blocks required.

2. For pipe 1-1/2 inches to 3 inches:

a. Fittings:

- 1) For ASTM 2241, SDR 21, Class 200 fittings shall be approved by the City Engineer.
- 2) PVC Schedule 40 shall have PVC Schedule 80 fittings.

b. Coupling Adapters:

- 1) Ford Style FC or approved equal

3. For PE Pipe – 2 inches or less:

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- a. Shall be Ford CTS Pack Joint Couplings for PE Pipe rated at the same pressure class as the pipe in which they are to be installed, or approved equal.
- E. Waterline Valves and Valve Boxes (for Valve 2 in. and larger):
1. Shall be iron body, non-rising stem, resilient wedge, gate valves with stainless steel bolts, and shall be epoxy paint coated.
 2. Valves shall be by Mueller, Clow, or M&H, or approved equal
 3. Valve Boxes shall be cast iron bonnet, PVC riser, with cast iron top and cover marked "water".
 4. Check Valves shall be similar and equal to Clow Valve Company horizontal swing check valves for 2 inch through 12 inch valves.
- F. Fire Hydrants
1. Fire hydrants shall be Mueller Super Centurion 250 or Clow Medallion with 4-1/2 inch pumper inlet, and two 2-1/2 hose connections. Hydrants shall be fully compatible with the requirements of the Osage Beach Fire Protection District.
 2. Fire hydrants shall be painted red with epoxy coating as approved by the City Engineer.
- G. Blow-Off Assembly
1. Post Hydrants shall be non-freezing, self draining type with a minimum 36" cover to the main. Hydrants shall be furnished with a 2" FIP inlet, a NOT-Turning operating rod, and shall open to the left. All working parts shall be Bronze-to-Bronze design. The outlet shall also be Bronze and be 2 1/2" NST. Hydrants shall be lockable to prevent unauthorized use.
 2. Hydrant shall be as manufactured by Kupferle Foundry Co., St. Louis, MO, or approved equal.
- H. Water Meter Assemblies:
1. 5/8 and 1 in. Residential Meters:
 - a. Tapping saddle shall be Ford Brass Saddles Style S90, min. 1 inch.
 - b. Corporation Stop shall be Ford or Ford Ballcorp F(B)1000 Series, with pack joint for PE pipe.
 - c. Meter Setter shall Be Ford 70 Series Coppersetter, tandem yoke, with lockable angle valve, spreader bar, and CTS pack joint.
Do not place dual check assembly on residential service lines.
 - d. Meter Vault shall be ADS N-12 corrugated plastic of appropriate size (min. 20 in.), with Ford Wabash lid cover with Clay & Bailey extension ring.

Design Guideline
City of Osage Beach
SECTION 2 – WATER SYSTEM

2. 1, 1-1/2, and 2 in. Meters for Commercial or Multi-family Residential Use:
 - a. Tapping saddle shall be Ford Brass Saddles Style S90, min. 1 inch for 1 inch meters and 2 inch for all larger.
 - b. Corporation Stop shall be Ford or Ford Ballcorp F(B)1000 Series, with pack joint for PE pipe.
 - c. Meter Setter shall Be Ford 70 Series Coppersetter, tandem yoke, with lockable angle valve, spreader bar, dual check assembly, and CTS pack joint.
Do not place dual check assembly on single family residential service lines.
 - d. Meter Vault shall be ADS N-12 corrugated plastic of appropriate size (min. 20 in.), with Ford Wabash lid cover with Clay & Bailey extension ring.
3. Meter larger than two inch.
 - a. Tap, valves, fittings, and meter service line shall be not less than 2 in. and shall be equal to or one size larger than the building service line. The meter, pressure reducing valve, and dual check backflow assembly may be one size smaller than the meter service line (i.e. 4 in. tap, 4 in. gate valve, 4 in. meter service line, 3 in. meter, 3 in. PRV, 3 in. dual check assembly, 4 in stub-out for building service line).
 - b. Tapping sleeve shall be Ford Style FAST, stainless steel flange.
 - c. Gate Valve shall be as specified above.
 - d. Fittings and flanged coupling adapters as specified above.
 - e. Pressure Reducing Valve shall be CLA-VAL Series 690, ductile iron body, pressure class 250.
 - f. Back-flow Assemblies shall be CLA-VAL Model DC7L dual check valves, Class 250.

WATERLINE AND APPURTENANCE INSTALLATION REQUIREMENTS

A. Waterline Installation

1. The minimum depth of cover is 36 in. above the top of the pipe.
2. The maximum depth of cover for waterlines is eight (8) ft. unless specifically authorized in writing by the City Engineer.
3. Green or Blue minimum four inch wide marking tape marked “waterline below” shall installed twelve inches above all waterlines.

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4. No. 12 solid copper toning wire shall be installed three inches above all city owned waterlines and shall be extended to all valves, hydrants, metersets, and terminus points.
5. Bedding shall be installed around the pipe from 6 inches below to 12 inches above the pipe. Bedding shall be nominal ½ inch minus crushed rock conforming to MoDOT Section 1004, Grade D, Chat, or pea-gravel, or Osage River Sand. Any material used shall have a PI of six or less.
6. Waterlines shall be separated by a minimum of 18 inches vertically and 10 feet horizontally from sanitary/storm sewer lines or sanitary/sewer sewer line appurtenances unless:
 - a. At crossings the water or sewer has an encasement to a point ten feet on either side of the sewer/water line crossing as appropriate. No joints shall occur in either the water or sewer line within the 20 ft. area. The encasement may be a free draining sleeve or an impervious concrete encasement a minimum of 12 in. thick.
 - b. For parallel lines closer than ten feet, exceptions can be made with prior approval of the City Engineer. Generally, this will require a separate trench with water main 18 inches above the sewer, or a benched trench with water 18 inches above the sewer or the waterline must be above and encased in a free draining sleeve drained to daylight.
7. Primary power lines of 480 volts or higher shall not be placed in the same trench with any other utility. See Section 6 Road Cuts, Utility Trenches, and Excavation.
8. Secondary power may be installed in an offset trench with water lines. See Section 6 Road Cuts, Utility Trenches, and Excavation.

B. Valve Locations

1. To the maximum extent practicable locate isolation and shut-off valve outside of roadways and paved surfaces.
2. When valves must be located within roadways and paved surfaces a cast or ductile iron valve box with valve box cover marked “water”. The box shall be flush with the pavement to ¼ in. below the finished pavement surface. The cover shall be set in a minimum 6 in. deep by 18 in. square concrete pad.

C. Water Meter Locations

Design Guideline
City of Osage Beach
SECTION 2 – WATER SYSTEM

1. As a general case water meters will be located on the customer's property immediately inside the property line from the city roadway or platted roadway property line.
2. Meters will be set in traffic type boxes only with prior written consent of the City Engineer. If property owners require that the meter box be placed in a location where a traffic type box is required they will be required to pay for the additional cost of the traffic type box and, if necessary, the remote location of the meter antenna.

D. Installation of Meter Assembly:

1. Residential and commercial hookup – 5/8 inch through 1 inch:
 - a. The City will furnish the water tap, valve cock, meter service line, meter, pressure-reducing valve, and meter pit and install all parts except the meter pit.
 - b. The owner must provide and install the residential service line.
 - c. The owner shall expose the water main, accomplish all necessary excavation, backfill and cleanup. City personnel or a designated contractor will make the tap. The owner shall connect the residential service line to the meter set and install the city furnished meter pit.
 - d. The meter installation shall be as detailed in the attached Typical Meter Installation Detail.
2. Residential and commercial hookup – 1-1/2 inch and 2 inch:
 - a. The Owner shall furnish and install the tap, meter service line, meterset, lockable shut-off valve, dual check assembly, pressure reducing valve, and the tandem meter setter, and meter vault
 - b. The City will furnish the water meter and transponder.
 - c. The meter installation shall be in accordance with the attached Typical Meter Installation for 1-1/2 and 2 inch Meters.
3. Domestic Service Connections 2-1/2 inch and larger:
 - a. These are considered as custom installation with the technical requirements varying for each installation. The owner shall provide construction drawings by a Registered Professional Engineer for approval. The owner shall furnish and install all materials and appurtenances for a complete and operable service connection.
4. Water Meter Installations for New Subdivisions or Multi-Structure Installations:

Design Guideline
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- a. The owner/developer shall submit full and complete working drawings for the construction of the water system within the development. Such system shall be in full accord with the City of Osage Beach Design Guideline and Missouri Department of Natural Resources requirements designed by a Registered Professional Engineer and approved by the City Engineer.
- b. All materials used shall be as specified by the city.
- c. The owner/developer shall make all connections and furnish all materials except water meters and radio-read transponders that will be furnished by the city.
- d. The owner/developer shall assure that all meter assemblies are fully compatible with the city furnished meters and make all modifications necessary to facilitate installation.
- e. Meter installations shall conform to the City of Osage Beach Typical Meter Installation Details.

E. Fire Hydrant Locations

1. Fire hydrants shall be located ten feet from the edge of pavement or immediately inside the property owners land per the easement which ever shall be the farthest from the edge of pavement. Hydrant and auxiliary valve should both be outside the roadway ditch areas.
2. Fire hydrants shall be located such that a clear work area a minimum of five feet in diameter exists around the hydrant.
3. All fire hydrant locations must be immediately accessible by fire vehicle.
4. Fire hydrants shall be installed with the 4-1/2 in pumper outlet toward the street or access point.
5. Fire hydrants shall be installed such that finish grade is between three inches below and level with the hydrant base ring.

WATERLINE INSPECTION AND TESTING FOR ACCEPTANCE

A. Inspections:

1. As a part of the platting and permitting process the developer/owner shall submit full and complete engineering drawings sealed by a Registered Professional Engineer in the State of Missouri. The design and materials specified shall conform to the requirements of the City of Osage Beach Design Guidelines. Such drawings shall be reviewed and approved by the City Engineer prior to any onsite construction.
2. During the progress of the work each utility line shall be inspected by the Engineering Department prior to trench backfill.

B. Water Main Leakage Tests

Design Guideline
City of Osage Beach
SECTION 2 – WATER SYSTEM

1. All water mains constructed by or for the City of Osage Beach shall be tested for leakage to the standards specified herein before they shall be accepted for service. A representative of the City shall be present during all testing.
2. Testing shall be by hydraulic means only. Air or vacuum tests will not be accepted.
3. Testing procedure is as follows:
 - a. Upon completion of the water main it shall be cleaned and all dirt, trash, debris, and deleterious materials removed from the line.
 - b. Filled to capacity and all extraneous air removed.
 - c. Pressurize to 75 psi above normal working pressure at the test location and hold for a period of not less than two hours.
 - d. At the end of the testing period the line shall be refilled with water and the amount of water to refill the line shall be measured and recorded.
 - e. The amount of water to refill the line must be less than the maximum allowable leakage. The maximum allowable leakage shall be computed thusly:

$$Q_{\text{Loss}} = \text{SDP}^{1/2} / 133000$$

Where:

Q_{Loss} = Maximum allowable leakage
S = Length of the section tested in feet
D = Diameter of the pipe in inches
P = Test Pressure, PSI

C. Cleanup, Chlorination, and Bacteriological Testing

1. Prior to final acceptance and after pressure testing of the waterline the contractor/owner shall:
 - a. Thoroughly flush all sediment, debris, and deleterious materials out of the line.
 - b. Fill the line with chlorinated water, chlorinated to not less than 50 ppm, and let stand for 24 hours.
 - c. At the end of 24 hours the line shall be thoroughly flushed and refilled with chlorinated water, chlorinated to 200 ppm and allowed to stand for three hours.
 - d. The line shall then be thoroughly flushed and bacteriological samples taken. Samples shall be forwarded to a certified laboratory for testing. Upon receipt of passing test results, and with the authorization of the City the line may be placed in service.

Design Guideline
City of Osage Beach
SECTION 2 – WATER SYSTEM

Prior to placing the waterline in service the City Representative shall be presented with certified pressure test results, certified passing biological test results, and written certification that the waterline and appurtenances have been constructed in accordance with MDNR and City of Osage Beach standards.

D. Privately Owned Systems

1. Privately owned water mains within subdivisions where the mains are to remain the property of, and be maintained, by the subdivision owner and connected to the City of Osage Beach water system shall be tested as specified herein. Building service lines between the water meter and the building shall be tested in accordance with the International Plumbing Code and as accepted by the Department of Public Works at the time the meter is activated.
2. A written certification of waterline test completion is required.

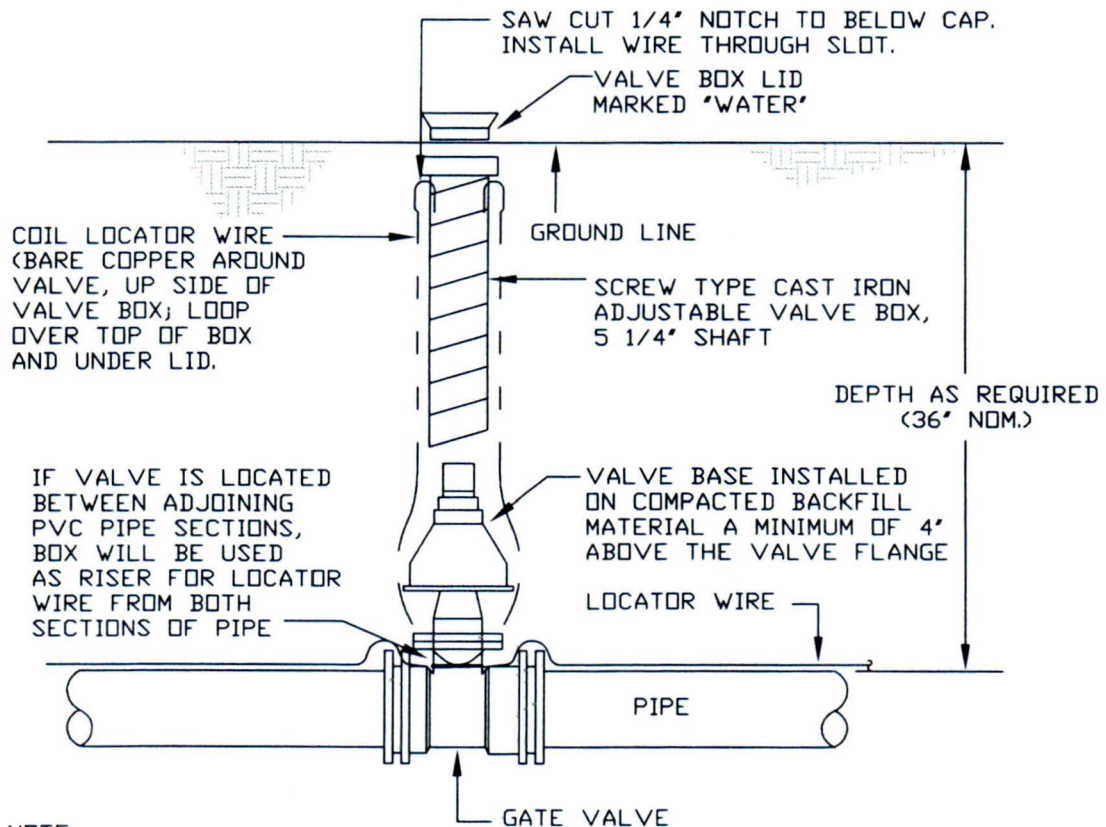
AS CONSTRUCTED DRAWINGS AND MAINTENANCE DOCUMENTS

The Developer/Contractor shall provide the City Engineering Department with not less than two full sized "As Constructed" drawings certified as being correct record drawings by a Registered Professional Engineer or Land Surveyor. If fire pumps, specialized standby equipment, etc. are to be turned over the City two full sets of operational and maintenance data for each pump or system shall be provided to the City Engineer.

WATERLINE AND APPURTENANCES CONSTRUCTION DETAIL DRAWINGS

Construction details and sketches are attached.

END



NOTE:
6" PVC PIPE WITH CAST IRON OR ALUMINUM CAP
AND LID MAY BE SUBSTITUTED FOR SCREW TYPE
CAST IRON VALVE BOX IN OUT OF TRAFFIC AREAS.

Date Revised:
OCTOBER 2004

By:
sh

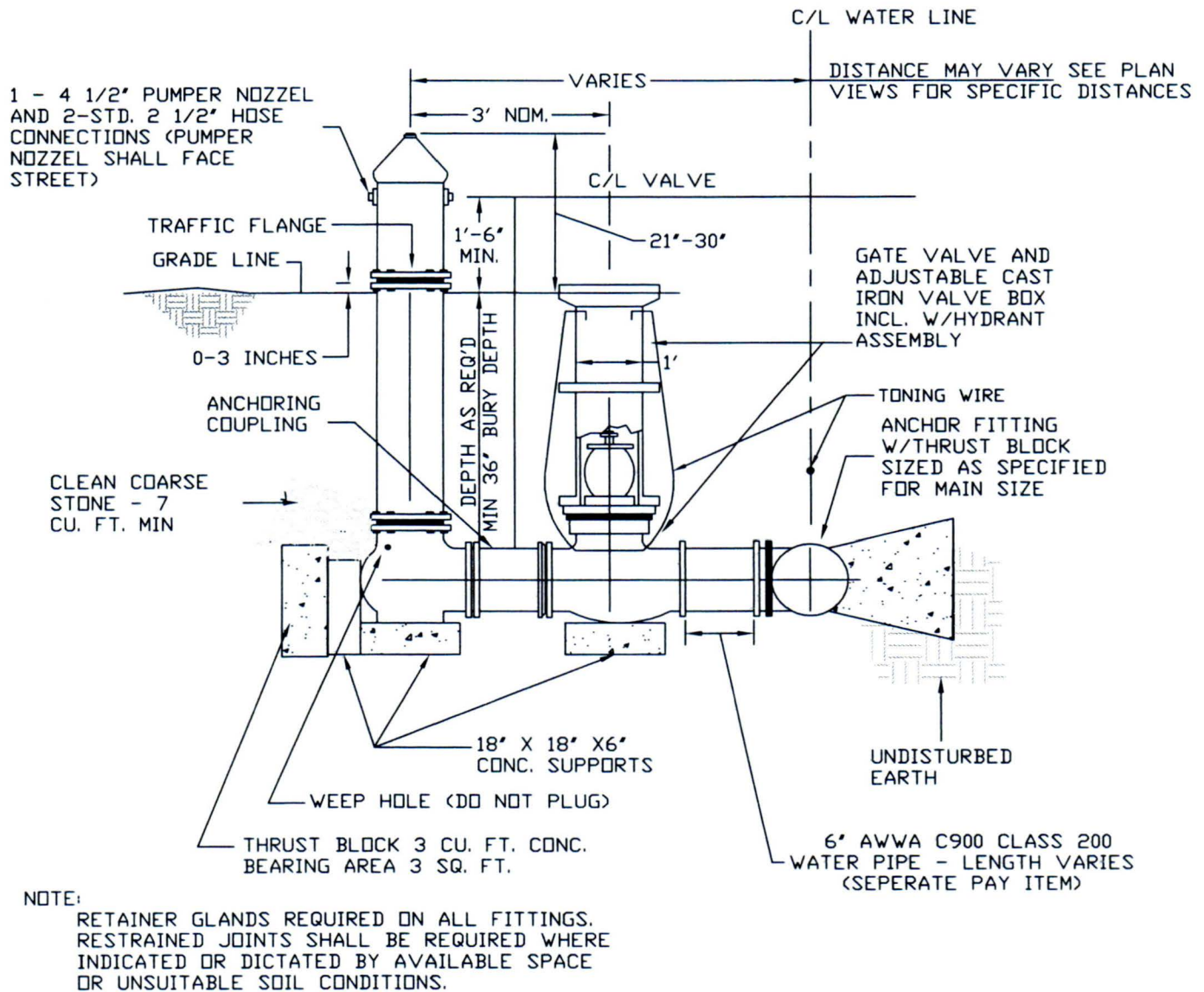
Checked By:
jb

CITY OF OSAGE BEACH
TYPICAL DETAIL
GATE VALVE INSTALLATION
NOT TO SCALE

Design Guideline:
SECTION 2

WATER SYSTEM

Drawing No:
II-1



Date Revised:
OCTOBER 2004

By:
sh

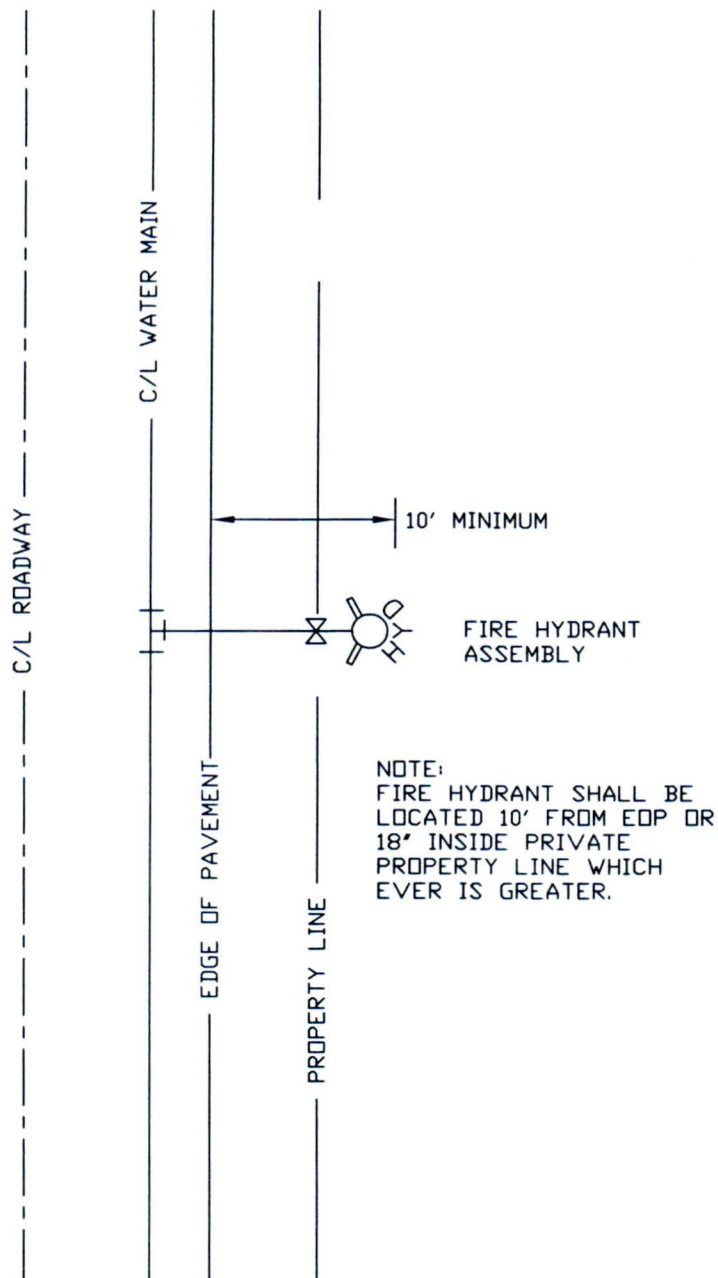
Checked By:
jb

CITY OF OSAGE BEACH
TYPICAL DETAIL
FIRE HYDRANT
NOT TO SCALE

Design Guideline:
SECTION 2

WATER SYSTEM

Drawing No:
11-2



Date Revised:
OCTOBER 2004

By:
sh

Checked By:
jb

CITY OF OSAGE BEACH
TYPICAL DETAIL
FIRE HYDRANT LOCATION

NOT TO SCALE

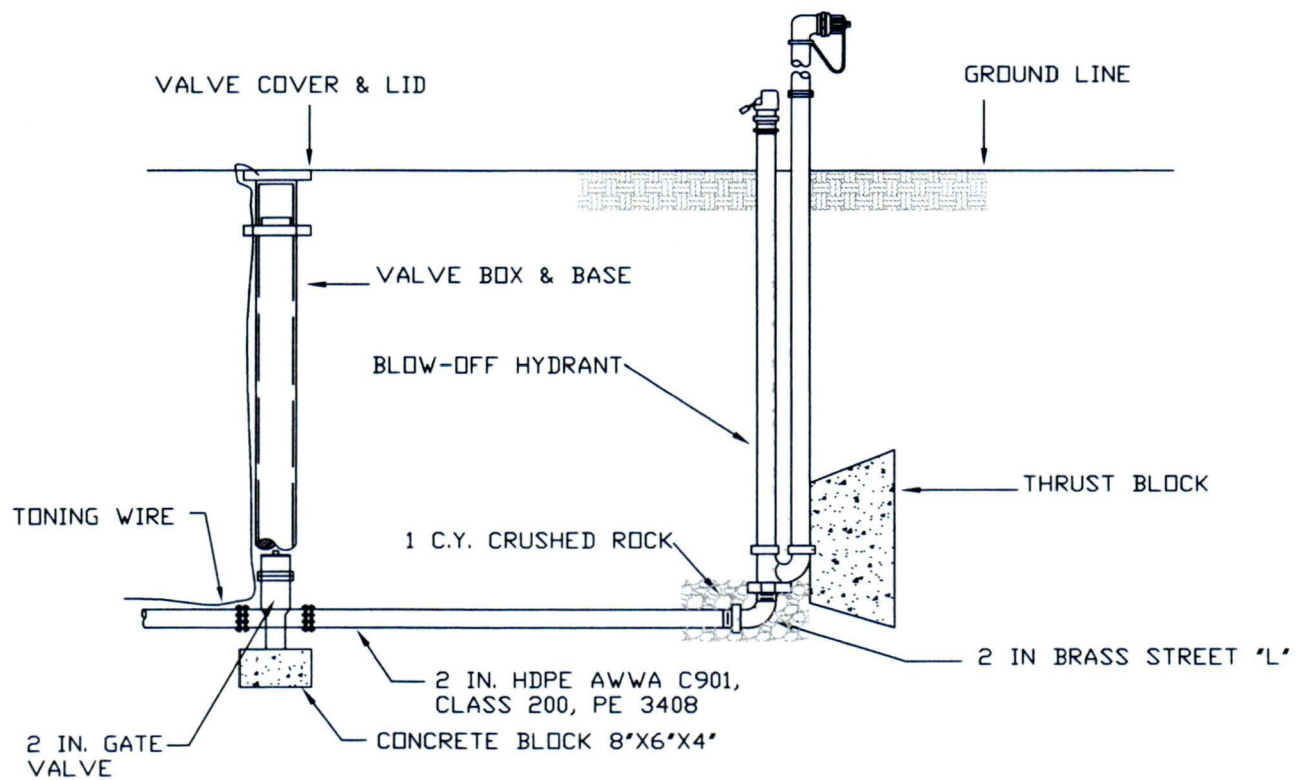
Design Guideline:
SECTION 2

WATER SYSTEM

Drawing No:

II-3

NOTE:
CONTRACTOR SHALL FIELD VERIFY WITH
ENGINEER DIRECTION OF BLOW OFF HYDRANT.



Date Revised:
OCTOBER 2004

By:
sh

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jb

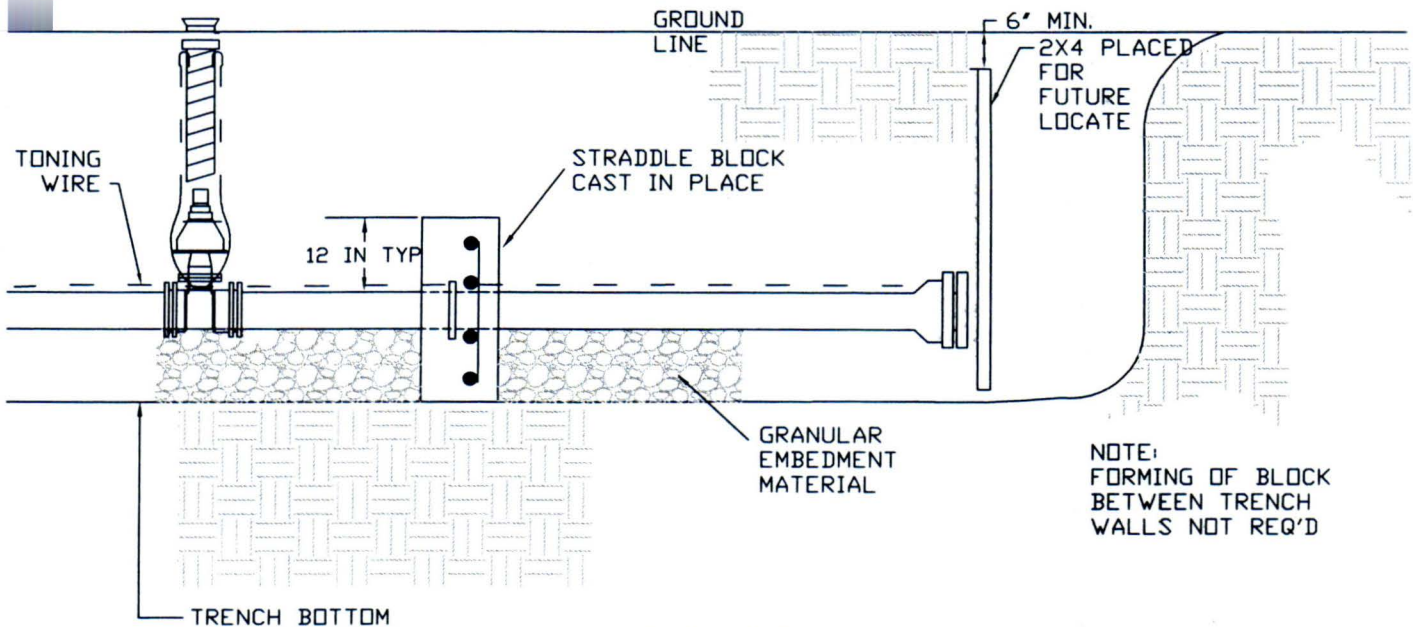
CITY OF OSAGE BEACH
TYPICAL DETAIL
BLOWOFF ASSEMBLY

NOT TO SCALE

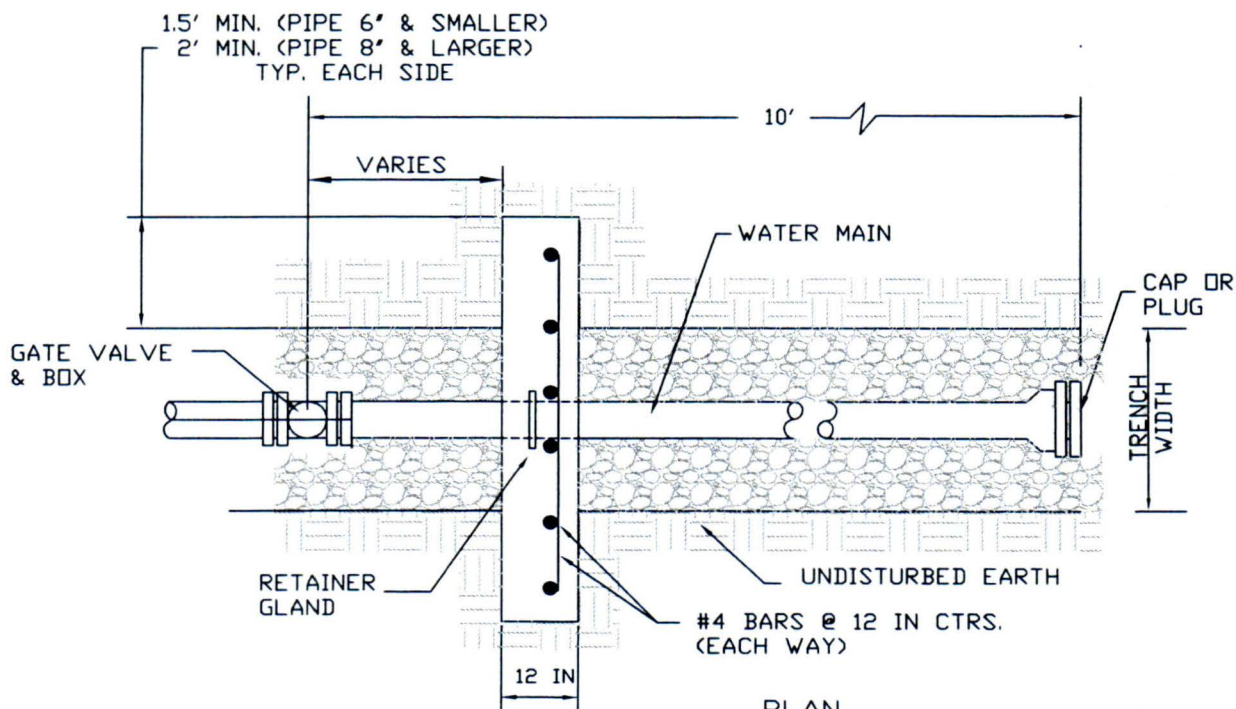
Design Guideline:
SECTION 2

WATER SYSTEM

Drawing No:
II-4



ELEVATION



PLAN

Revised:
OCTOBER 2004

By:
sh

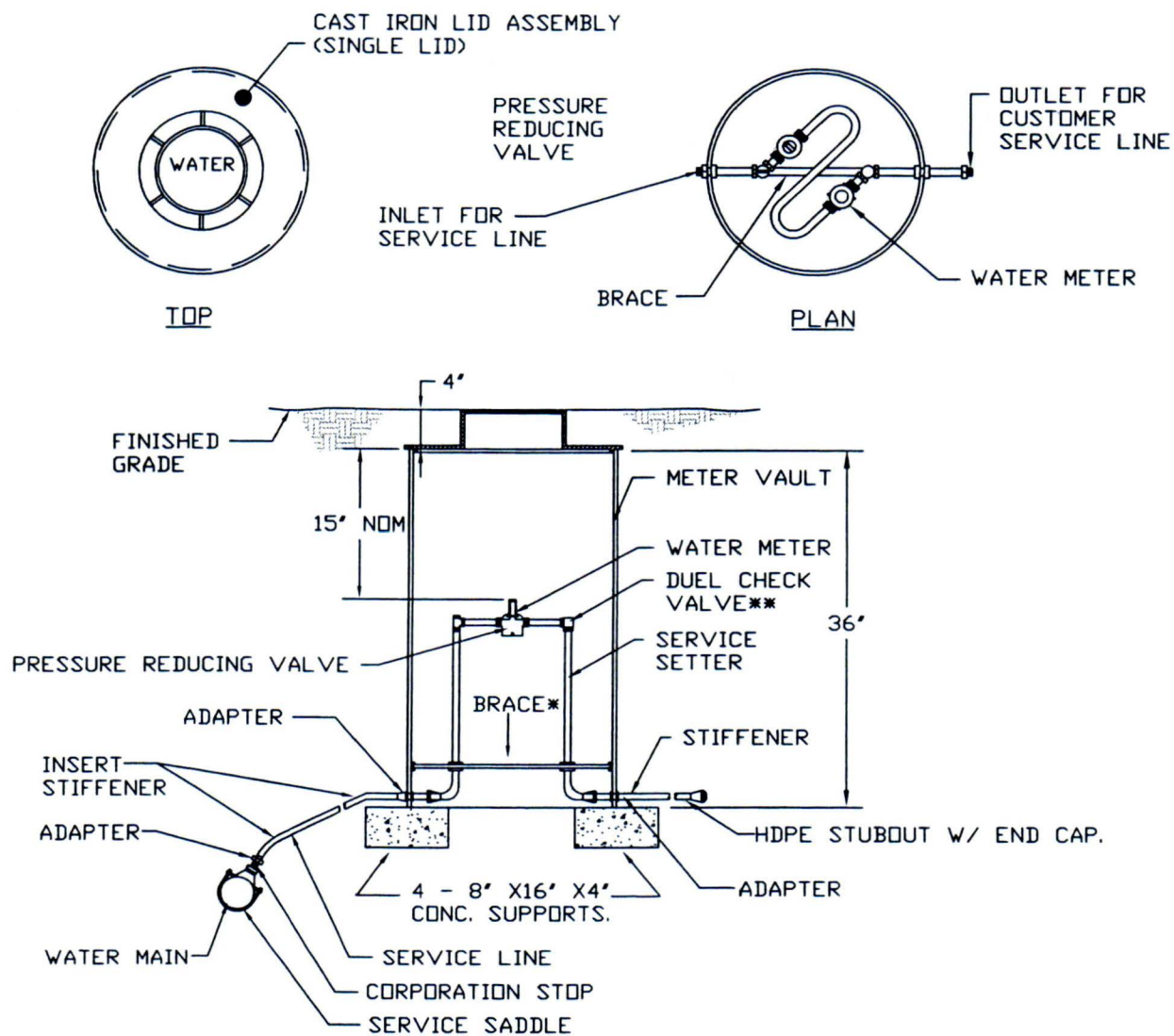
Checked By:
jb

CITY OF OSAGE BEACH
TYPICAL DETAIL
WATER LINE TERMINATION
NOT TO SCALE

Design Guideline:
SECTION 2

WATER SYSTEM

Drawing No:
II-5



NOTES: *BRACE TO BE PART
OF PREFABRICATED
METER WELL.
**NOT TO BE PLACED
ON RESIDENTIAL LINES

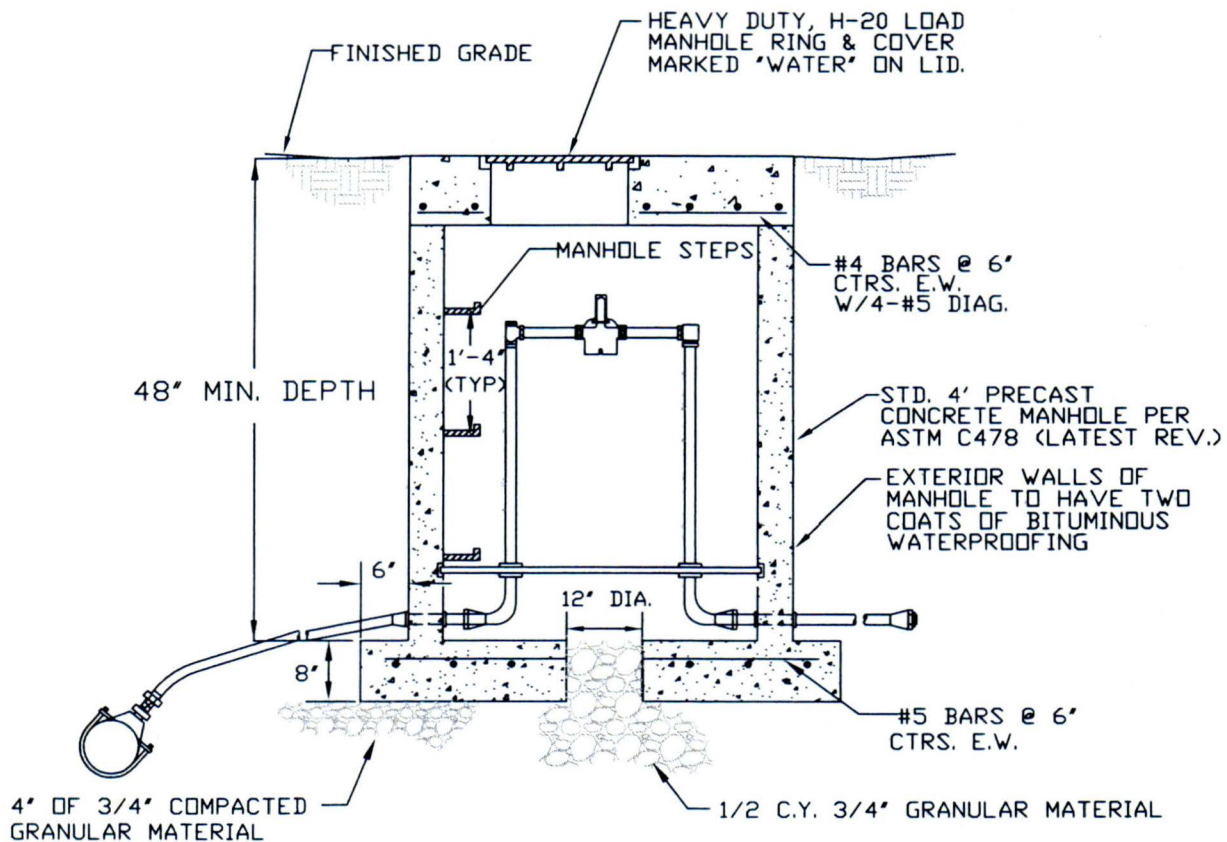
ELEVATION

NOT TO SCALE

Date Revised:
OCTOBER, 2004
By:
sh
Checked By:
JB

CITY OF OSAGE BEACH
TYPICAL DETAIL
TYPICAL TANDEM METER SETTING
SIDEWALK OR LAWN
5/8"x3/4", 1", 1-1/2" OR 2" METERS

Design Guideline:
SECTION 2
WATER SYSTEM
Drawing No.:
II-6



Date Revised:
OCTOBER, 2004

By:
sh

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JB

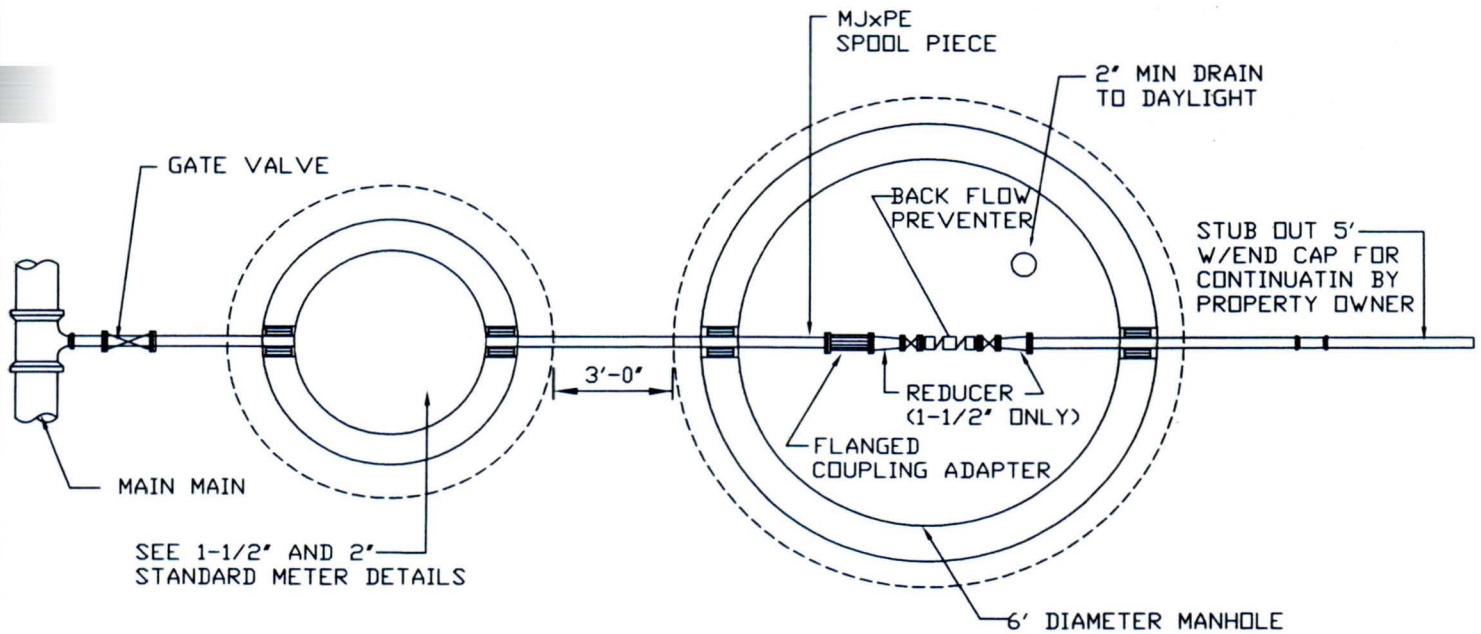
CITY OF OSAGE BEACH
TYPICAL DETAIL
METER VAULT
DRIVEWAY OR PARKING AREA
NOT TO SCALE

Design Guideline:
SECTION 2

WATER SYSTEM

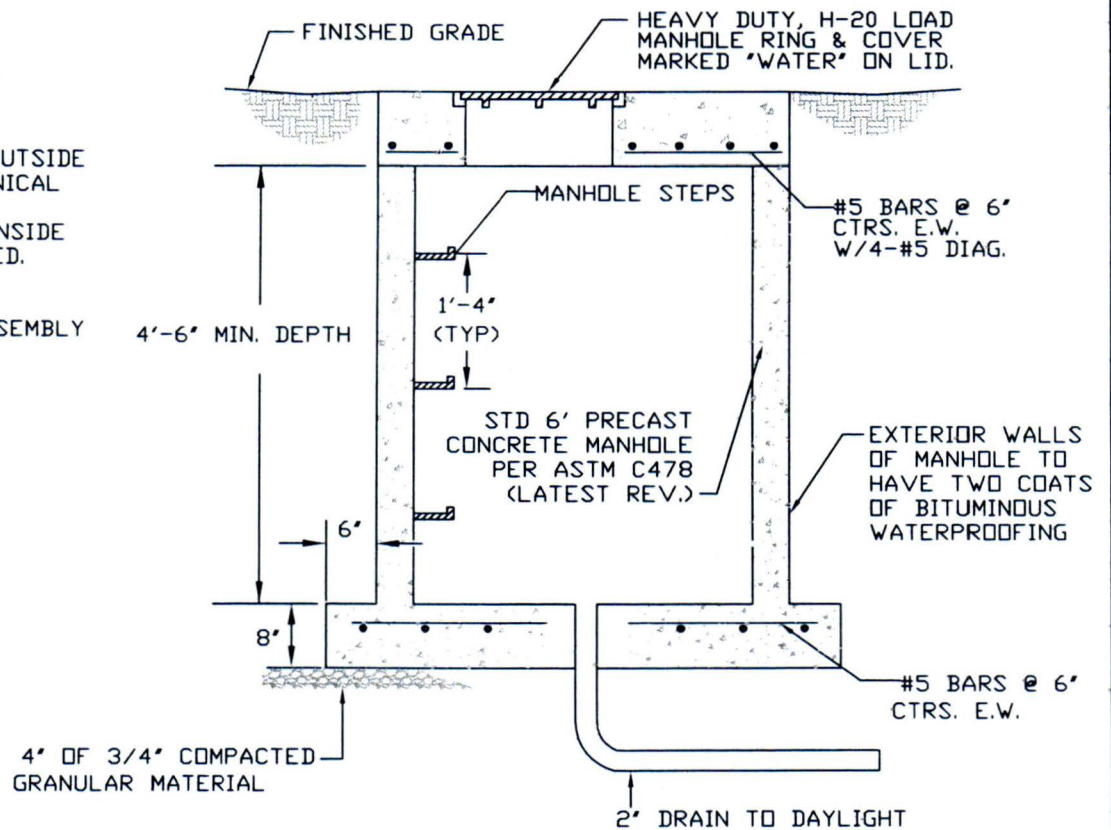
Drawing No.:
II-7

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PLAN VIEW (TOP REMOVED)

1. ALL PIPE AND FITTINGS OUTSIDE VAULTS SHALL BE MECHANICAL JOINT.
2. ALL PIPE AND FITTINGS INSIDE VAULTS SHALL BE FLANGED.
3. PROVIDE ADEQUATE PIPE SUPPORT AS REQUIRED.
4. BACKFLOW PREVENTER ASSEMBLY MIN. OF 12\"/>



BACKFLOW PREVENTER ELEVATION

Date Revised:
OCTOBER, 2004

By:
sh

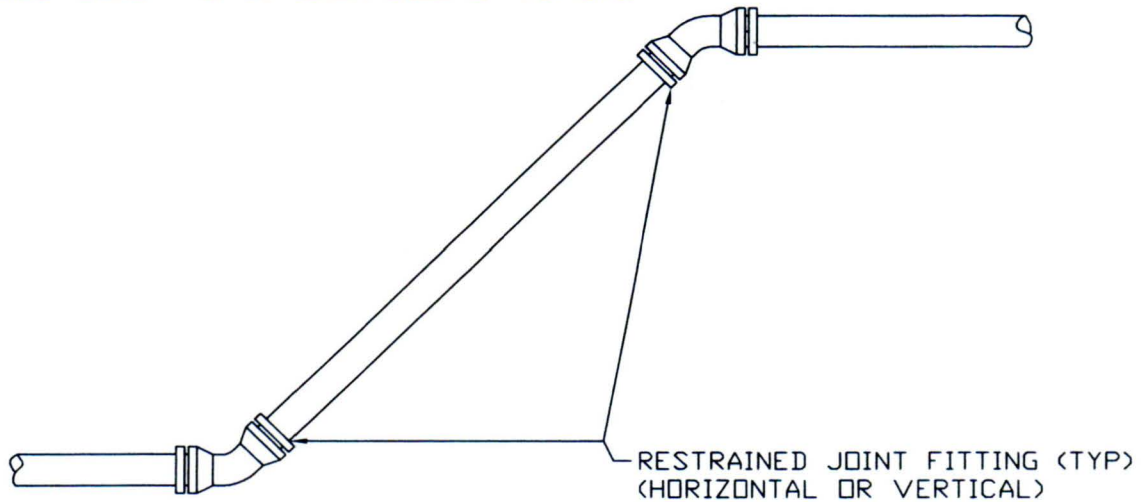
Checked By:
JB

CITY OF OSAGE BEACH
TYPICAL DETAIL
1½\"/>

Design Guideline:
SECTION 2
WATER SYSTEM

Drawing No.:
II-8Page 30 of 231

SCHEDULE (6" THROUGH 12" PIPE)
 90° BEND - 60 LF EACH SIDE OF FITTING
 45° BEND - 30 LF EACH SIDE OF FITTING
 22.5° BEND - 20 LF EACH SIDE OF FITTING
 11.25° BEND - 10 LF EACH SIDE OF FITTING



NOTE:
 LENGTHS SHOWN ARE BASED ON DIP WITH POLYETHYLENE
 ENCASMENT. ADJUST AS REQUIRED FOR OTHER PIPE
 MATERIALS.

Date Revised:
 OCTOBER 2004

By:
 sh

Checked By:
 jlb

CITY OF OSAGE BEACH
 TYPICAL DETAIL
 RESTRAINED JOINT PIPE
 NOT TO SCALE

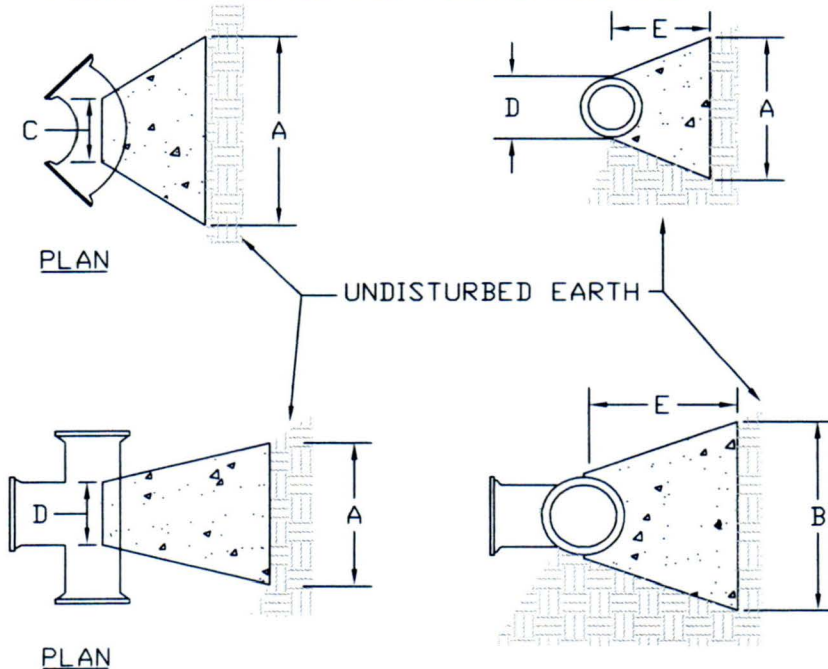
Design Guideline:
 SECTION 2
 WATER SYSTEM
 Drawing No:
 II-9

PIPE SIZE CHART

PIPE SIZE	FITTING	DISTANCE IN INCHES				
		A	B	C	D	E
4" AND SMALLER	11.25 & 22.5"	9	9	8	8	6
	45 DEGREE	18	9	8	8	12
	90 DEGREE	21	12	8	8	12
	TEE/PLUG	15	12	8	8	12
6"	11.25 & 22.5"	12	12	8	10	12
	45 DEGREE	27	12	8	10	12
	90 DEGREE	33	18	8	10	12
	TEE/PLUG	24	18	8	10	12
8"	11.25 & 22.5"	18	15	8	10	12
	45 DEGREE	33	15	8	10	18
	90 DEGREE	42	24	8	10	18
	TEE/PLUG	30	24	8	10	18
10" & 12"	11.25 & 22.5"	27	24	12	12	18
	45 DEGREE	51	24	12	12	24
	90 DEGREE	63	36	12	12	30
	TEE/PLUG	45	36	12	12	24
14" & 16"	11.25 & 22.5"	33	33	12	16	18
	45 DEGREE	69	33	12	16	30
	90 DEGREE	84	48	12	16	36
	TEE/PLUG	60	48	12	16	30

NOTES:

1. THRUST BLOCKS ARE BASED ON A WORKING PRESSURE OF 200 P.S.I. PLUS 0% SURGE & 2000 P.S.F. ALLOWABLE SOIL BEARING PRESSURE.
2. FOR PIPE SIZES NOT SHOWN USE DIMENSIONS FOR NEXT LARGER SIZE.
3. USE 3/8" PLYWOOD SEPARATOR BETWEEN BLOCKS AND PLUGS TO PROVIDE FOR FUTURE REMOVAL.



Date Revised:
OCTOBER 2004

By:
sh

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jb

CITY OF OSAGE BEACH TYPICAL DETAIL THRUST BLOCK DETAIL

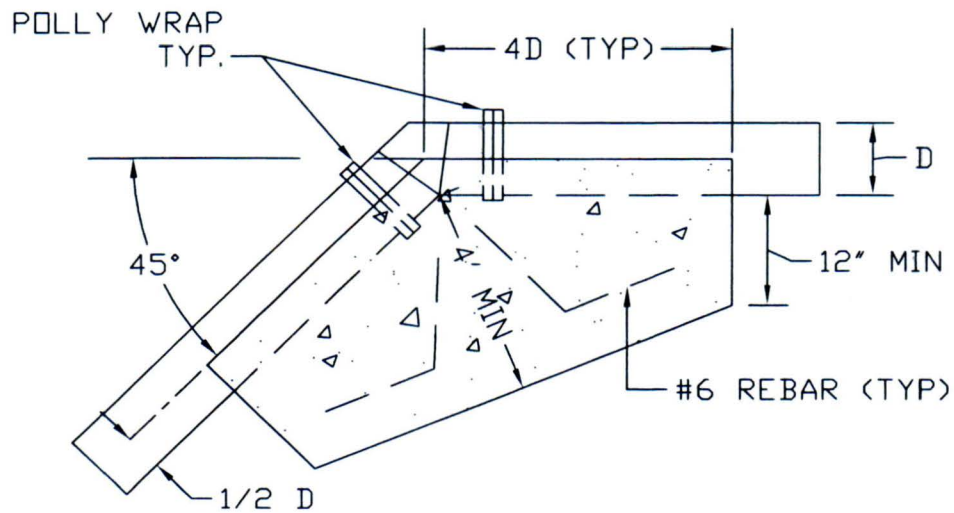
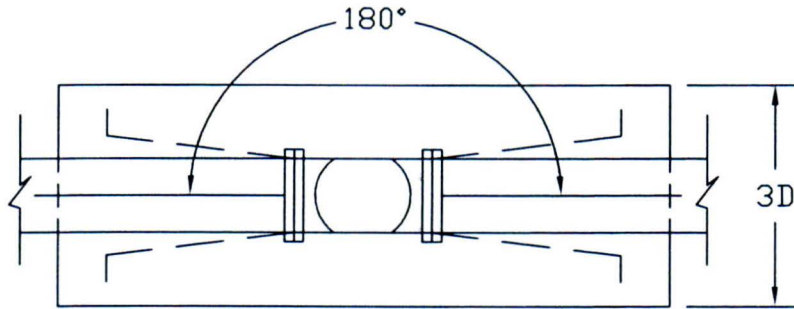
NOT TO SCALE

Design Guideline:
SECTION 2

WATER SYSTEM

Drawing No:
II-10

NOTE:
MJ FITTING WITH RETAINER GLANDS
REQUIRED FOR ALL VERTICAL BENDS



Date Revised:
OCTOBER 2004

By: sh

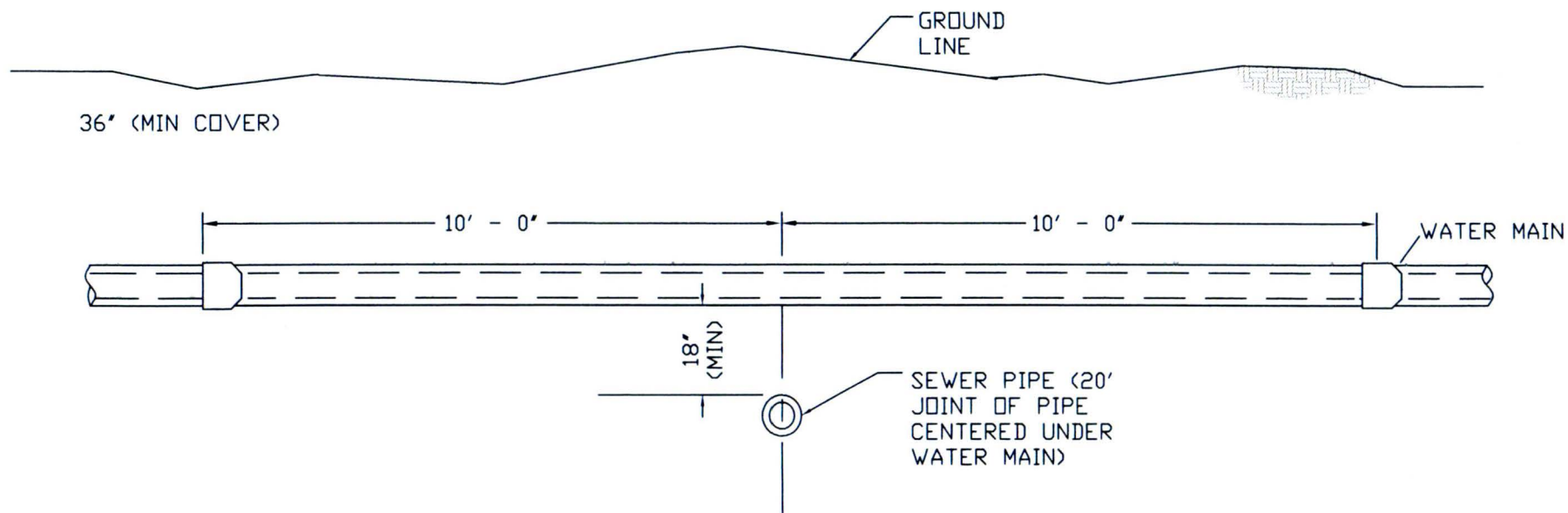
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CITY OF OSAGE BEACH
TYPICAL DETAIL
VERTICAL BEND THRUST BLOCK
NOT TO SCALE

Design Guideline:
SECTION 2

WATER SYSTEM

Drawing No:
II-11



Date Revised:
OCTOBER 2004

By:
sh

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jb

CITY OF OSAGE BEACH
TYPICAL DETAIL
WATER SEWER CROSSING
NOT TO SCALE

Design Guideline:
SECTION 2

WATER SYSTEM

Drawing No:
II-12

Design Guideline
City of Osage Beach
SECTION 2 - WATER SYSTEM

(Revised 23 OCT 2014-NLE)

OVERVIEW

The City of Osage Beach is authorized to construct, operate, and maintain a water system to serve the inhabitants, business establishments, and infrastructure needs of the city by Title VII Utilities of the City Code. The city water system is operated under license of the Missouri Department of Natural Resources (MDNR), Drinking Water Division as authorized under 10 CSR 60-3 and 10 CSR –10 of the Missouri Safe Drinking Water Act and the Missouri Public Drinking Water Regulations. The purpose of this guideline is to establish design policy and guidance for the design and construction of the city water system.

The design, construction, and operation of the city water system will conform to the requirements of the MDNR regulations, standards, and policies, the City of Osage Beach Design Guideline, and the applicable provisions of the International Plumbing Code and the International Building Code and with reference to requirements of the International Fire Code and the recommendations of the Insurance Services Organization (ISO)

REFERENCED CITY ORDINANCES

Chapter 400.110 Subdivision Regulations

Chapter 410.130 Contents (~~Location and design of water mains and appurtenances~~)

Chapter 410.190 ~~Design~~ Basic Standards

Chapter 410.320 Waterlines

Chapter 505.~~010~~ Fire ~~Prevention and~~ Protection Code

Chapter 705 Waterworks

GOALS AND OBJECTIVES

The basic goal of the City of Osage Beach is to provide an efficient, cost effective water system to supply the fire protection and drinking water needs of the city. This guideline will establish the basic parameters, design criterion, and material requirements for the system. The system will be designed to meet all of the appropriate standards for domestic water supply and to achieve a reasonable fire protection capability. The fire protection requirements will be developed in conjunction with the Osage Beach Fire Protection District.

OVERALL WATER SYSTEM STANDARDS AND CRITERION

The initial water system was designed by Archer Engineers offices in Lee Summit and Springfield, Missouri. A Water Master Plan was developed that establishes the basic requirement for the system. Essentially Osage Beach has two separate water systems, one on each side of the Grand Glaize Bridge. Basic requirements for the supply system are as follows:

Design Guideline
City of Osage Beach
SECTION 2 - WATER SYSTEM

EAST SIDE SYSTEM

	<u>1999</u>	<u>2019</u>	<u>Ultimate</u>
Average Daily Demand, gpd	433,000	845,000	1,015,000
Fire Fighting Demand, gpd	240,000	240,000	240,000
Required Storage, gpd	673,000	1,085,000	1,291,000
Available Storage:			
Columbia College, gpd	500,000		
Passover Tower, gpd	150,000		
Bluff Tower, gpd		800,000	1,300,000
Required Water Supply, gpm	451	880	1,094
Water Supply Available:			
Columbia College No. 1, gpm	250	250	250
Columbia College No. 2, gpm	550	550	550
Passover Well No. 1, gpm	260*	260*	260*
Bluff No. 1, gpm (Future)		500	500
Bluff No. 2, gpm (Future)			500
Total Available, gpm	800	1,300	1,800
*limited Service Area			

WESTSIDE SYSTEM

	<u>1999</u>	<u>2019</u>	<u>Ultimate</u>
Average Daily Demand, gpd	992,000	1,563,000	1,840,000
Fire Fighting Demand, gpd	240,000	240,000	240,000
Required Storage, gpd	1,232,000	1,803,000	2,089,000
Available Storage:			
Woodland Tower, gpd	(150,000)*	0	0
Swiss Village Tower, gpd	1,500,000	1,500,000	1,500,000
Future, gpd		800,000	800,000
Total Available	1,500,000	2,300,000	2,300,000
*Out of service—remove from service			
Water Supply Available:			
Swiss Village Well No. 1, gpm	550	550	550
Swiss Village Well No. 2, gpm	550	550	550
Swiss Village Well No. 3, gpm	550	550	550
Woodland Cove Well, gpm	OTS*	0	0
Future Wells, gpm		1,000	1,000
Total Available, gpm	1,100	2,100	2,100
*OTS—Out of Service			

Design Guideline
City of Osage Beach
SECTION 2 - WATER SYSTEM

The master plan requires chlorination and fluoridation of the water system. No further treatment is proposed at this time. The system will be added to and/or modified as necessary to assure full compliance with MDNR Regulations.

WATER DISTRIBUTION – BASIC DESIGN CRITERION

A. Fire Demand and Supply

1. Industrial, commercial, and multi-unit residential structures:
 - a. Provide not less ~~that~~ than 2000 gpm at a residual pressure of 20 psi at each building site.
 - b. Provide two fire hydrants within 300 feet of each structure.
 - c. Hydrant spacing in commercial and industrial areas shall not be less than 300’.
 - d. Provide one hydrant within 125 feet of each fire main entrance into the structure.
 - e. Provide fire main service to each structure with indicating type valve at the water main. Minimum size fire service line is four inches.
 - f. Minimum static pressure at each structure shall be 35 psi.
 - g. Commercial buildings, Condominiums and Multi-Family Occupancies, which have a fire suppression system, must also be served by an approved fire hydrant not further than 150’, in the line of hose path travel, from the fire department connection.
2. Residential and Undeveloped
 - a. Provide not less than 1000 gpm at a residual pressure of 20 psi.
 - b. Provide not less than one fire hydrant within 300 feet.
 - c. In the case of a structure or residence that is not connected to city water a fire hydrant must be available within ~~850~~ 600 feet.
 - d. In undeveloped areas a fire hydrant shall be installed every 600 feet.

B. Fire Main Connections to Structures

1. Where required by the Osage Beach Fire District, NFPA, ~~Internation~~ Fire Code and/or International Plumbing Code a fire main shall be extended into each building as a separate fire main. This entrance main shall be only for fire protection system use. No meters or valves are allowed between ~~the~~ main and ~~the~~ building except for an indicating shut-off valve at the main and a post indicating valve which shall be located a minimum of 5 feet away from the building. Shut-off valves installed on fire mains shall be of the indicating type that clearly shows if the valve is open or closed.

Design Guideline
City of Osage Beach
SECTION 2 - WATER SYSTEM

C. Water Distribution Mains

1. Water distribution mains shall be looped to the maximum ~~extend~~ extent feasible.
2. The MDNR standard for a minimum size main is eight inches. The city standard allows for six inch mains in residential areas where a fire flow of 1000 gpm at a residual pressure of 20 psi can be maintained.
3. ~~The minimum size main allowable for domestic residential service is two inches so long as the main is less than 600 feet long, serves less than ten residences and fire protection is available within 300 ft.~~
4. The minimum static pressure for domestic service shall not be less than 35 psi.
5. A fire hydrant or blow-off valve shall be installed at the end of all water mains.
6. The maximum design flow velocity shall be 8 fps.
7. An isolation valve shall be installed at not less than every ~~1250 feet~~ 500 feet commercial, 800 feet residential and:
 - a. At each branch main with one valve on the downstream main and one on the branch main.
 - b. At loop connections on each leg of the connecting loop.

Isolation valves shall be of the same nominal size as the main in which they are installed.

DOMESTIC SUPPLY CONNECTIONS AND METER POLICY

A. General Requirements for Customer Service Lines

1. City meter assemblies for single family residents and all 5/8 in. meter installations will not have a city owned backflow device installed.
2. Industrial and commercial connections and all meter installations of 1 in and larger shall have a ~~city~~ privately owned dual check device installed. This backflow device is exclusive of and specifically not intended for use in lieu of backflow devices required by the customer's use.

Design Guideline
City of Osage Beach
SECTION 2 - WATER SYSTEM

3. Materials used for customer service lines shall conform to materials specified herein.
4. All domestic services shall be metered.
5. Meters shall be sized in accordance with the following unless specifically directed otherwise by the Public Works ~~Director~~ **Operations Manager** or designee:

<u>Meter size</u>	<u>Meter Demand</u>	<u>Requirements</u>
5/8"x 3/4"	1 to 20 gpm	Single family residence with 2-1/2 baths, small commercial offices or retail establishments establishments. Maximum continuous continuous flow 10 gpm.
1"	3 to 50 gpm	Large residences, swimming pools, lawn irrigation for lawns less than 6000 SF, apartments and condos with less than 10 units, motels of less than 15 units, small to medium restaurants, commercial uses with maximum continuous demand less than 25 gpm.
1-1/2"	5 to 100 gpm	Apartments and condos of less than 30 units, motels of less than 35 units, commercial uses with maximum continuous demand of less than 50 gpm.
2"	8 to 160 gpm	Apartments and condo of less than 60 units, hotels with less than 70 units, commercial uses with maximum continuous demand less than 80 gpm.
3"	4 to 320 gpm	Commercial applications with continuous demand of less than 160 gpm
4"	6 to 500 gpm	Commercial use less than 250 gpm continuous flow (Compound Meter)
	10 to 1200 gpm	Municipal Use Only (Turbine Meter)
6"	20 to 2500 gpm	Municipal Use Only (Turbine Meter)

Design Guideline
City of Osage Beach
SECTION 2 - WATER SYSTEM

B. Meter Connection Policy

1. Single Family Residential, and small commercial connections
 - a. Each individually owned residence or business shall be connected through a single tap on the main, one meter, and receive one billing. Generally single family residences and small businesses will be setup with a 5/8 inch meter. Individual owners shall confer with the Public Works ~~Director~~ Operations Manager or designee to determine appropriate size to meet their requirements.
 - b. Billing will be at the established monthly rate based upon water usage.
2. Multi-Family Residential Units
 - a. The general rule shall be one property, one billing. Multi-family residential units are billed on the basis of the number of units times the basic monthly rate plus the water usage over the base amount.
 - b. All multi-unit residential buildings that require a separate fire main and sprinkler system shall be constructed with a separate metered domestic supply line and a non-metered fire main entrance. The meter shall be sized to meet the demand requirements of the individual building. On properties with more than one building, each building shall be metered separately.
3. Duplex Residential Units – Multiple Single Family Rental Units on one Property
 - a. The general rule is one owner of the property one meter. If there are multiple duplexes or single family units on one property and individual fire service mains are not required to any of the buildings then the one owner – one meter rule applies. The billing shall be at the established monthly rate per unit plus the gallons used over 1000 gal. per unit billed at the established rate per 1000 gal.
 - b. In the case where each unit is individually owned then each unit shall be individually billed and metered. This specifically intended for duplex and single family cluster homes only.
4. All Non-Residential Properties with Fire Sprinkler Systems
 - a. At all locations where the structures require a separate fire main to the building each building shall have a separate, metered, domestic supply main.

Design Guideline
City of Osage Beach
SECTION 2 - WATER SYSTEM

- b. One commercial property with multiple overnight lodging units (a motel or hotel) not requiring fire mains shall be metered by one-meter assembly and billed on the water use.
- c. One commercial property with multiple commercial units without fire mains, with individual tenants, may be metered with one meter, or individually, as mutually determined by the owner and the Public Works ~~Director~~ Operations Manager or designee.
- d. One property with mixed residential long term, overnight rental, and commercial enterprises, may be metered on one-meter assembly, or multiple meters, as determined by the Public Works ~~Director~~ Operations Manager or designee. Billing will be on a water use basis.
- e. Where there are multiple buildings on one property that require fire main services, each building's domestic supply will be metered. All meters will be billed to the property owner.

C. Fire Main Connections

- 1. Fire main connections are required for all sprinkled buildings and structures. The owner/developer shall submit appropriate drawings and computations by a Registered Professional Engineer for approval. The owner/developer shall furnish all valves, fittings, and incidentals required to make the connection and shall employ a city approved contractor to perform the work.
- 2. Indicating shut-off valves shall be installed at the fire main connection to the water main.
- 3. Pipe materials for the main between the building and post indicating valve shall be Ductile Iron as shown below in Materials for Waterlines and Appurtenances section A. point 1 subpoint a.

D. City Ordinance 98.41 - Owner Furnished Backflow Preventer Assembly

- 1. Owner furnished backflow assemblies shall be licensed, furnished, installed, and maintained by the owner at the locations specified in City Code 705.470. Most of these will be for lawn sprinkler systems and the like.
Note: These units are required in addition to any dual check assembly installed by the city at the meter installation.

Design Guideline
City of Osage Beach
SECTION 2 - WATER SYSTEM

MATERIALS FOR WATERLINES AND APPURTENANCES

A. Water Mains

1. All mains ~~four~~ six inches and larger:
 - a. Ductile Iron Pipe, AWWA C150 and C151, Class 350
 - 1) Cement mortar lined per AWWA C104
 - 2) Joints:
 - a) For buried pipe: push-on joints per AWWA C111
 - b) For exposed or interior: Flanged joints
 - b. PVC, AWWA C900 or C905, DR 14, Class ~~200~~ 305
 - 1) Joints shall be push-on type rubber gasket
2. ~~Mains 1 1/2 inches to three inches:~~
 - a. ~~PVC, ASTM 2241, SDR 21, Class 200~~
 - 1) ~~Joints shall be push-on type with rubber gasket~~
 - b. ~~Schedule 40 PVC~~
 - 1) ~~Joints shall be solvent welded~~

B. Water Meter Service Lines and City Service Lines ~~two inch and less~~

1. HDPE AWWA C901, ~~PE 3408~~, CTS, ~~HDR 7 SDR9~~, Class 200 ~~for I.D. pipe, or DR 9, Class 200 for O.D. pipe.~~
2. ~~Larger than two inch to be approved by Public Works Operations Manager~~

C. Water Service Lines from meter to building (Privately Owned Lines Only)

1. These lines shall conform to the requirements of the International Plumbing Code.
2. ~~Materials may be of the owner choice.~~

D. Water Fittings and Adapters Ductile Iron and PVC

1. ~~four~~ 6 inches and Larger:
 - a. Fittings:
 - 1) Ductile iron fittings, cement mortar lined, conforming to AWWA C150 or C151.

Design Guideline
City of Osage Beach
SECTION 2 - WATER SYSTEM

- 2) All buried or flooded locations shall use **grip restraint** mechanical joint pipe and fittings, **such as Megalug or approved equal.**
 - 3) Flanged fittings shall be provided for flanged pipe (above ground installations only). Faces shall be coated with rust Protective coating.
 - 4) Cement mortar lined pipe and fittings shall be coated with coal tar epoxy paint **with** a minimum thickness of 24 mils.
 - 5) **Bolts shall be stainless steel, fluoropolymer coated, or approved equal.**
- b. Flanged Coupling Adapters:
- 1) Shall be Ford 193, Smith-Blair 913, Rockwell 913, or approved equal.
 - 2) Bolts shall be Stainless Steel, Type 216.
 - 3) Minimum rated operating pressure to match the line in which installed.
- c. Joint Restraints:
- ~~1) — Shall be Ford Style FR, Uni-Flange 1300 Series, or approved equal.~~ Bell Joints shall be restrained with all threads or approved equal.
 - 2) Approved concrete thrust blocks required.
2. For pipe 1-1/2 inches to 3 inches:
- a. Fittings:
- 1) For ASTM 2241, SDR 21, Class 200 fittings shall be approved by the Public Works ~~Director~~ **Operations Manager or designee.**
 - ~~2) — PVC Schedule 40 shall have PVC Schedule 80 fittings.~~
- ~~b. — Coupling Adapters:~~
- ~~1) — Ford Style FC or approved equal.~~
3. For PE Pipe – 2 inches or less:
- a. Shall be Ford CTS Pack Joint Couplings for PE Pipe rated at the same pressure class as the pipe in which they are to be installed or approved equal.

Design Guideline
City of Osage Beach
SECTION 2 - WATER SYSTEM

- E. Waterline Valves and Valve Boxes (for Valve 2 in. and larger):
1. Shall be iron body, non-rising stem, resilient wedge, gate valves with stainless steel bolts, and shall be epoxy paint coated.
 2. Valves shall be by Mueller, Clow, ~~or~~ M&H, or approved equal.
 3. Valve Boxes shall be cast iron bonnet, PVC riser, with cast iron top and cover marked "water".
 4. ~~Check Valves shall be similar and equal to Clow Valve Company horizontal swing check valves for 2 inch through 12 inch valves.~~
- F. Fire Hydrants
1. Fire hydrants shall be Mueller Super Centurion 250, ~~American-Darling B32~~ or Clow Medallion with 4-1/2 inch pumper inlet, and two 2-1/2 hose connections. Hydrants shall be fully compatible with the requirements of the Osage Beach Fire Protection District.
 2. Fire hydrants shall be painted red with epoxy coating as approved by the Public Works ~~Director~~ Operations Manager or designee.
- G. Blow-Off Assembly
1. Post Hydrants shall be non-freezing, self draining type with a minimum ~~42"~~ ~~36"~~ cover to the main. Hydrants shall be furnished with a 2" FIP inlet, a NOT-Turning operating rod, and shall open to the left. All working parts shall be Bronze-to-Bronze design. The outlet shall also be Bronze and be 2 1/2" NST. Hydrants shall be lockable to prevent unauthorized use.
 2. Hydrant shall be as manufactured by Kupferle Foundry Co., St. Louis, MO, or approved equal.
- H. Water Meter Assemblies:
1. 5/8 and 1 in. Residential Meters:
 - a. Tapping saddle shall be Ford Brass Saddles Hinged Series S91 for PVC and Series 202B IP for DIP, Min. 1 inch.
 - b. Corporation Stop shall be Ford or Ford Ballcorp F(B)1000 Series, with pack joint for PE pipe.
 - c. Meter Setter shall Be Ford 70 Series Coppersetter, ~~tandem~~ single yoke, with lockable angle valve, spreader bar, and CTS pack joint. *Do not place dual check assembly on residential service lines.*

Design Guideline
City of Osage Beach
SECTION 2 - WATER SYSTEM

- d. Meter Vault shall be ADS N-12 corrugated plastic of appropriate size (min. ~~20~~ 24 in.), with Ford Wabash lid cover with Clay & Bailey extension ring. *The lid cover must have a hole that accommodates the meter antenna.*
 - e. *If the distance from the angled valve to the top of the lid is greater than 24 inches, the meter pit shall be up sized to 36 inches in diameter.*
 - f. *All additional devices, equipment, and valves shall be down stream of the water meter and not located within the water meter pit.*
2. 1, 1-1/2, and 2 in. Meters for Commercial or Multi-family Residential Use:
- a. Tapping saddle shall be Ford Brass Saddles Hinged Series S91 for PVC and Series 202B IP for DIP. It shall be a 2-in tap with 2-in service line to the meter., min. 1 inch for 1 inch meters and 2 inch for all larger.
 - b. Corporation Stop shall be Ford or Ford Ballcorp F(B)1000 Series, with pack joint for PE pipe.
 - c. Meter Setter shall Be Ford 70 Series Coppersetter, ~~tandem~~ *single* yoke, with lockable angle valve, spreader bar, dual check assembly, and CTS pack joint.
Do not place dual check assembly on single family residential service lines.
 - ~~d. The pressure reducing valve shall be Watts LF25AUB-23~~
 - e. Meter Vault shall be ADS N-12 corrugated plastic of appropriate size (min. ~~20~~ 36 in.), with Ford Wabash lid cover with Clay & Bailey extension ring. *The lid cover must have a hole that accommodates the meter antenna.*
 - f. *All additional devices, equipment, and valves shall be down stream of the water meter and not located within the water meter pit.*
3. Meter larger than two inches.
- a. Tap, valves, fittings, and meter service line shall be not less than 2 in. and shall be equal to or one size larger than the building service line. The meter, pressure reducing valve, and dual check backflow assembly may be one size smaller ~~that~~ *than* the meter service line (i.e., 4 in. tap, 4 in. gate valve, 4 in. meter service line, 3 in. meter, 3 in. PRV, 3 in. dual check assembly, 4 in stub-out for building service line).
 - b. Tapping sleeve shall be Ford Style FAST, stainless steel flange.
 - c. Gate Valve shall be as specified above.
 - d. Fittings and flanged coupling adapters as specified above.
 - ~~e. Pressure Reducing Valve shall be CLA-VAL Series 690, ductile iron body, pressure class 250.~~
 - ~~f. Back-flow Assemblies shall be CLA-VAL Model DC7L~~

Design Guideline
City of Osage Beach
SECTION 2 - WATER SYSTEM

- ~~dual check valves, Class 250.~~
- g. All additional devices, equipment, and valves shall be located on the customers side of the water meter and not located within the water meter pit.

WATERLINE AND APPURTENANCE INSTALLATION REQUIREMENTS

A. Waterline Installation

1. The minimum depth of cover is ~~36~~ 42 in. above the top of the pipe.
2. The maximum depth of cover for waterlines is ~~eight (8)~~ five (5) ft. unless specifically authorized in writing by the Public Works ~~Director~~ Operations Manager or designee.
3. ~~Green or~~ Blue minimum four inch wide marking tape marked "waterline below" shall be installed twelve inches above all waterlines.
4. Locator wire shall be standard tracer wire, a single No. 12 U.L. approved copper wire of the solid type with insulation for 600 volts. Wire for this service shall be blue in color and provided in standard rolls of not less than five hundred (500) foot lengths. Locator wire shall be placed on top of the water main and secured with tape at 8-foot intervals. Locator wire shall extend to al terminus, such as valves, hydrants, and meter pits. ~~No. 12 solid copper Toning wire shall be located three inches above taped to the top of all City owned waterlines and shall be extended to all valves, hydrants, meter sets, and terminus points.~~
 - a. Splices shall only be allowed where accessible. Buried splices will not be allowed. If valve box locations are spaced more than 500 feet apart, contractor shall install a vertical piece of 6-inch diameter PVC adjacent to the water main topped with a cast iron bonnet and cover marked "water". The wire shall be run outside up alongside the valve box, then through a hole in the valve box just below ground level. The splice connector shall be left exposed at the top of the valve box. Wire contact points shall be provided at no more then 500-foot intervals.
 - b. Prior to final acceptance by the City, the contractor shall demonstrate that the locator wire works to the satisfaction of the City Inspector, Public Works Operations Manager or designee.
5. Bedding shall be installed around the pipe from 6 inches below to 12 inches above the pipe. Bedding shall be ~~nominal 1½ inch minus~~ crushed rock conforming to MoDOT Type 5 aggregate, Section 1007.

Design Guideline
City of Osage Beach
SECTION 2 - WATER SYSTEM

~~1004, Grade D, Chat, or pea gravel, or Osage River Sand. Any material used shall have a PI of six or less. Trench backfill material shall not contain any material with a nominal particle size greater than six (6) inches.~~

6. Waterlines shall be separated by a minimum of 18 inches vertically and 10 feet horizontally from sanitary/storm sewer lines or sanitary/~~storm sewer~~ sewer line appurtenances unless:
 - a. At crossings the water or ~~sewer non-potable main~~ has an encasement to a point ten feet on either side of the sewer/water line crossing as appropriate. No joints shall occur in either the water or sewer line within the 20 ft. area. The encasement may be a free draining sleeve ~~of a material that is approved for use as a water main or one of the water or sewer main shall be constructed of mechanical or manufactured restrained joint pipe, fusion welded pipe. an impervious concrete encasement, a minimum of 12 in. thick.~~
 - b. For parallel lines closer than ten feet, exceptions can be made with prior approval of the Public Works ~~Director~~ Operations Manager or designee. Either the water main or the non-potable main shall be constructed of mechanical or manufactured restrained joint pipe, fusion welded pipe, or cased in a continuous casing. Casing pipe must be a material that is approved for use as a water main. ~~or designee. Generally, this will require a separate trench with water main 18 inches above the sewer, or a benched trench with water 18 inches above the sewer or the waterline must be above and encased in a free draining sleeve drained to daylight.~~
7. Primary power lines of 480 volts or higher shall not be placed in the same trench ~~with~~ any other utility. See Section 6 Road Cuts, Utility Trenches, and Excavation.
8. Secondary power may be installed in an offset trench with water lines. See Section 6 Road Cuts, Utility Trenches, and Excavation.

B. Valve Locations

1. When valves must be located within roadways and paved surfaces a cast or ductile iron valve box with valve box cover marked "water". The box shall be flush with the pavement to ¼ in. below the finished pavement surface. The cover shall be set in a minimum 6 in. deep by 18 in. square concrete pad.

Design Guideline
City of Osage Beach
SECTION 2 - WATER SYSTEM

2. Post Indicating Valves shall be located a minimum of 5 feet from the building that they are servicing.
- C. Water Meter Locations
1. As a general case water meters will be located on the customer's property immediately inside the property line from the city roadway or platted roadway property line.
 2. Meters will be set in traffic type boxes only with prior written consent of the Public Works ~~Director~~ Operations Manager or designee.
- D. Installation of Meter Assembly:
1. Residential and commercial hookup – 5/8 inch through 1 inch:
 - a. The Owner shall furnish and install the ~~service saddle, corporation stop, curb valve and box, tap,~~ meter service line, meter set, lockable shut-off valve, ~~pressure-reducing valve,~~ and the ~~tandem single~~ meter setter and the meter vault.
 - b. Wet taps are to be performed by a City approved contractor and witnessed by the City.
 - c. The City will furnish the water meter and transponder.
 - d. The meter installation shall be as detailed in the attached Typical Meter Installation Detail.
 - e. The water meter lid shall be easily accessible and visible.
 - f. All hard surfaces, including concrete and asphalt, that surround the water lid assembly will need prior approval from the Public Works Operations Manager or designee.
 - g. All obstructions within a 5-foot radius that present a clear obstacle to the maintenance of the city water meter shall be removed at the home owner's expense.
 2. Residential and commercial hookup – 1-1/2 inch and 2 inch:
 - a. The Owner shall furnish and install the ~~service saddle, corporation stop, curb valve and box, tap,~~ meter service line, meter set, lockable shut-off valve, ~~pressure-reducing valve,~~ and the ~~tandem single~~ meter setter and the meter vault.
 - b. Wet taps are to be performed by a City approved contractor and witnessed by the City.
 - c. The City will furnish the water meter and transponder.
 - d. The meter installation shall be in accordance with the attached Typical Meter Installation for 1-1/2 and 2 inch Meters.
 - e. The water meter lid shall be easily accessible and visible.
 - f. All hard surfaces, including concrete and asphalt, that surround the water lid assembly will need prior approval

Design Guideline
City of Osage Beach
SECTION 2 - WATER SYSTEM

- from the Public Works Operations Manager or designee.
- g. All obstructions within a 5-foot radius that present a clear obstacle to the maintenance of the city water meter shall be removed at the home owner's expense.

3. Domestic Service Connections 2-1/2 inch and larger:

- a. These are considered as custom installation with the technical requirements varying for each installation. The owner shall provide construction drawings by a Registered Professional Engineer for approval. The owner shall furnish and install all materials and appurtenances for a complete and operable service connection.
- b. Any wet tap larger than 2-inch shall be performed by a City approved contractor and witnessed by City Staff.

E. Fire Hydrant Locations

1. Fire hydrants shall be located ~~ten~~ five feet from the edge of pavement or ~~immediately inside the property owners land per the easement which ever shall be the farthest from the edge of pavement within the City's Right-of-way.~~ Hydrant and auxiliary valve should both be outside the roadway ditch areas.
2. Fire hydrants shall be located such that a clear work area a minimum of five feet in diameter exists around the hydrant.
3. All fire hydrant locations must be immediately accessible by fire vehicle.
4. Fire hydrants shall be installed with the 4-1/2 in pumper outlet toward the street or access point.
5. Fire hydrants shall be installed such that the finish grade is between three inches below and level with the hydrant base ring.

WATERLINE INSPECTION AND TESTING FOR ACCEPTANCE

A. Inspections:

1. As a part of the platting and permitting process the developer/owner shall submit full and complete engineering drawings sealed by a Registered Professional Engineer in the State of Missouri; ~~construction of one- and two-family dwellings and their accessory structures are excluded from this requirement, unless the design requires an extension to the City's system.~~ The design and materials specified shall conform to the requirements of the City of Osage Beach Design Guidelines. Such drawings shall be reviewed and approved by the Public Works ~~Director~~ Operations Manager or

Design Guideline
City of Osage Beach
SECTION 2 - WATER SYSTEM

designee prior to any onsite construction.

2. During the progress of the work each utility line shall be inspected by the ~~Engineering Department~~ City Inspector prior to trench backfill.

B. Water Main Leakage Tests

1. All water mains constructed by or for the City of Osage Beach shall be tested for leakage to the standards specified herein before they shall be accepted for service. A representative of the City shall be present during all testing.
2. Testing shall be by hydraulic means only. Air or vacuum tests will not be accepted.
3. Testing procedure is as follows:
 - a. Upon completion of the water main it shall be cleaned ~~and of~~ all dirt, trash, debris, and deleterious materials removed from the line.
 - b. Filled to capacity and all extraneous air removed.
 - c. Pressurize to 75 psi above normal working pressure at the test location and hold for a period of not less than two hours.
 - d. At the end of the testing period the line shall be refilled with water and the amount of water ~~needed~~ to refill the line shall be measured and recorded.
 - e. The amount of water ~~needed~~ to refill the line must be less than the maximum allowable leakage. The maximum allowable leakage shall be computed thusly:

$$Q_{Loss} = SDP^{1/2} / 133000$$

Where:

Q_{Loss} = Maximum allowable leakage

S = Length of the section tested in feet
D = Diameter of the pipe in inches

P = Test Pressure, PSI

C. Cleanup, Chlorination, and Bacteriological Testing

1. Prior to final acceptance and after pressure testing of the waterline the contractor/owner shall:
 - a. Thoroughly flush all sediment, debris, and deleterious

Design Guideline
City of Osage Beach
SECTION 2 - WATER SYSTEM

- materials out of the line.
- b. Fill the line with chlorinated water, chlorinated to not less than 50 ppm, and let stand for 24 hours.
 - c. At the end of 24 hours the line shall be thoroughly flushed and refilled with chlorinated water, chlorinated to 200 ppm and allowed to stand for three hours.
 - d. The line shall then be thoroughly flushed and bacteriological samples taken ~~Samples shall be forwarded to a Certified laboratory for testing. Upon receipt of passing test results, and with the authorization of the City the line may be placed in service in the following manner:~~
 - 1) Two consecutive sets of samples taken at least 24 hours apart from the new main in accordance with AWWA.
 - i. Samples to be taken every 1,200 of new main, plus one set from the end of the line and at least one set from each branch.
 - ii. Samples shall be collected in sterile bottles treated with sodium thiosulfate. No hose or fire hydrant shall be used in the collection of samples.
 - 2) Samples shall be tested by a Certified laboratory
 - 3) Upon receipt of passing test results, and with the authorization of the City, the line may be placed in service.

Prior to placing the waterline in service, the City Representative shall be presented with certified pressure test results, certified passing biological test results, and written certification that the waterline and appurtenances have been constructed in accordance with MDNR and City of Osage Beach standards.

D. Privately Owned Systems

1. Privately owned water mains within subdivisions where the mains are to remain the property of, and be maintained, by the subdivision owner and connected to the City of Osage Beach water system shall be tested as specified herein. Building service lines between the water meter and the building shall be tested in accordance with the International Plumbing Code and as accepted by the Department of Public Works at the time the meter is activated.
2. A written certification of waterline test completion is required.

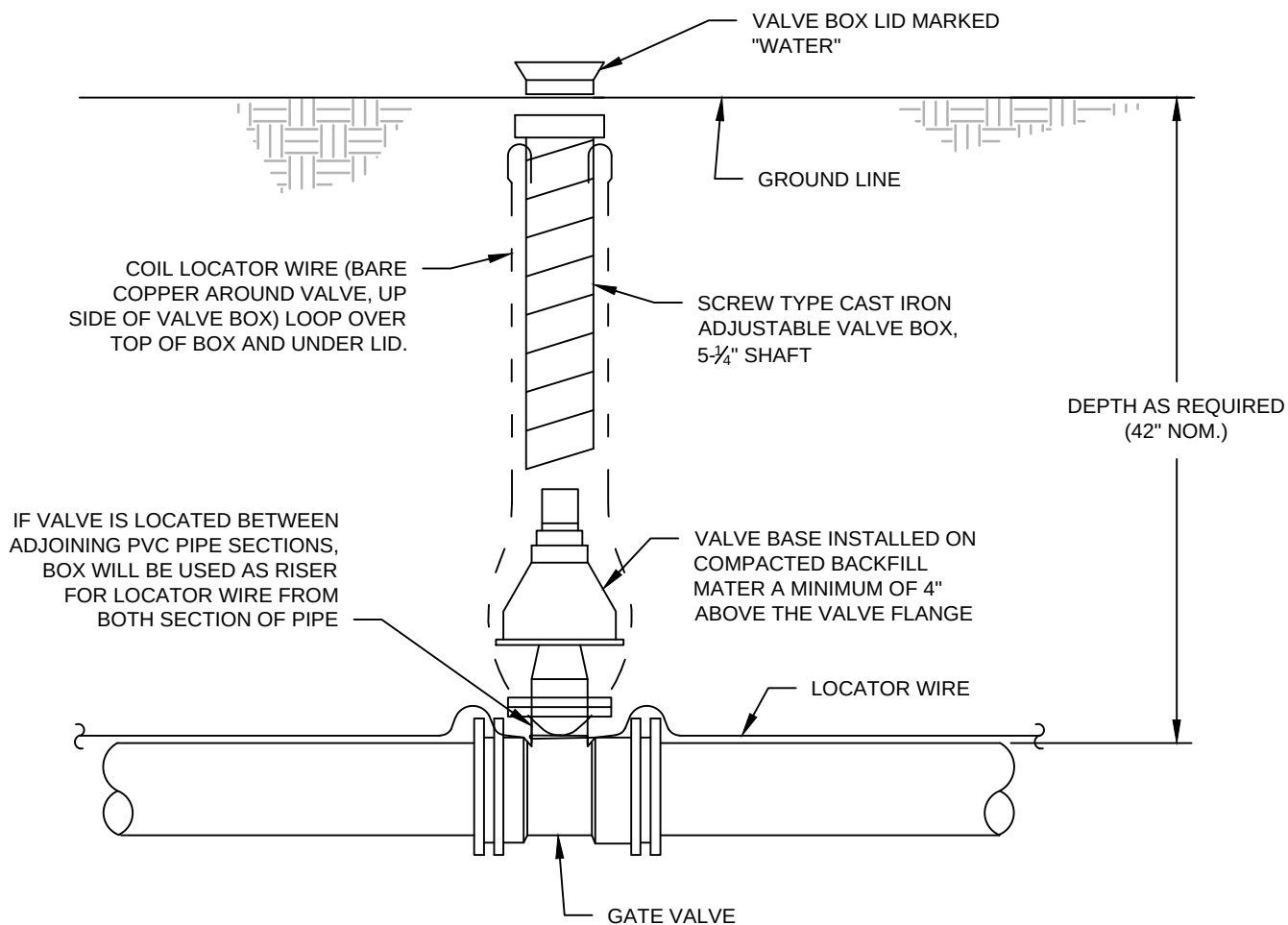
Design Guideline
City of Osage Beach
SECTION 2 - WATER SYSTEM

AS CONSTRUCTED DRAWINGS AND MAINTENANCE DOCUMENTS

The Developer/Contractor shall provide the Public Works Department with not less than two full sized "As Constructed" drawings certified as being correct record drawings by a Registered Professional Engineer or Land Surveyor. If fire pumps, specialized standby equipment, etc. are to be turned over the City two full sets of operational and maintenance data for each pump or system shall be provided to the Public Works ~~Director~~ **Operations Manager or designee**.

WATERLINE AND APPURTENANCES CONSTRUCTION DETAIL DRAWINGS

Construction details and sketches are attached.



NOTE:
6" PVC PIPE WITH CAST IRON OR ALUMINUM CAP
AND LID MAY BE SUBSTITUTED FOR SCREW TYPE
CAST IRON VALVE BOX IN OUT OF TRAFFIC AREAS.

Date Revised:
OCTOBER 2004

By:
SH

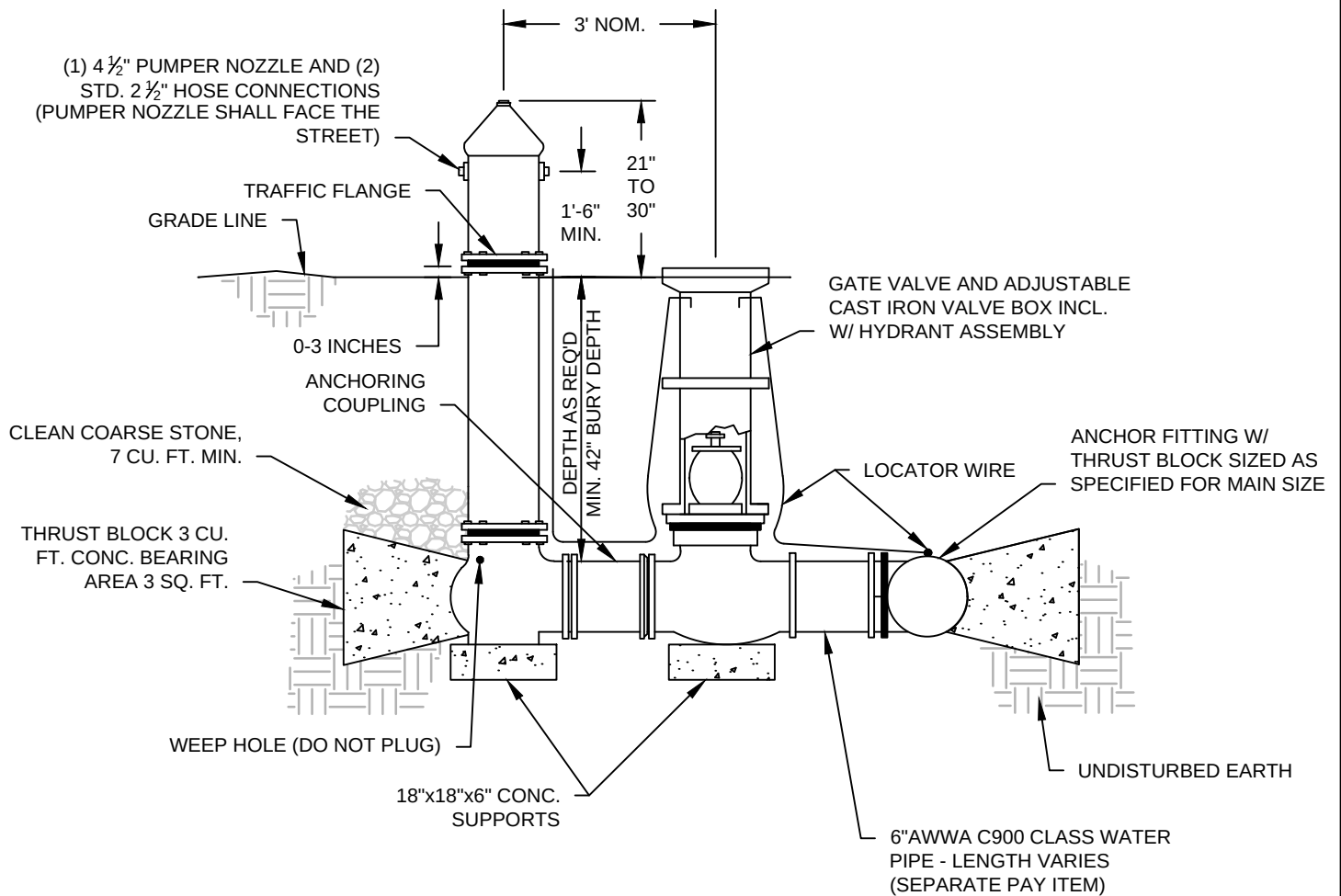
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CITY OF OSAGE BEACH
TYPICAL DETAIL
GATE VALVE INSTALLATION

Design Guideline:
SECTION 2

WATER SYSTEM

Drawing No:
II-1



NOTE:
RETAINER GLANDS REQUIRED ON ALL FITTINGS. RESTRAINED JOINTS SHALL BE REQUIRED WHERE INDICATED OR DICTATED BY AVAILABLE SPACE OR UNSUITABLE SOIL CONDITIONS.

Date Revised:	OCTOBER 2004
By:	SH
Checked By:	JB

CITY OF OSAGE BEACH TYPICAL DETAIL FIRE HYDRANT

Design Guideline:	SECTION 2
	WATER SYSTEM
Drawing No:	II-2

C/L ROADWAY

C/L WATER MAIN

EDGE OF PAVEMENT

R/W

R/W

RIGHT-OF-WAY LINE

R/W

NOTE:
FIRE HYDRANT SHALL BE LOCATED
5' FROM EOP OR WITHIN THE
CITY'S RIGHT-OF-WAY

5' MINIMUM

FIRE
HYDRANT
ASSEMBLY

Date Revised:
OCTOBER 2004

By:
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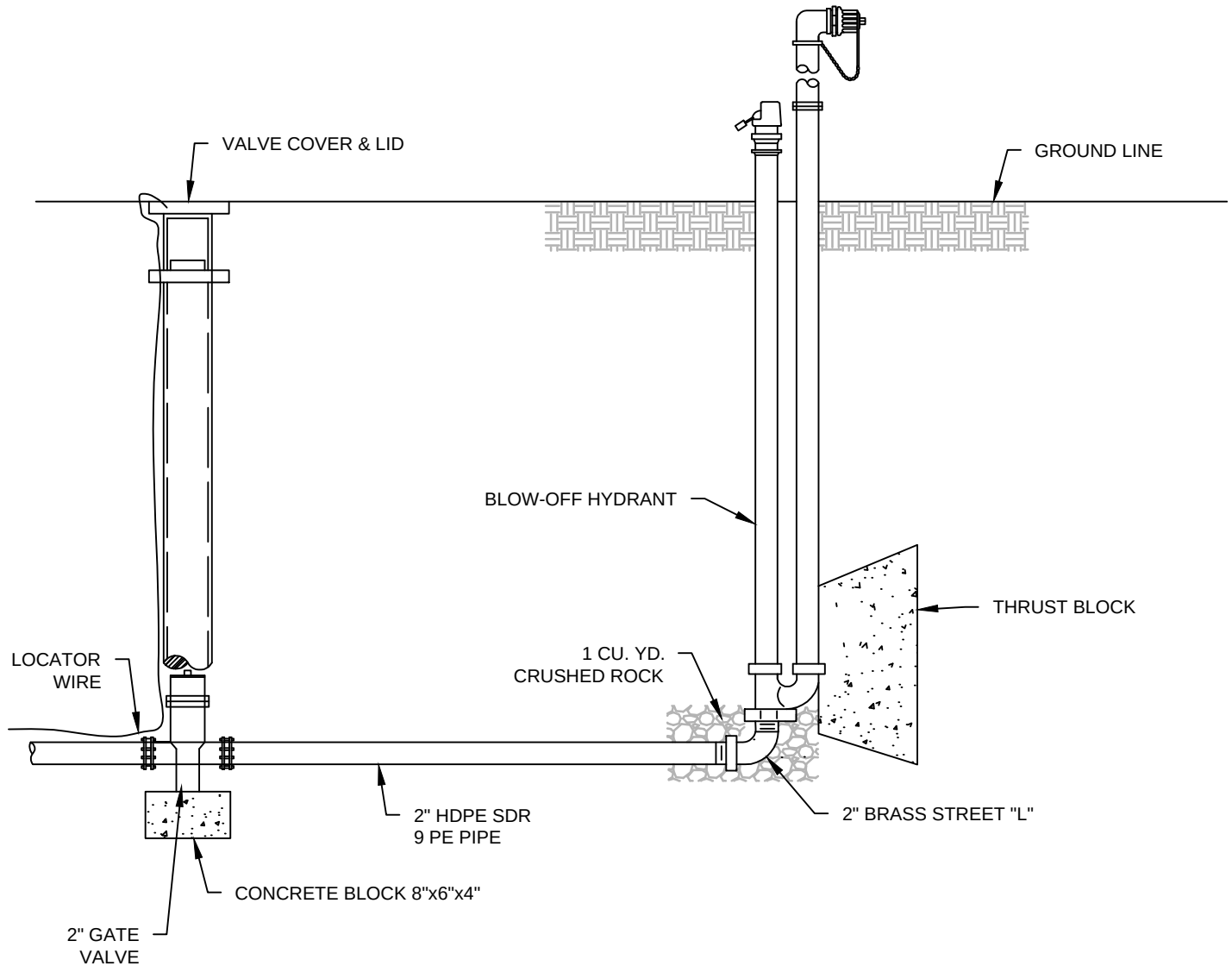
CITY OF OSAGE BEACH
TYPICAL DETAIL
FIRE HYDRANT LOCATION

Design Guideline:
SECTION 2

WATER SYSTEM

Drawing No:
II-3

NOTE:
CONTRACTOR SHALL FIELD VERIFY WITH
ENGINEER DIRECTION OF BLOW-OFF HYDRANT.



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**CITY OF OSAGE BEACH
TYPICAL DETAIL
BLOW-OFF ASSEMBLY**

Design Guideline:
SECTION 2

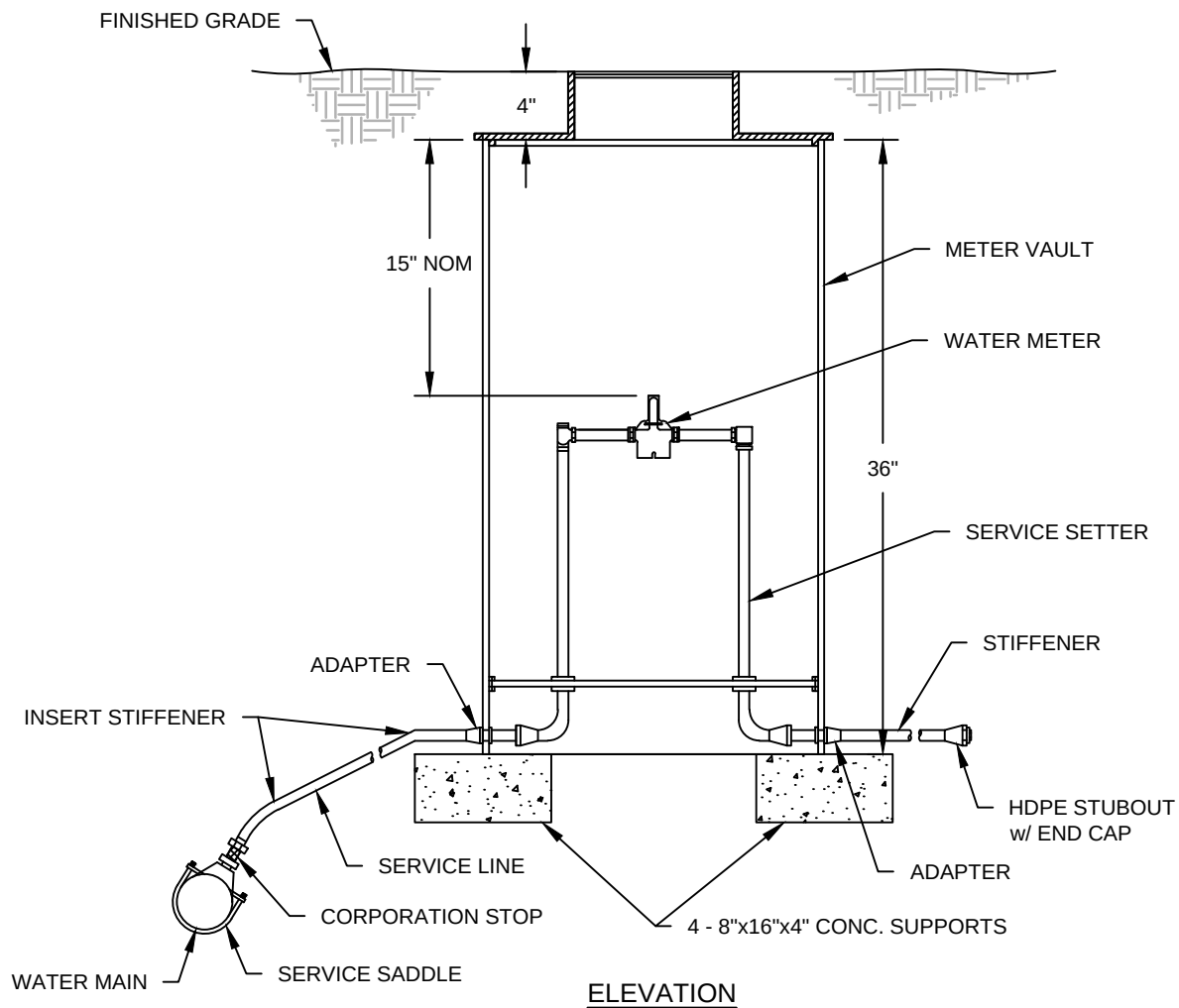
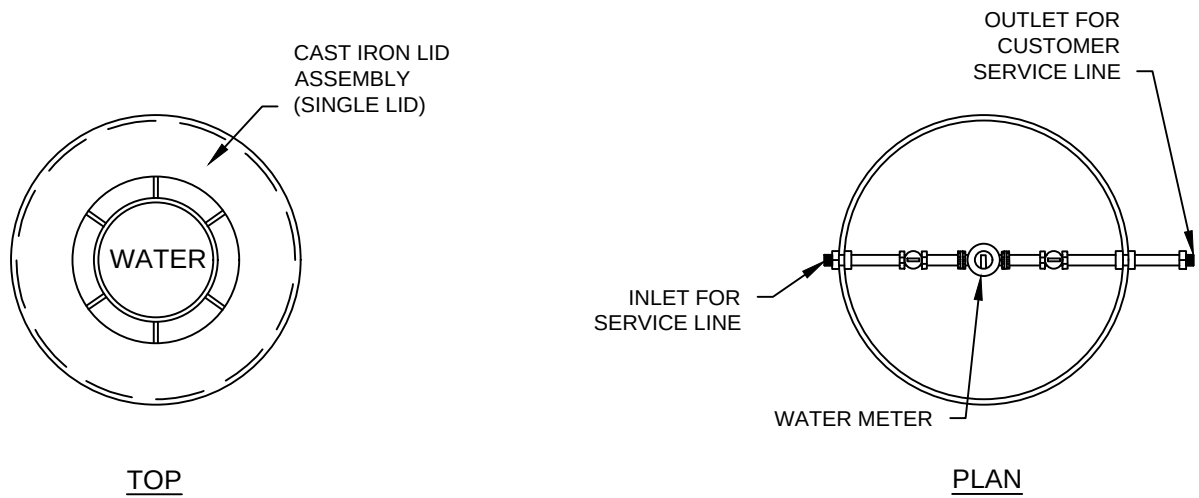
WATER SYSTEM

Drawing No:
II-4

Diagram illustrating the cross-section of a trench for a locator wire. The components and labels are:

- GROUND LINE**: The top surface of the ground.
- 2x4 PLACED FOR FUTURE LOCATE**: A vertical board placed on top of the locator wire for future locating.
- LOCATOR WIRE**: The wire used for locating the trench.
- 12" TYP.**: The typical height of the straddle block.
- STRADDLE BLOCK CAST IN PLACE**: A block cast over the locator wire.
- TRENCH BOTTOM**: The bottom of the trench.
- GRANULAR BEDDING MATERIAL**: The material used for bedding the trench.

Technical drawing showing a cross-section of a trench. The trench is 10' wide. The water main is 1.5' MIN. (PIPE 6") and 2' MIN. (PIPE 8" & LARGER) TYP. EACH SIDE. The gate valve and box is shown. The retaining wall is 12" thick and contains #4 BARS @ 12" CTRS. (EACH WAY). The trench is filled with gravel, and the surrounding area is undisturbed earth. A cap or plug is shown on the right side of the water main.



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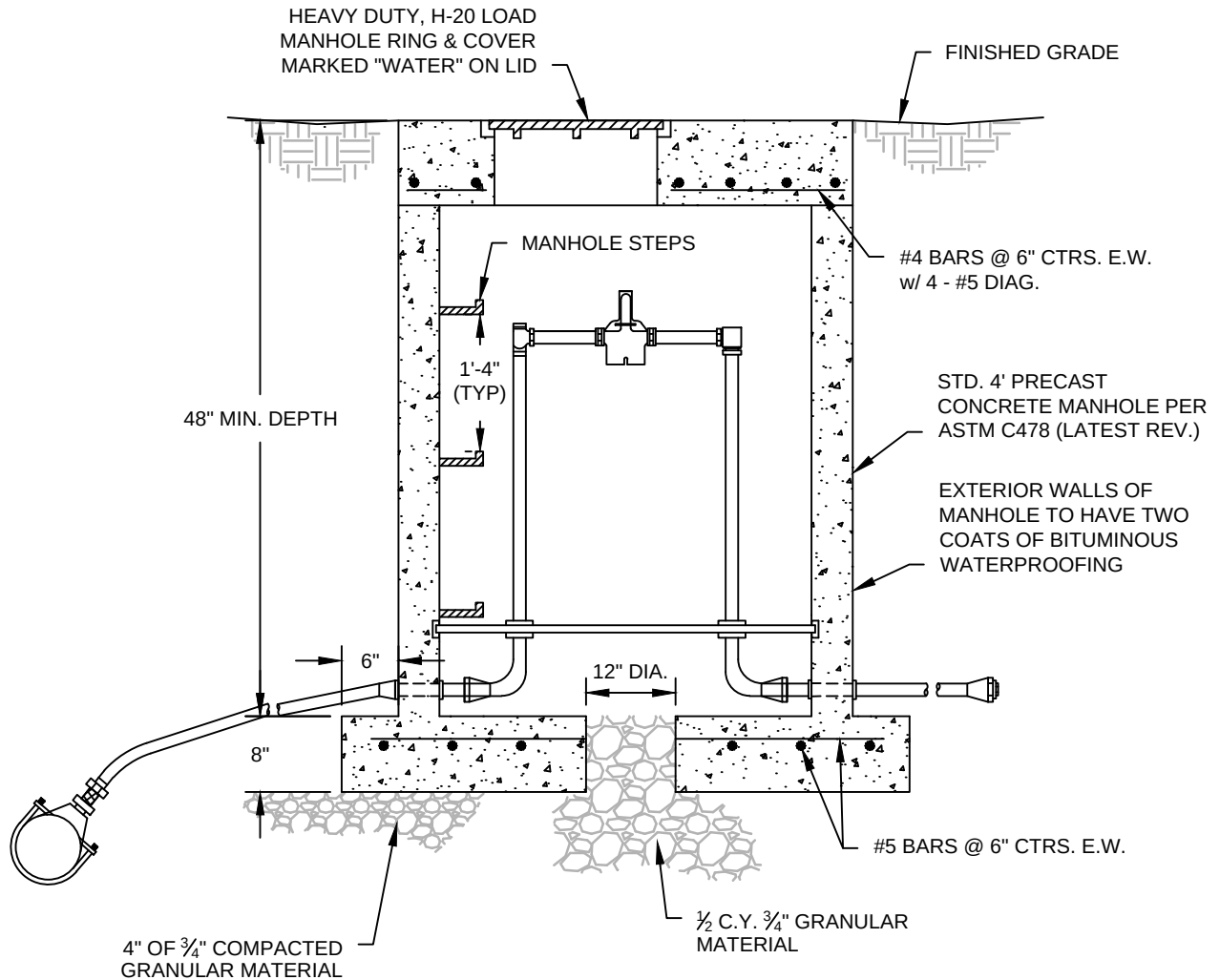
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CITY OF OSAGE BEACH
TYPICAL DETAIL
METER SETTING SIDEWALK OR LAWN
5/8"x3/4", 1", 1-1/2", OR 2" METERS

Design Guideline:
SECTION 2

WATER SYSTEM

Drawing No:
II-6



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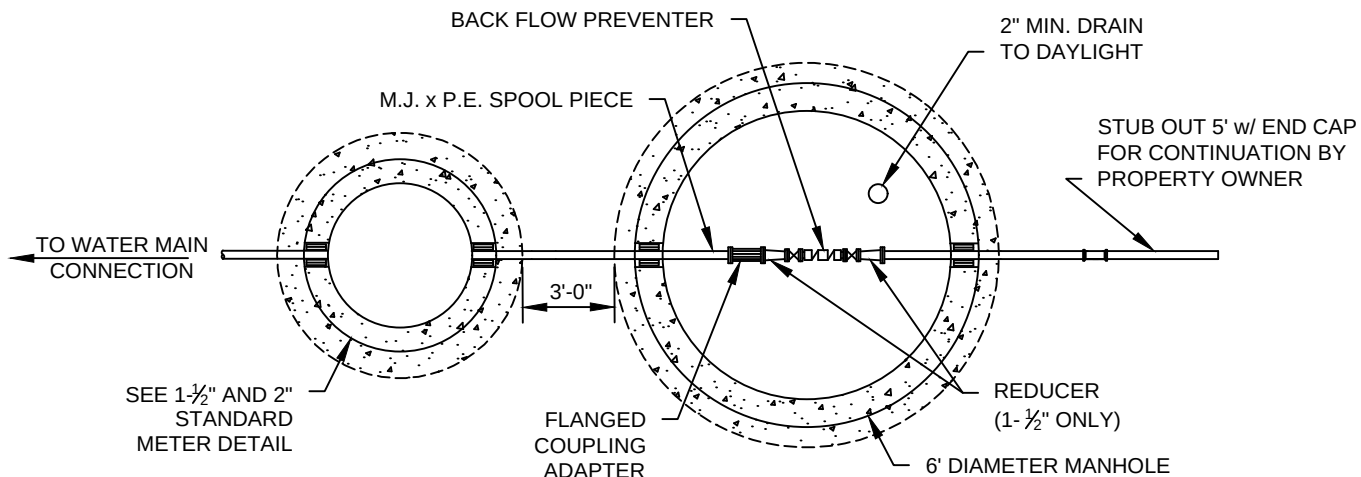
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CITY OF OSAGE BEACH
TYPICAL DETAIL
METER VAULT DRIVEWAY OR
PARKING AREA

Design Guideline:
SECTION 2

WATER SYSTEM

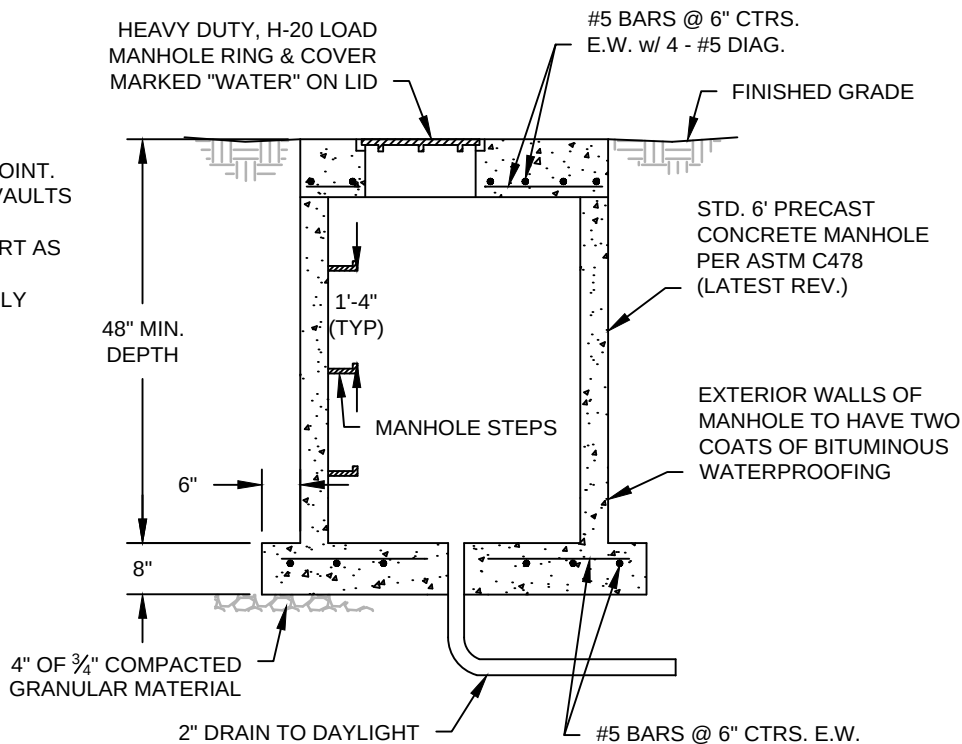
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II-7



PLAN VIEW (TOP REMOVED)

NOTES:

1. ALL PIPE AND FITTINGS OUTSIDE VAULTS SHALL BE MECHANICAL JOINT.
2. ALL PIPES AND FITTINGS INSIDE VAULTS SHALL BE FLANGED.
3. PROVIDE ADEQUATE PIPE SUPPORT AS REQUIRED.
4. BACK FLOW PREVENTER ASSEMBLY MIN. OF 12" OFF FLOOR.



BACKFLOW PREVENTER ELEVATION

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**CITY OF OSAGE BEACH
TYPICAL DETAIL
1- $\frac{1}{2}$ " TO 2" METER WITH
BACK FLOW PREVENTER**

Design Guideline:
SECTION 2

WATER SYSTEM

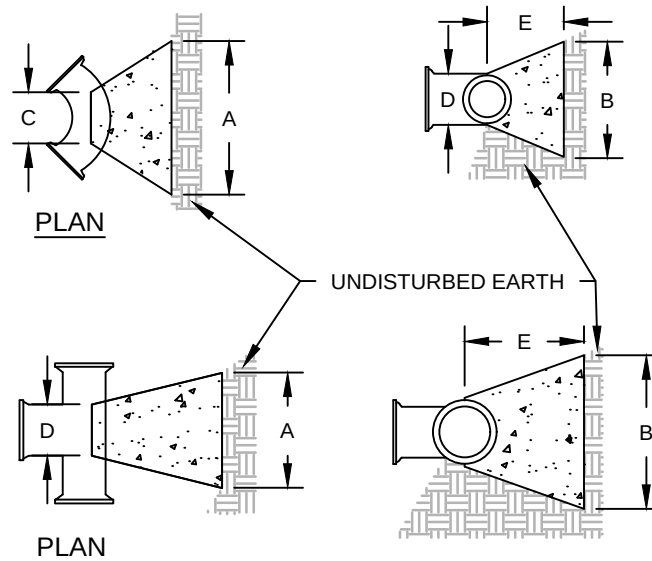
Drawing No:
II-8

PIPE SIZE CHART

PIPE SIZE	FITTING	DISTANCE IN INCHES				
		A	B	C	D	E
4" AND SMALLER	11.25° & 22.5°	9	9	8	8	6
	45°	18	9	8	8	12
	90°	21	12	8	8	12
	TEE/PLUG	15	12	8	8	12
6"	11.25° & 22.5°	12	12	8	10	12
	45°	27	12	8	10	12
	90°	33	18	8	10	12
	TEE/PLUG	24	18	8	10	12
8"	11.25° & 22.5°	18	15	8	10	12
	45°	33	15	8	10	18
	90°	42	24	8	10	18
	TEE/PLUG	30	24	12	10	18
10" & 12"	11.25° & 22.5°	27	24	12	12	18
	45°	51	24	12	12	24
	90°	63	36	12	12	30
	TEE/PLUG	45	36	12	12	24
14" & 16"	11.25° & 22.5°	33	33	12	16	18
	45°	69	33	12	16	30
	90°	84	48	12	16	36
	TEE/PLUG	60	48	12	16	30

NOTES:

1. THRUST BLOCKS ARE BASED ON A WORKING PRESSURE OF 200 P.S.I. PLUS 0% SURGE & 2000 P.S.F. ALLOWABLE SOIL BEARING PRESSURE.
2. FOR PIPE SIZES NOT SHOWN USE DIMENSIONS FOR NEXT LARGER SIZE.
3. USE 3/8" PLYWOOD SEPARATOR BETWEEN BLOCKS AND PLUGS TO PROVIDE FOR FUTURE REMOVAL.



Date Revised:
OCTOBER 2004

By:
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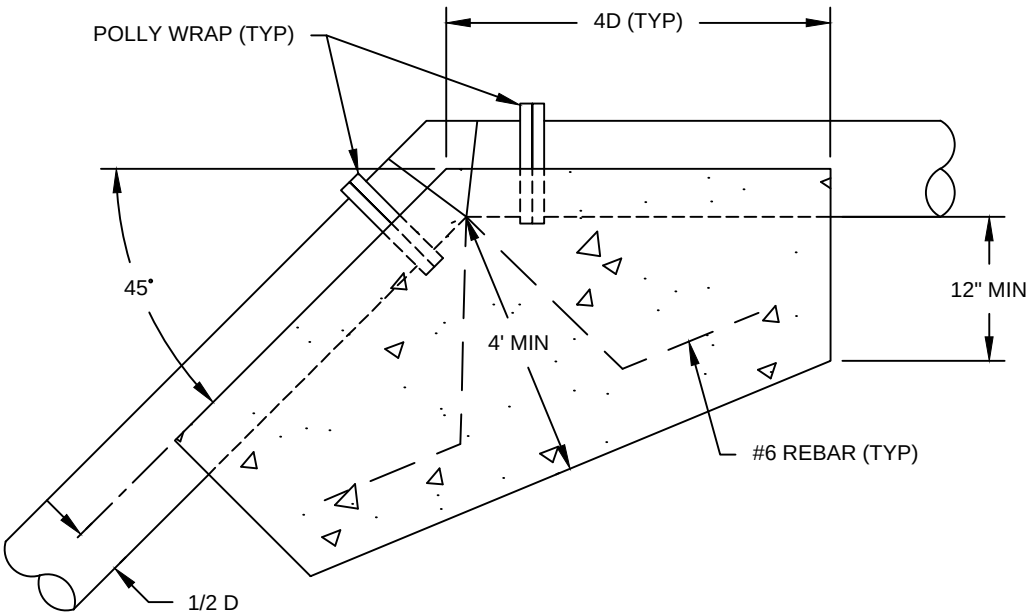
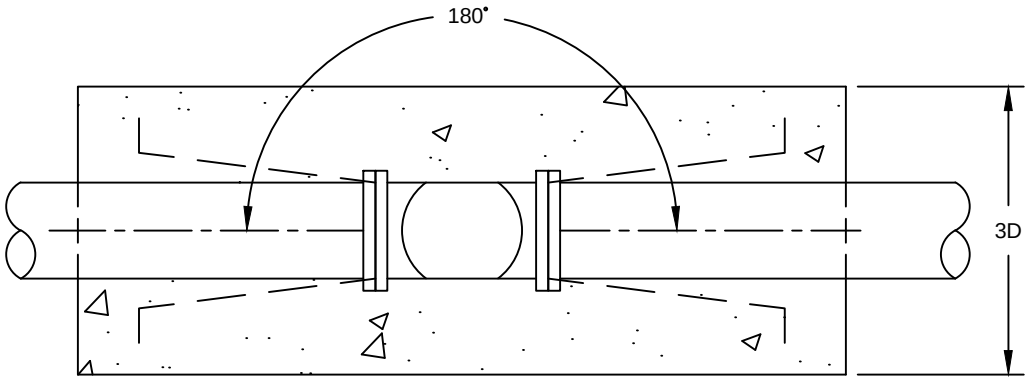
CITY OF OSAGE BEACH TYPICAL DETAIL THRUST BLOCK DETAIL

Design Guideline:
SECTION 2

WATER SYSTEM

Drawing No:
II-9

NOTE:
M.J. FITTING WITH RETAINER GLANDS
REQUIRED FOR ALL VERTICAL BENDS



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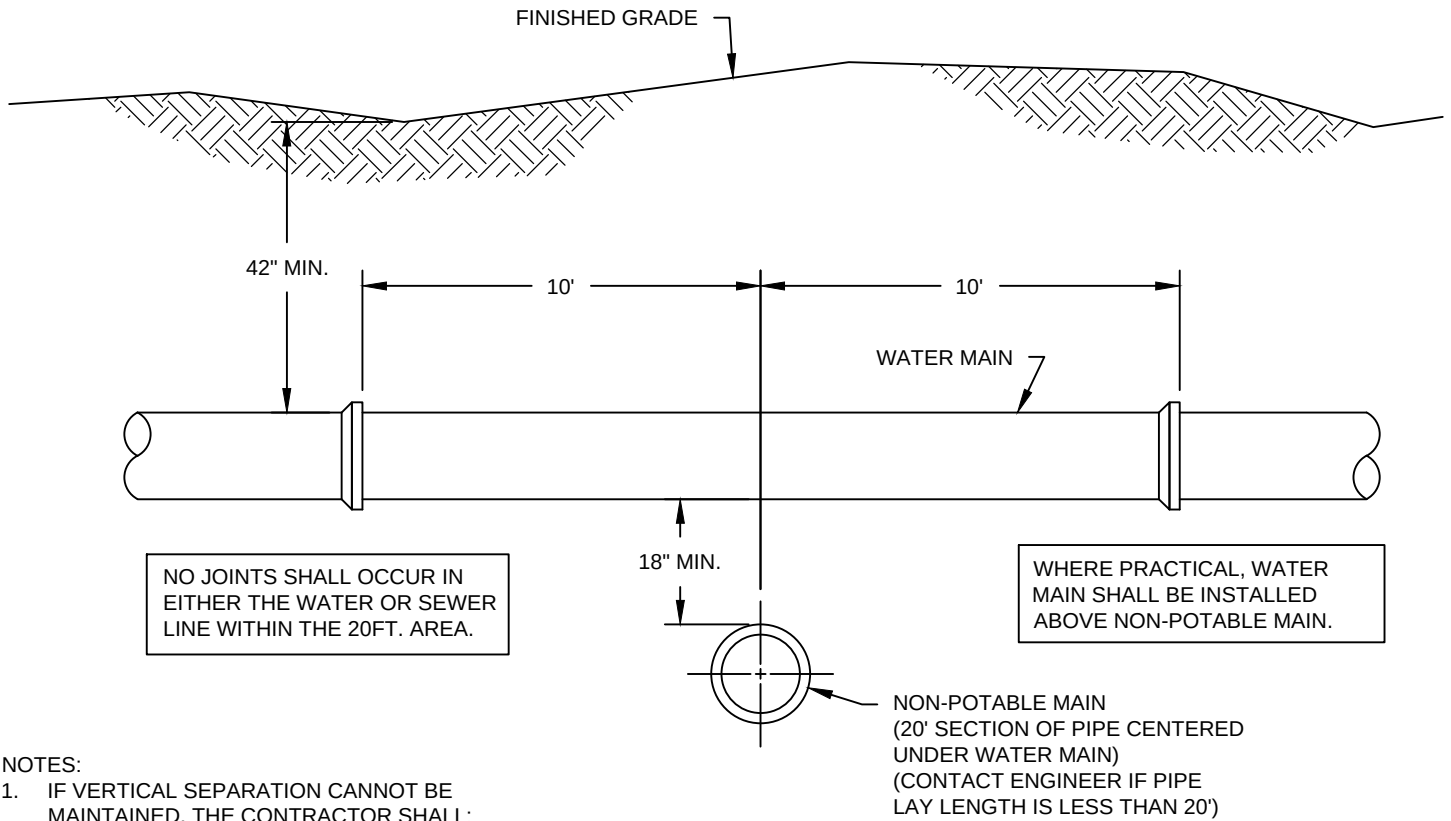
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CITY OF OSAGE BEACH
TYPICAL DETAIL
VERTICAL BEND THRUST BLOCK

Design Guideline:
SECTION 2

WATER SYSTEM

Drawing No:
II-10



NOTES:

1. IF VERTICAL SEPARATION CANNOT BE MAINTAINED, THE CONTRACTOR SHALL:

1.1. PROVIDE ENCASEMENT TO A POINT OF TEN FEET ON EITHER SIDE OF THE SEWER/WATER LINE CROSSING AS APPROPRIATE. CASING PIPE MUST BE A MATERIAL THAT IS APPROVED FOR USE AS WATER MAIN.

OR

1.2. CONSTRUCT ONE OF THE WATER OR SEWER MAIN WITH MECHANICAL OR MANUFACTURED RESTRAINED JOINT PIPE OR FUSION WELDED PIPE.

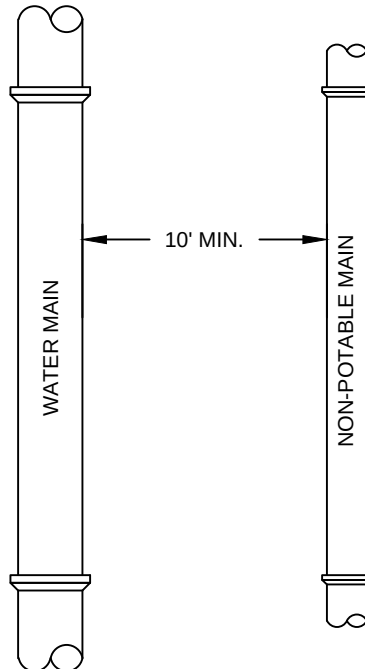
2. IF HORIZONTAL SEPARATION CANNOT BE MAINTAINED, THE CONTRACTOR SHALL:

2.1. CONSTRUCT ONE OF THE WATER OR SEWER MAIN WITH MECHANICAL OR MANUFACTURED RESTRAINED JOINT PIPE OR FUSION WELDED PIPE.

OR

2.2. PROVIDE A CONTINUOUS CASING. CASING PIPE MUST BE A MATERIAL THAT IS APPROVED FOR USE AS A WATER MAIN

VERTICAL SEPARATION



HORIZONTAL SEPARATION

Date Revised:
OCTOBER 2004

By:
SH

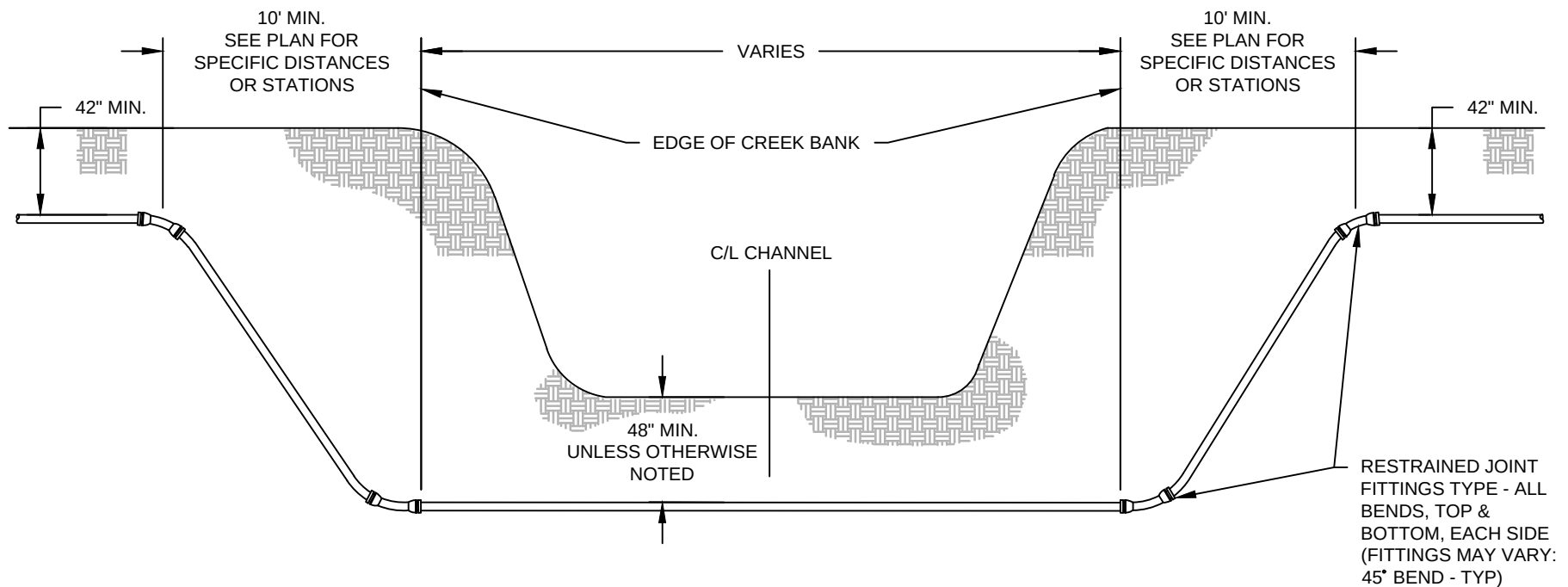
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CITY OF OSAGE BEACH
TYPICAL DETAIL
WATER / NON-POTABLE MAIN CROSSING

Design Guideline:
SECTION 2

WATER SYSTEM

Drawing No:
II-11



Date Revised:
OCTOBER 2004

By: SH

Checked By:
JB

CITY OF OSAGE BEACH TYPICAL DETAIL CREEK CROSSING

Design Guideline:
SECTION 2

WATER SYSTEM

Drawing No:
II-12

Design Guidelines
City Of Osage Beach
SECTION 3 - SEWERAGE DESIGN

(Revised 03 MAY 2005 - JCB)

GENERAL

The City of Osage Beach operates a sewage collection and treatment system in accordance with the Missouri Department of Natural Resources (MDNR) regulations. The system is comprised of pressure and gravity sewer lines, grinder stations, lift stations, and a jointly owned regional sewage treatment facility. The plant is managed by the Lake Ozark / Osage Beach Joint Sewer Board. The collection system within Osage Beach, and from the city to the plant, is owned and operated by the City of Osage Beach. At the current time, there are a few isolated areas within the city that are not served by the collection system. It is the policy of the city that all occupied facilities within the city will have city sewer service.

At the present time, there are over 1100 grinder stations and 54 sewage lift stations. These stations have been standardized to use ABS pumps and appurtenances. This practice shall continue until determined by the city to be infeasible or otherwise unsatisfactory.

All modifications to the sewage treatment plant or the sewage collection system shall conform to the MDNR regulations and policies as supplemented herein.

REFERENCED CITY ORDINANCES

Chapter 400.110 Subdivision Regulations
Chapter 410.130 Contents (Location and design of water mains and appurtenances)
Chapter 410.190 Design Standards
Chapter 410.260 Location of Utilities in Right-of-Ways
Chapter 410.330 Sanitary Sewers
Chapter 710 Sewers and Sewerage Systems

SEWERAGE DESIGN

1. Waste Water Treatment Facility; Modifications to the existing treatment facility must be made under the direction of the Lake Ozark / Osage Beach Joint Sewer Board. Such modifications must be designed in accordance with, and approved by, the MDNR. If the city needs to have changes made in the plant, they must forward the request to the Joint Sewer Board.
2. Sewage Collection System; Modifications of, and additions to, the existing sewage collection system shall be made in accordance with MDNR regulations as supplemented herein.

Design Guidelines
City Of Osage Beach
SECTION 3 - SEWERAGE DESIGN

3. Hydraulic Design shall be based upon the following criterion:

AVERAGE DAILY FLOWS

Type of Establishment	Pounds BOD per person	Gallons/Day per person
<u>Residential</u>		
Single family	0.17	100
Apartments	0.17	100
Condos	0.17	100
<u>Commercial Food & Drink</u>		
Tavern	0.01	2
Fast food	0.02	5
Restaurant	0.04	5
(with garbage grinder)	0.07	6
Car Wash (10.3 gpd/sf) (31.5 gpm Peak Hour / Bay)		See data To left
<u>Institutions</u>		
Day school		
W/ gym & showers	0.03	20
W/ cafeteria - ADD	0.02	4
W/ garbage grinding - ADD	0.02	1
Hospital - per bed	0.22	200
Nursing homes	0.17	125
Park restroom	0.02	5
Park restroom w/showers	0.06	25
Swimming pools	0.06	25
Country club per resident	0.17	100
Country club per member	0.06	25
Service Stations	0.01	5
Laundromats per machine	1.25	580
Hotels	0.15	50
Motel w/o restaurant	0.1	40
Luxury Resort	0.17	75
Camp trailer	0.08	30
Churches per seat	0.01	5
Stores, shopping centers, malls per 1000 sf of floor area	0.34	200
Stadiums, auditoriums, theaters or drive-ins per seat	0.01	5

*Includes infiltration

Design Guidelines
City Of Osage Beach
SECTION 3 - SEWERAGE DESIGN

EQUIVALENT POPULATION

Facility	Persons/Unit
Single family residence	3.7
Apartment or condo	
one bedroom	2
two bedrooms	3
three bedrooms	3.7
Mobile homes	3
Camper trailer	3
Motels per room	3

PEAK HOURLY FLOW = 4 X AVERAGE DAILY FLOW

4. Gravity Sewers design shall conform to the applicable Missouri Department of Natural Resources regulations and as specified herein. The peak hourly flow shall be determined and the gravity line sized accordingly with the following additions:
 - a. Gravity sewer laterals from a residence to grinder station or main:
 - 1) Shall be not less than 4-inch pipe.
 - 2) Shall have a cleanout located within 5 feet of the residence and at all vertical and horizontal bends; a sanitary tee within 5 feet of the grinder station or main; and a backflow valve adjacent the grinder station.
 - 3) Shall not exceed 150 feet in length. Residence service lines over 150 feet in length shall be treated as sewer mains.
 - 4) Shall be SCH 40 with SCH 40 fittings or ASTM D3034 DR 26 PVC with sanitary sewer DR 26 PVC or ductile iron fittings.
 - 5) All bends shall be long radius bends. Short radius 90° bends are specifically prohibited.
 - b. Gravity Sewer mains:
 - 1) Sewer mains shall be designed for the peak hourly flow and shall be not less than 8-inch pipe.
 - 2) Gravity sewer pipe shall be:
 - a) Ductile iron, ASTM A746, Class 350 with cement lining. Ductile iron Push-on type joints and fittings shall be used, or
 - b) ASTM 2241, DR 21, Class 150 with approved fittings.
 - c) PVC, ASTM D3034, SDR 26, with SDR 26 PVC sanitary fittings.
 - d) **ASTM D3034, SDR 35, with SDR 35 fittings where maximum depth of cover is eight (8) feet or less.**
 - e) SCH 40 PVC with SCH 40 fittings
 - 3) Manholes shall be constructed at the end of main and at changes in horizontal or vertical alignment, or not more than every 350 feet.
 - 4) When a residence service line will exceed 150 feet, a manhole shall be constructed with a 4-inch service line to the residence and a minimum eight-inch main to remainder of the system.

Design Guidelines
City Of Osage Beach
SECTION 3 - SEWERAGE DESIGN

- 5) All bends shall be long radius bends. Short radius 90° bends are specifically prohibited.
- c. Connections to sewer mains shall be made using a sanitary wye tapping fitting.
- d. Connections to grinder pump basins:
 - 1) Shall be made using a cast iron inlet hub of appropriate diameter and shall be bolted to the grinder basin and sealed with an approved silicone seal. A PVC backflow valve (check valve) shall be installed within 2 feet of the basin.
 - 2) Inlet pipes shall be installed a minimum of four feet above the bottom of the grinder basin and not less than 18 inches below the top of the basin.
- e. Bedding:
 - 1) Shall be installed around the pipe from 3 inches below to 12 inches above the pipe. Bedding shall be nominal ½ inch minus crushed rock conforming to MoDOT Section 1004, Grade D, Chat, or pea-gravel, or Osage River Sand. Any material used shall have a PI of six or less.
- f. Detectable Marking Tape and Toning Wire:
 - 1) Metallic detectable marking tape, Type III, shall be placed in the trench above all sewers, gravity and pressure, one foot above the pipe.
 - 2) No. 12 solid copper toning wire shall be located three inches above the sewer line and shall be continuous from terminus to terminus and shall include all city owned sewers.
- g. Minimum grades for gravity sewers:
 - 1) 4-inch sewer shall be not less than 1.00%
 - 2) 6 inch sewer shall be not less than 0.67%
 - 3) 8 inch sewer shall be not less than 0.50%
 - 4) 10 inch sewer shall be not less than 0.33%
 - 5) Larger shall be as approved by the City Engineer
- h. Minimum depth of cover for gravity sewers:
 - 1) Shall be not less than 18 inches above the top of pipe
- i. Maximum depth of cover shall be eight (8) feet unless specifically authorized in writing by the City Engineer.
- j. Manholes:
 - 1) Shall be as detailed in the Osage Beach Design Guideline
 - 2) Or as approved by the City Engineer
- k. Valve Boxes:
 - 1) Shall be Buffalo type with cast iron lid marked “sewer”.
- l. Leak testing for gravity sewers:
 - 1) Gravity sewer lines may be tested by air or water method.
 - a) Water Tests: Gravity sewer lines shall be plugged at the bottom end and filled with water to the top of the next upstream manhole; or if no manhole, to the top of the farthest upstream cleanout; and left for twenty-four hours. The line shall then be refilled with a measured amount of water. The allowable leakage shall be one gallon per hundred feet of line tested.
 - b) Air Tests: Test lines between manholes with low-pressure air. Safety requires a regulator or relief valve on pressurizing

Design Guidelines
City Of Osage Beach
SECTION 3 - SEWERAGE DESIGN

equipment, set at 8 psig. No one will be allowed in manholes while there is air pressure against test plugs.

- 1) Plug all pipe outlets to resist test pressure. Give special attention to laterals.
- 2) Plug all other pipes in both upstream and downstream manholes and fill manholes with clear water to just above the line plugged for testing. Any bubbles appearing during the test indicate leakage past a plug or in part of the test equipment.
- 3) Compute the test pressure by multiplying 0.43 times the elevation difference (in feet) of the upstream manhole rim and the invert of the line under test at the downstream manhole. The result is in psig and may be rounded to the nearest half psig. The test pressure shall be not less than 3.5 psig, nor more than 6.0 psig. Total line length included in any test section shall not exceed 400 feet.
- 4) Supply air into the line until test pressure is attained. Allow at least 5 minutes for air temperature in the test section to stabilize.
- 5) Reestablish the test pressure, and start a stop watch. Determine the time required for pressure to drop 0.5 psig.
- 6) If the pressure does not drop during the stabilization period, and no additional air has been added, the section undergoing test will have passed without further testing.
- 7) The pipe section will also have passed if the time observed for the pressure to drop 0.5 psig is greater than that determined by using the following table:

Pipe Size, Inches	Time
4	4 minutes 2 seconds
6	6 minutes 0 seconds
8	7 minutes 37 seconds
10	9 minutes 8 seconds
12	10 minutes 58 seconds
14	12 minutes 30 seconds
16	14 minutes 32 seconds

When a combination of more than one pipe size is under test, the calculated time for the larger pipe shall apply.

Design Guidelines
City Of Osage Beach
SECTION 3 - SEWERAGE DESIGN

- 2) Manholes may be tested by vacuum or water method.
 - a) Water Method: Manholes shall be tested by plugging inlet and outlet pipes and filling with water to the top of the manhole cover ring and letting set for twenty-four hours. The maximum leakage shall be a drop in water level of three inches.
5. Pressure Sewers design shall conform to MDNR requirements and as supplemented herein. The design of additions to the city sewer system shall minimize the need for pressure sewer to the maximum extent practicable in order to reduce the number of lift or grinder stations to the minimum required. Pressure sewers shall conform to the following criterion:
 - a. Pressure sewers shall be designed for flow rates between 2.0 fps and a maximum of 7.0 fps. The minimum diameter of pipe used shall be 1-1/4 inches.
 - b. Pressure pipe:
 - 1) Less than four inches in diameter shall be schedule 40 PVC or ASTM 2241, DR 21, Class 150.
 - 2) Four inches and larger shall be: AWWA C151 Class 350 ductile iron, or AWWA C900 DR 18 Class 150 PVC.
 - c. Joints:
 - 1) For SCH 40 pipe shall be solvent welded.
 - 2) For other pipe shall be neoprene lined push-on type joints or as approved by the City Engineer.
 - d. Fittings:
 - 1) For Schedule 40 pipe shall be Schedule 80 fittings.
 - 2) For other pipe may be appropriately rated and compatible PVC or ductile iron on PVC and shall be ductile iron on ductile iron sewers. All fittings shall be neoprene gasket push-on type or as approved by the City Engineer.
 - 3) Long radius bends or multiple fittings shall be used. The use of short radius 90° bends is prohibited.
 - e. The minimum cover for pressure sewer is 30 inches.
 - f. The maximum depth of cover for pressure sewers is eight (8) feet unless specifically authorized in writing by the City Engineer.
 - g. Bedding shall be installed around the pipe from 3 inches below to 12 inches above the pipe. Bedding shall be nominal ½ inch minus crushed rock conforming to MoDOT Section 1004, Grade D, Chat, or pea-gravel, or Osage River Sand. Any material used shall have a PI of six or less.
 - h. Detectable marking tape and Toning Wire:
 - 1) A metallic detectable marking tape, Type III, marked "Sewer Below" shall be placed in the trench one foot above all pressure sewers pipe.
 - 2) A No. 12 solid copper toning wire shall be installed three inches above the pressure sewer and shall extend from terminus to terminus.
 - i. The check valve shall be brass body, single flap type.
 - j. The inlet connection hub shall be cast iron inlet hub bolted to the basin. The back of the hub shall be sealed to the basin using approved silicone sealant. Appropriate inlet hubs are stocked by the ABS supplier.

Design Guidelines
City Of Osage Beach
SECTION 3 - SEWERAGE DESIGN

- k. An isolation valve shall be installed at the connection to the sewer main. The valve shall be brass body, globe valve of the same nominal size as the pressure sewer shall be installed at the connection to the sewer force main. The valve should be located so as to be outside roadway or other similar traffic areas. The globe valve shall have integral checks for open and closed positions. The valve shall be placed upon a concrete, or approved, masonry pedestal to prevent settlement; shall be covered with a buffalo type valve box and cover extended to one inch above the finished surface. If the finished surface is concrete or asphalt pavement in which case the valve box cover shall be flush with the paved surface. Valve box covers on pressure sewers shall be marked "SEWER". The markings shall be cast into the cover.
- l. The tapping saddle shall be PVC similar and equal to Rockwell 315 or 317I. The tapping saddle shall be sealed to the pipe by means of a rubber "O" ring seal to provide a connection suitable for a working pressure of 200 psi. Tapping saddles shall have flanged or threaded outlets conforming to ANSI B16.1. If at all possible, all tapping saddles shall be in the horizontal position. Under no circumstances shall anyone make a wet tap without approval and authorization of City Building Official.
- m. Leakage test: The pressure sewer shall be filled with water from the isolation valve to the grinder station shut-off valves and shall be fitted with a testing connection such that the line can be pressurized and refilled with water. The line shall be brought to a pressure 50 psi above line working pressure and held at that pressure for two hours. The line shall then be refilled with a measured quantity of water. The maximum allowable leakage shall be one gallon per inch of pipe diameter per 1000 feet of pipe. Air or vacuum tests will not be accepted.

DESIGN OF GRINDER PUMPS AND SEWAGE LIFT STATIONS

The design of grinder pump installation shall be certified by a Registered Professional Engineer and shall conform to MDNR and the City Of Osage Beach requirements. In order to reduce maintenance and operational cost, the city has selected ABS pumps and equipment as their standard. Accordingly, all grinder pumps and lift stations shall be designed using ABS equipment unless specifically authorized by the City Engineer. The size, type, and capacity of the grinder pump, or lift station, shall be based upon the hydraulic loading and gradient necessary to pump sewage from the source to an appropriate location.

- 1. Hydraulic Design Considerations
 - a. Using the previously presented charts determine the following:
 - 1) Average daily flow (ADF)
 - 2) Peak hourly flow (PHF)
 - b. Calculate the following and provide calculations in the design submittal:
 - 1) Total static head from the proposed pump inlet to point of discharge. The point of discharge will be to the next lift station wet well on the sewer pressure main.
 - 2) Total dynamic head This must include total static head plus line friction losses for pipe, fittings, and connections from the proposed pump to the point of discharge. This also must include friction losses for flow in the

Design Guidelines
City Of Osage Beach
SECTION 3 - SEWERAGE DESIGN

main assuming that a portion of the downstream pumps are running. The City Engineer will be able to assist in this determination.

- 3) Pumping Rate based upon wet well size and a maximum cycle time at peak hourly flow of six times per hour.
- 4) Wet Well Capacity based upon a minimum storage above high pump off elevation of two hours of peak hourly flow. Wet well capacity shall be determined as follows:

$$V_M = (Q_{PHF} \times 120) + V_{HPO}$$

Where V_M is the volume in the wet well below the inlet pipe, Q_{PHF} is the peak hourly flow in gpm and V_{HPO} is the volume in the wet well below the emergency pump on. The wet well design shall also conform to the following:

- a) The minimum diameter for simplex wet wells is 36 inches
 - b) The minimum diameter for duplex wet wells is 48 inches
 - c) The minimum depth from bottom invert of the inlet to bottom of the wet well is 48 inches.
 - d) The maximum total depth of the wet well from lid to bottom is 12 feet.
 - 5) Select the pump model and horsepower from the ABS pump curves.
 - 6) Select the pressure line type and size as discussed under "pressure sewers" herein.
- c. Additional Limitations or Specifications for Grinder Pumps
- 1) No more than two residences may be served by a simplex grinder station.
 - 2) No more than fifteen single-family residences, or their equivalent, may be served by a single duplex grinder station. This is subject to the review of the City Engineer
 - 3) In instances where a commercial facility has an average daily flow of less than 16 gpm, and no further development or additional capacity is contemplated, a simplex pump and controls maybe installed in a duplex basin.
 - 4) Triplex package units or custom-built lift stations are subject to the review and approval of the City Engineer.
 - 5) Each Grinder Pump Station shall include an ABS pump(s) fiberglass basin including internal piping, pump base and guide rail; and ABS Pump Control Panel as described in the ABS specifications
 - a) The basin will be an ABS basin, or the equivalent thereof, and either simplex or duplex as required. All internal piping and pump guide rails shall be galvanized steel. A concrete anti-floatation ring shall be cast around the basin base. The basin cover (lid) shall be of steel with minimum thickness of ¼ inch and shall be coated with a high temperature baked epoxy or air-dried epoxy paint, green in color. The lid shall be fully bolted and/or hinged secured
 - b) All grinder stations of 6.2 HP or less shall have internal discharge piping of 1-1/4 inch galvanized steel pipe.

Design Guidelines
City Of Osage Beach
SECTION 3 - SEWERAGE DESIGN

- c) All grinder stations of more than 6.2 HP shall have galvanized steel discharge piping of minimum two inch, or as approved by the City Engineer.
 - d) All grinder stations shall have a brass-bodied globe valve installed in each discharge line within the grinder station at a location approved by the City Engineer.
 - e) The minimum distance from top of grinder basin cover to top of inlet pipe shall be 18 inches.
 - f) The minimum distance from top of grinder basin to bottom of discharge pipe(s) shall be 48 inches.
 - g) The maximum depth of the grinder station basin shall be 12 feet.
- 6) Electrical Service for Sewage Lift Stations and Grinder Stations
- a) AmerenUE is the provider for electrical service. The owner, developer, or contractor shall make arrangements with AmerenUE for electrical service to the grinder station. Electrical energy shall be provided on a direct individually metered service of the appropriate capacity for the facility to be served.
 - b) The use of "Add-a-Phase" or other artificial phasing devices is prohibited. When three phase service is required the owner or developer shall make all necessary arrangements with AmerenUE to provide the required service.
- 7) Grinder Station Electrical Panel: ABS / Electric Control Company shall provide the standard panel developed for the City of Osage Beach of the correct model to match the pump(s). The control panel shall be fully and completely compatible and parts interchangeable with existing city owned units or as directed by the City Engineer. It shall be mounted on galvanized steel rack at a height of approximately 5 feet above finished grade. Each control panel shall have a wiring diagram, or schematic, attached to the inside of the outer door of the control panel box. All exterior wiring shall be run in rigid metal conduit. All work should be done in accordance with the National Electric Code and all material should be UL approved. The control rack shall be 24-inch frame width. Frame shall be 2 inch square steel tubing (#9 gauge minimum). All components shall be hot dip galvanized. Field cuts must be saw cut. Saw cuts shall be painted with Rust-Oleum or Galva-Well. Below grade metal components shall be painted with a minimum of two coats of Koppers Super Service (blk) Tenemec #450 Heavy Tenemecol coating/sealer, or approved equal. Legs shall be set in concrete. Concrete shall be a minimum of 18 inches deep and 12 inches in diameter. Electrical service wires, pump service wires, and float control wires, shall be run in minimum 2-inch galvanized rigid steel conduit. All bends and fittings shall be long radius bends. An explosion proof wye fitting shall be installed six inches below the control panel. No splice boxes will be permitted within the grinder pump basin. Riser for ground wire shall be in

Design Guidelines
City Of Osage Beach
SECTION 3 - SEWERAGE DESIGN

- ½ inch rigid, galvanized steel, conduit with grounded bushings, with stubbed and bonding jumper.
- 8) Grounding Rod shall be copper clad grounding rod, ½ inch by 8 feet in length. The rod shall be driven vertically into the ground or as directed by the City Engineer.
 - 9) Electric meter, meter base, disconnect, and panel shall comply with AmerenUE Service Manual, Section 5.3.1 (bypass requirements).

REQUIRED INSPECTIONS, TESTING, AND STARTUP PROCEDURE

1. Construction Drawings are required for all gravity and pressure sewers and all grinder or sewage lift stations. Such drawings shall be designed and sealed by a Registered Professional Engineer in the State of Missouri.
2. All materials and equipment shall conform to the City of Osage Beach Design Guidelines.
3. All gravity and pressure sewers shall be inspected by Engineering Department Personnel prior to backfill.
4. All gravity and pressure sewers, manholes, and wetwells shall be tested for leakage as specified herein. All tests shall be performed in the presence of City personnel.
5. Grinder and sewage lift stations shall be fully tested for performance and operation in the presence of Engineering Department personnel. Such testing shall include pumping rates, pumping cycle tests including emergency alarm and startup of standby equipment (if so equipped), electrical current and voltage checks. The contractor / developer shall provide the services of a manufactures factory representatives to be present during the tests.
6. Upon completion of all testing startup procedures the Engineering Department will issue a certificate of acceptance. The system will not be connected to the city service or accepted by the city until the acceptance certificate is issued. If the system can not be accepted no building occupancy permit will be issued.

AS CONSTRUCTED DRAWINGS AND MAINTENANCE DOCUMENTS

The Developer/Contractor shall provide the City Engineering Department with not less than two full sized "As Constructed" drawings certified as being correct record drawings by a Registered Professional Engineer.

The developer or contractor shall provide not less than two copies of a certified and recorded utility easement for all sewerlines and grinder station sites to be turned over to the city. Easements shall be prepared and sealed by a Registered Land Surveyor in the State of Missouri.

TYPICAL DETAILS FOR SEWER APPURTENANCES

Sewer appurtenances shall conform to the Typical Details attached hereto.

Design Guidelines
City Of Osage Beach
SECTION 3 - SEWERAGE DESIGN

PUBLIC INFORMATION PACKET – SEWER DESIGN

Applicants for a building or zoning permits will be provided with a “Sewer Information Packet” which reflects the requirements contained in this design manual and pertinent city ordinances. Such packet shall be considered as an approved part of the City Of Osage Beach Design Guideline.

SEPTIC TANK SYSTEMS

City Code Section 710.090 requires that any facility constructed within 300 feet of an existing city sewer must connect to such sewer. There are a few locations within the city where city sewer is not available. In those cases the owner may be authorized by the City Engineer to construct or repair a septic system.

REQUIREMENTS FOR AUTHORIZED PRIVATE SEWAGE DISPOSAL SYSTEMS

A Septic Tank Permit from the City Engineer is required prior to construction. Approved soil morphology, permeability tests and soil percolation tests, site topography, septic tank and absorption system, design by a registered professional engineer are required for the permit.

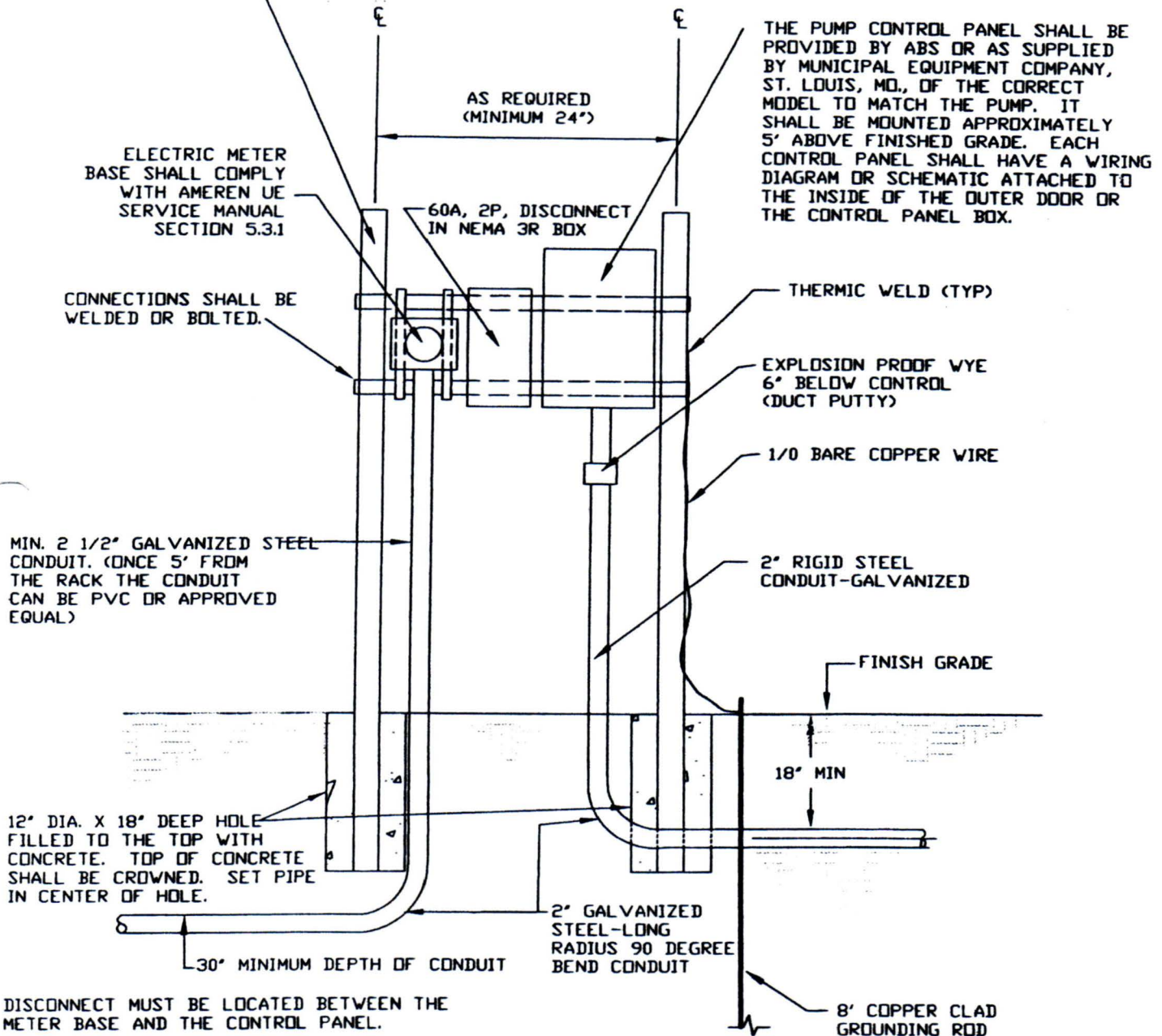
1. The system must be designed by a Registered Professional Engineer in accordance with Missouri Department of Health Regulations 710.025 through 710.059, Missouri Laws for On-site Sewage Disposal Systems, and 19 CSR 20-3.060 Minimum Standards for On-site Sewage Disposal Systems
2. Soil morphology, permeability tests and soil percolation tests shall be made by a registered professional engineer or state certified soil scientist. Tests and reports shall be in accordance with 19 CSR 20-3, Para (2) Site Evaluation.
3. The Minimum Setback Distances shown in 19 CSR 20-3, Table 1 Minimum Setback Distances shall be strictly followed.
4. Flow Rates or Volumes shall be computed on the basis of 120 gal/day/bedroom or 60 gal/day/person, the minimum flow from a residence shall be 240 gal.
5. The minimum septic tank capacity shall be 1250 gallons. Septic tanks shall be constructed in strict conformance to 19 CSR 20-3, Para. (4).
6. Absorption Systems shall be in accordance with 19 CSR 20-3, Para. (5) Absorption Systems.
7. Alternative Systems shall be in accordance with 19 CSR 20-3, Para (6) Alternative Systems.

A Septic Tank Permit from the City Engineer is required prior to construction. Approved soil morphology, permeability tests and soil percolation tests, site topography, septic tank and absorption system, design by a registered professional engineer are required for the permit.

END

FRAME SHALL BE 2" SQUARE STEEL TUBING (#9 GAUGE MINIMUM). HEAVY DUTY GALVANIZED UNI-STRUT MAY BE USED. ALL COMPONENTS SHALL BE HOT DIP GALVANIZED. FIELD CUTS MUST BE SAW CUT. SAW CUTS SHALL BE PAINTED WITH RUST-OLEUM OR GALVA-WELL. BELOW GRADE METAL COMPONENTS SHALL BE PAINTED WITH A MINIMUM OF TWO COATS OF KOPPERS SUPER SERVICE (blk.) OR TENEMEC #450 HEAVY TENEMECOL COATING/SEALER OR APPROVED EQUAL.

* ALL ELECTRIC WORK SHALL BE DONE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE AND ALL MATERIAL SHALL BE UL APPROVED.



Date Revised:
OCTOBER 2004

By: sh

Checked By: JB

CITY OF OSAGE BEACH
TYPICAL DETAIL
GRINDER STATION RACK
NOT TO SCALE

Design Guideline:
SECTION 3

SEWERAGE DESIGN

Drawing No: Page 77 of 231
111-9A

Design Guidelines
City of Osage Beach
SECTION 6 – ROAD CUT, UTILITY TRENCH AND EXCAVATION PERMIT
(Revised 02 MAY - 2005 - JCB)

OVERVIEW

This guideline pertains to all encroachments into the City of Osage Beach street right-of-ways, street easements and utility easements including: intersections with new roadways to be dedicated to the city, private roadways or parking areas, driveways, trenches for underground utilities such as water or sewer lines and any other underground utility, aerial utility lines, and roadway appurtenances.

PERMITS

- A. A City of Osage Beach Road Cut and Utility Trench Permit is required prior to any encroachments into or over city right-of-ways or easements.
- B. A City of Osage Beach Excavation Permit is required for any excavation of more than 50 cubic yards and/or cut or fill which change existing elevations by more than two feet.

GENERAL

- A. Timely notice of work is required:
 - 1. The applicant shall notify the city Building Official not less than twenty-four (24) hours in advance of any work in the city right-of-way or easements.
 - 2. Additional notice shall be given to the City Building Official by telephone (573-302-2030) four (4) hours prior to actual excavation so that a City Inspector can be dispatched to carry out the required inspection.
 - 3. As a general rule inspections will not be made on weekends or official city holidays. In the case of an emergency good judgment shall rule.
- B. Timely completion of the work is required:
 - 1. Disruption of public access or use shall be minimized to the maximum extent practicable.
 - 2. Work within the city right-of-way or easement shall be done on a continuous basis, i.e.: once work is started it shall be continuous during normal work hours on a continual basis until completed.
 - 3. Leaving open trenches or other excavations for more than forty-eight (48) hours is prohibited.
- C. Traffic control, signs, and barricades:
 - 1. All open trenches or excavations within street right-of-ways or easements shall be provided with appropriate warning signs and barricades.

Design Guidelines
City of Osage Beach
SECTION 6 – ROAD CUT, UTILITY TRENCH AND EXCAVATION PERMIT

2. If street traffic is interfered with appropriate flagman shall be provided.
3. All traffic control activities and devices shall conform to the U. S. Department of Transportation Manual of Uniform Control Devices.
4. If the excavated trench is to remain open or surface repairs to the street not completed prior to darkness appropriate warning lights shall be provided.
5. The applicant shall maintain all traffic control devices for the duration of the work.
6. At least one traffic lane shall be maintained in usable condition at all times.
7. All trenches within the traveled way shall be closed during nighttime hours.
8. No work will be permitted within the city right-of-way or easements over weekends or holiday periods.

INTERSECTIONS, PARKING AREAS, AND DRIVEWAYS

- A. Prior to construction for all proposed intersections with new streets, parking areas and driveways the applicant shall:
 1. Obtain an encroachment permit.
 2. Submit a drawing showing horizontal and vertical alignment of the intersecting facility and all storm drainage facilities.
- B. Intersecting streets and parking areas shall conform to the City of Osage Beach Design Standards for width, alignment, and grade.
 1. Intersecting streets and parking areas shall have curb and gutters.
 2. Streets, parking areas and driveways shall intersect perpendicular to the city street to the maximum extent practicable.
- C. Minimum width for driveway entrances to commercial properties shall be twelve (12) feet for a one-way entrance and twenty-four (24) feet for two-way entrances. Minimum radius for flares shall be fifteen (15) feet.
- D. Driveways for private residences shall be a minimum of ten (10) feet of driving surface exclusive of flares. Minimum radius for flares shall be ten (10) feet.
- E. All entrances into city streets shall be designed and constructed to accommodate storm drainage run-off.
 1. Appropriate catch drains shall be provided to accommodate run-off from or into driveways.
 2. Where roadway ditches exist on the city street appropriate culverts, swales, or slotted drains shall be provided.

Design Guidelines
City of Osage Beach
SECTION 6 – ROAD CUT, UTILITY TRENCH AND EXCAVATION PERMIT

UTILITY TRENCHES

- A. Utility trenches traversing under a city roadway.
1. Saw cut all pavement surfaces.
 2. All utility lines, except storm sewer, across city right-of-ways shall be incased in Schedule 40 or SDR 21 PVC sleeve.
 3. The sleeve shall be not less two inches in inside diameter larger than the maximum outside diameter of the widest dimension of the utility duct or pipe to be run through the sleeve.
 4. The minimum depth of cover of the sleeve shall be:
 - a. In accordance with Section 2 - Water Systems for waterlines
 - b. In accordance with Section 3 - Sewerage Design for sanitary sewer
 - c. In accordance with Section 4 - Storm Drainage for storm sewer
 - d. 36 inches below finished pavement grade for all others or as described in this Section.
 5. The maximum depth of cover for all water and sewer lines shall be eight (8) feet unless specifically authorized in writing by the City Engineer.
 6. Select Backfill shall be installed:
 - a. From six inches below the utility to eighteen inches below the finished pavement grade for water, pressure sewer and primary power lines.
 - b. From four inches below the utility to 9 inches below the finished pavement grade for storm sewer and secondary power lines.

Select backfill shall be 95% of maximum density nominal ½ inch minus crushed rock conforming to MoDOT Section 1004, Grade D, Chat, pea-gravel or Osage River Sand. Any material used shall have a PI of six or less.

6. Concrete Backfill:
 - a. Shall be installed from three inches below finished pavement grade to the top of the Select Backfill.
 - b. The top six inches of the concrete backfill shall be extended not less than twelve inches on each side of the utility trench.
 - c. Shall conform to MDOT Section 501, Concrete.
 - 1) Concrete shall be Class A-1
 - 2) Course aggregate shall be Gradation B
 - 3) Fine aggregate shall be Class A
 - 4) Cement shall be either Type I or III.

Design Guidelines
City of Osage Beach
SECTION 6 – ROAD CUT, UTILITY TRENCH AND EXCAVATION PERMIT

- 5) An accelerator may be used in conformance with MoDOT Section 1054.5.

7. Asphalt Pavement

- a. Shall be installed from the surface to three (3) inches below finished grade.
- b. Asphalt pavement shall conform to MoDOT Section 403; Type 1B
- c. Asphalt cement shall be AC-30
- d. Concrete backfill as specified above maybe utilized in lieu of asphalt pavement with prior permission of the City Engineer.
- e. Finish Tolerance the surface of the finished roadcut shall not exceed ¼ inch below a ten (10) foot straight edge as measured below the straight edge.

B. Utility trenches paralleling under a city roadway or parking area.

1. Saw cut all pavement surfaces.
2. The minimum depth of cover shall be:
 - a. In accordance with Section 2 - Water Systems for waterlines
 - b. In accordance with Section 3 - Sewerage Design for sanitary sewer
 - c. In accordance with Section 4 - Storm Drainage for storm sewer
 - d. 24 inches below finished pavement grade for all others or as described in this Section.
3. Select Backfill shall be installed:
 - a. From six inches below the utility to three (3) inches below the finished pavement grade.
 - b. Select backfill shall be 95% of maximum density nominal ½ inch minus crushed rock conforming to MoDOT Section 1004, Grade D, Chat, pea-gravel or Osage River Sand. Any material used shall have a PI of six or less.
4. Asphalt Pavement
 - a. Shall be installed from the surface to three (3) inches below finished grade.
 - b. Asphalt pavement shall conform to MoDOT Section 403; Type 1B
 - c. Asphalt cement shall be AC-30
 - d. Concrete backfill as specified above maybe utilized in lieu of asphalt pavement with prior permission of the City Engineer.
 - e. Finish Tolerance the surface of the finished roadcut shall not exceed ¼ inch below a ten (10) foot straight edge as measured below the straight edge.

Design Guidelines
City of Osage Beach
SECTION 6 – ROAD CUT, UTILITY TRENCH AND EXCAVATION PERMIT

C. Utility trenches out of traffic area

1. The minimum depth of cover shall be:
 - a. In accordance with Section 2 - Water Systems for waterlines
 - b. In accordance with Section 3 - Sewerage Design for sanitary sewer
 - c. In accordance with Section 4 - Storm Drainage for storm sewer
 - d. 24 inches below finished pavement grade for all others or as described in this Section.
3. Select Backfill shall be installed:
 - a. In accordance with Section 2 - Water Systems for waterlines
 - b. In accordance with Section 3 - Sewerage Design for sanitary sewer
 - c. In accordance with Section 4 - Storm Drainage for storm sewer
 - d. 6 inches below the utility line to 12 inches above the utility line for all others.
4. Backfill shall be granular material or select soil excavated from the trench, free of rocks over ½ inch in least dimension, foreign material or frozen earth.
 - a. Backfill shall be compacted to 95% of optimum density at optimum moisture content.
 - b. The surface shall be graded to smooth flowing lines blending into surrounding slopes.
5. Restore disturbed surface area to pre-construction condition (seed & mulch, decorative rock, etc.).

D. Utility trenches more than 150 feet in length shall have an impervious clay or bentonite plug constructed at each terminus or intersection with other trenches to prevent water from following the trench line and creating drainage problems.

E. Underground Primary Power Trenches. All electrical power of 480 volts AC or more is considered “primary power”.

1. All primary power shall be installed in Schedule 40 PVC conduit, or as approved by the City Engineer.
2. Primary power trenches shall be a minimum of thirty-six (36) inches in depth.
3. All primary power shall have a warning barrier of Portland cement concrete backfill a minimum of three (3) inches thick by the width of the trench located three inches above the power duct.

Design Guidelines
City of Osage Beach
SECTION 6 – ROAD CUT, UTILITY TRENCH AND EXCAVATION PERMIT

4. An approved warning tape shall be installed six inches above the concrete barrier.
 5. Where underground primary power crosses city utilities, the primary power shall be a minimum of one-foot below.
 6. Where primary power line parallels a city utility line it shall be separated by a minimum of four feet.
 7. In special circumstances with prior written approval of the City Engineer primary power may be run in the same trench as water or sewer lines, the primary power shall be in conduit and located not less than one-foot below the water or sewer line with the concrete barrier and warning tape in place.
- F. Underground Secondary Power Trenches, all electrical power less than 480 volts.
1. Secondary power trenches shall be a minimum of twenty-four (24) inches of cover in depth.
 2. An approved warning tape shall be installed twelve inches above the duct.
 3. Underground secondary power ducts can be co-located with water or sewer lines if they are placed not less than one foot to the side and at or below the elevation of the water or sewer line.
 4. Where secondary power crosses water or sewer lines, the power shall be in conduit and shall be a minimum of one-foot below water or sewer lines.

ROAD BORES

In all location where the utility is to be installed under a paved area that has been constructed within the previous five (5) years, as determined by the city engineer, a road bore shall be constructed. The minimum depth of the bore shall be thirty-six (36) inches. All bores shall be sleeved as specified above.

AERIAL UTILITIES

- A. Minimum vertical clearance for aerial utilities shall be a minimum of eighteen feet (18 ft. 0 in.) at the lowest point of crossing above the finished pavement grade of any city street.
- B. Utility poles shall not be located less than three (3) feet from the edge of pavement on city streets or parking areas.

ROADWAY APPURTENANCES

- A. Traffic control signs shall be installed in accordance with US Department of Transportation and Federal Highway Administrations Uniform Manual of Traffic Control Devices.
- B. Other signs.

Design Guidelines
City of Osage Beach
SECTION 6 – ROAD CUT, UTILITY TRENCH AND EXCAVATION PERMIT

1. A City of Osage Beach Sign Permit is required for all signs within city right-of-ways or easements except traffic control signs.
- C. No sign shall be installed within three (3) feet of the edge of pavement.
- D. Mailbox.
1. Mailboxes and/or newspaper boxes shall not be located within twelve (12) inches of the edge of pavement on city streets.
 2. If the street has concrete curb and gutter the face of the mailbox shall not protrude into the roadway past the back of the curb.
 3. Mail and newspaper boxes shall be removed within thirty days of cessation of delivery service. If the box is unused and not removed the city will remove it at the owner's expense.
- E. Guard Rail or Crash Barrier
1. Shall only be installed at locations where a severe traffic safety hazard exists and only with the approval of the City Engineer.
 2. Installation shall conform to MoDOT Specifications.

INSPECTIONS

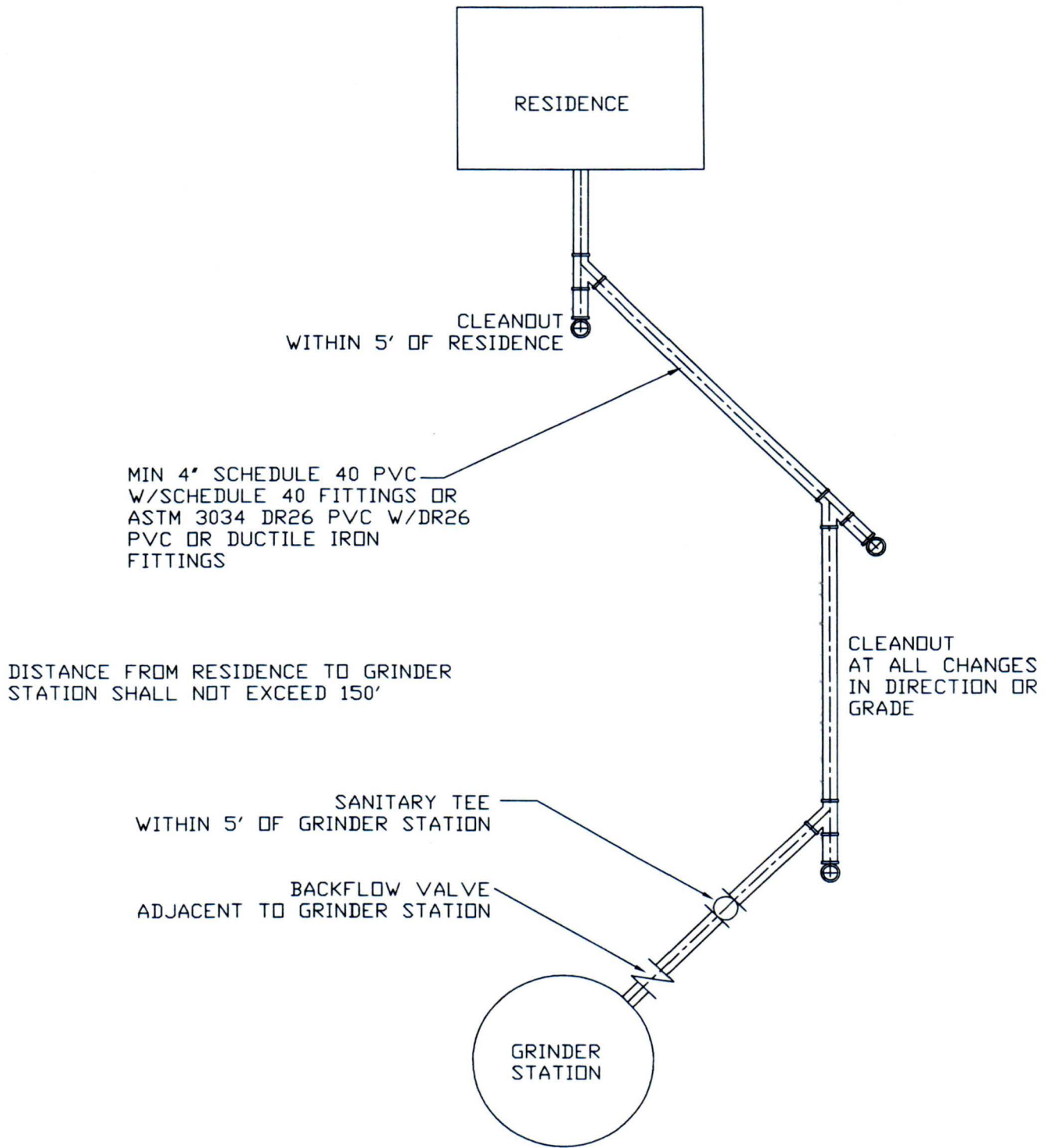
During the progress of the work each utility line shall be inspected by the Engineering Department prior to trench backfill.

ROADCUT AND UTILITY TRENCH CONSTRUCTION DETAIL DRAWINGS

Construction details and sketches are attached.

END.

Replaced 3/8/07



TYPICAL RESIDENTIAL SERVICE CONNECTION
TO GRINDER STATION

NOT TO SCALE

Date Revised:
Oct., 2004

By:
sh

Checked By:
JB

CITY OF OSAGE BEACH
TYPICAL DETAIL
RESIDENTIAL SERVICE CONNECTION

Design Guideline:
SECTION 3

SEWERAGE DESIGN

Drawing No.:
III-1 Page 85 of 231

Diana



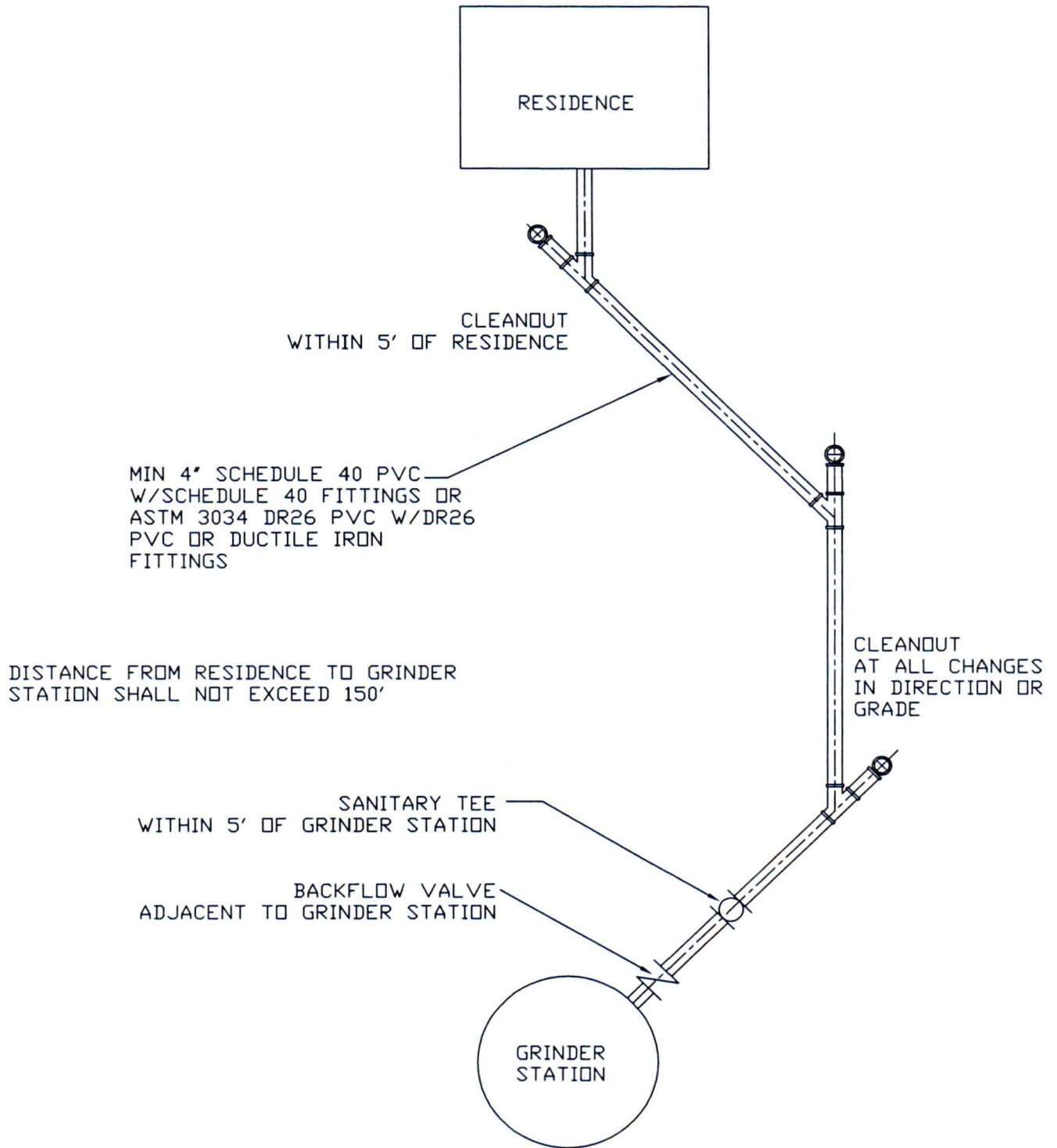
1000 City Parkway • Osage Beach, MO 65065
City Hall [573] 302-2000 • Fax [573] 302-0528

March 8, 2007

Please replace the enclosed sheet with the one in Section 3 Drawing #1 of your City of Osage Beach Design Guideline Book.

Thank you.

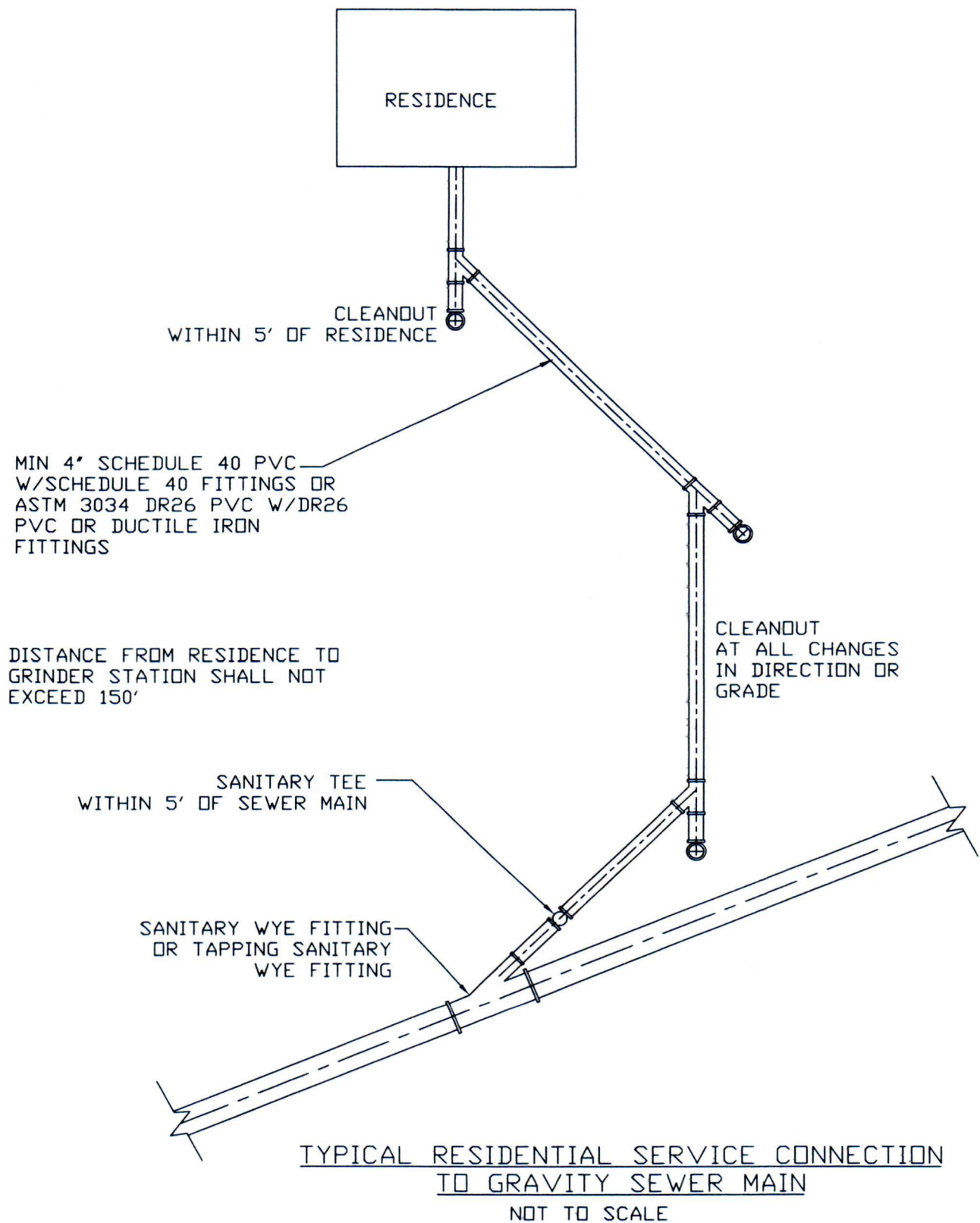
Nicholas Edelman, PE
City Engineer



TYPICAL RESIDENTIAL SERVICE CONNECTION
TO GRINDER STATION

NOT TO SCALE

Revised: Oct., 2004	CITY OF OSAGE BEACH TYPICAL DETAIL RESIDENTIAL SERVICE CONNECTION	Design Guideline: SECTION 3
By: sh		SEWERAGE DESIGN
Checked By: JB		Drawing No.:
		III-1Page 87 of 231



Date Revised:

OCT., 2004

By:

sh

Checked By:

JB

CITY OF OSAGE BEACH
TYPICAL DETAIL
RESIDENTIAL SERVICE CONNECTION

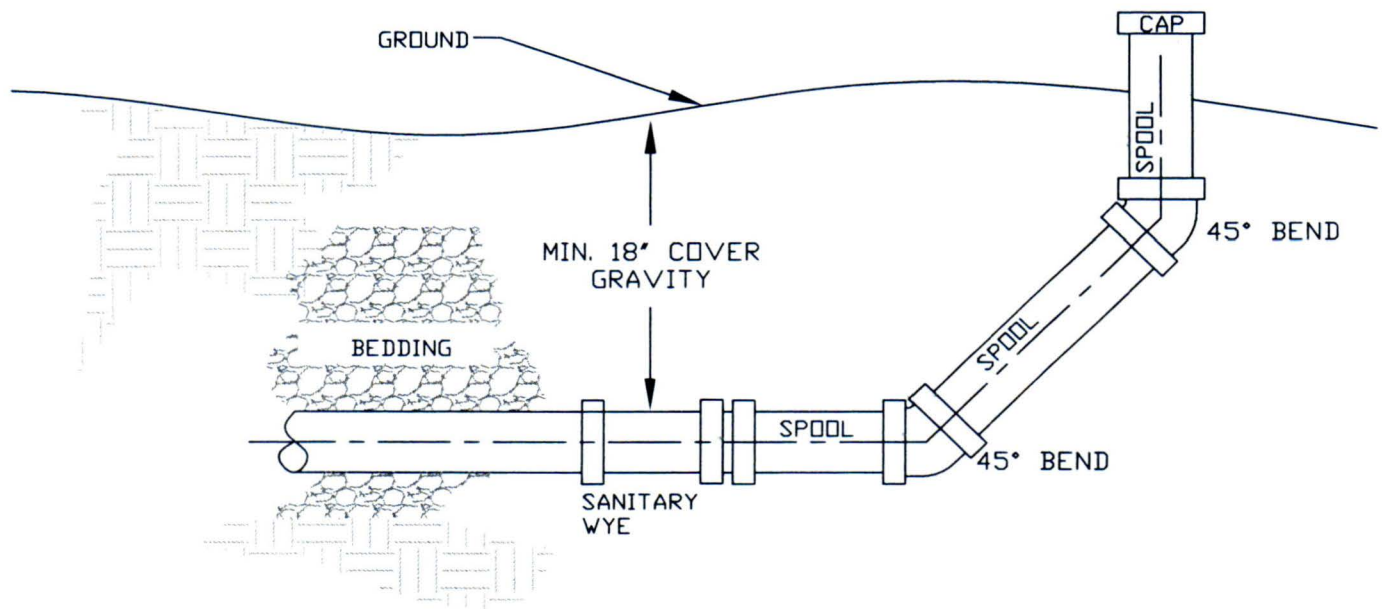
Design Guideline:

SECTION 3

SEWERAGE DESIGN

Drawing No.:

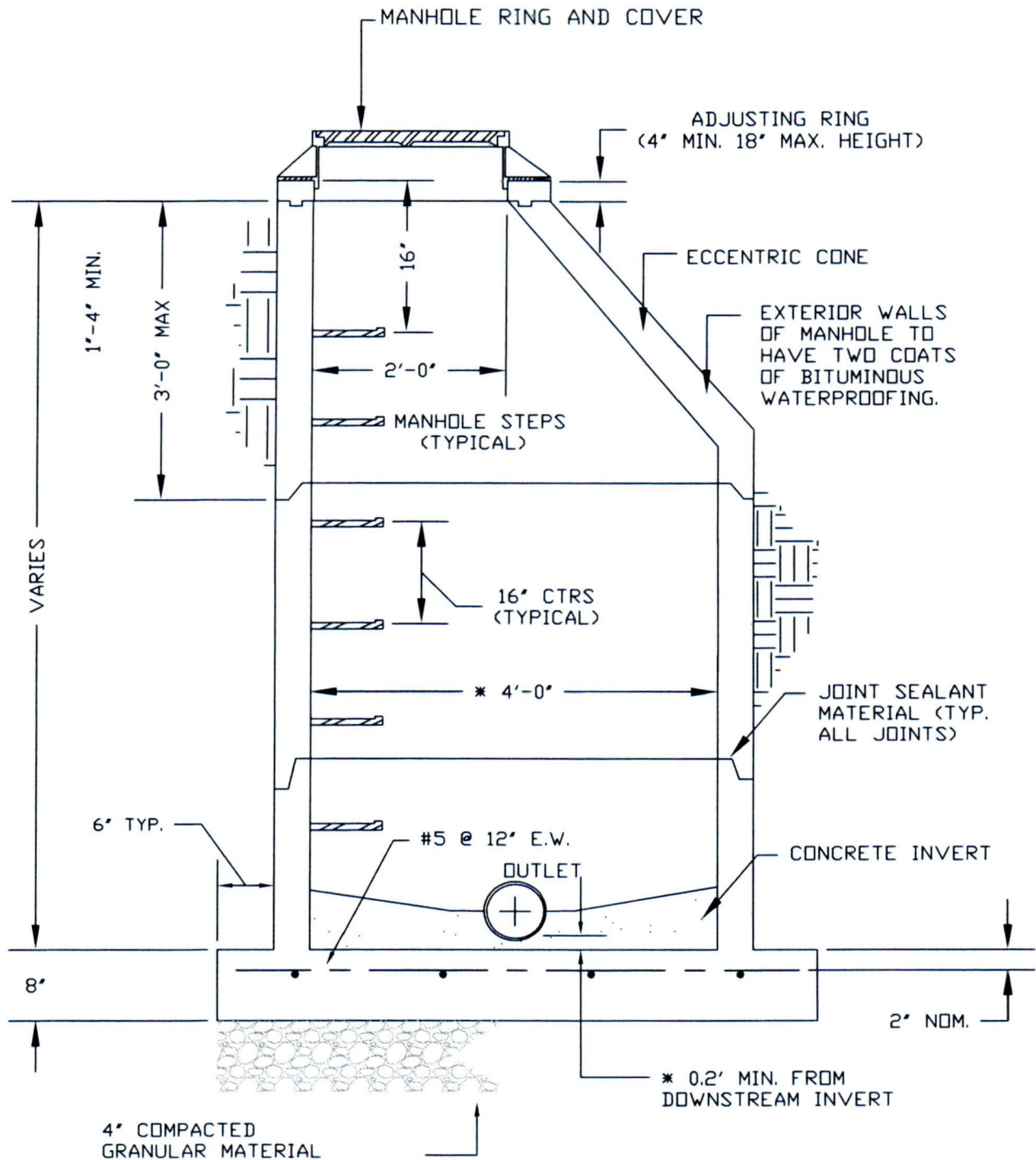
III-2Page 88 of 231



Date Revised:
Oct., 2004
By:
sh
Checked By:
JB

CITY OF OSAGE BEACH
TYPICAL DETAIL
SANITARY SEWER CLEANOUT DETAIL
NOT TO SCALE

Design Guideline:
SECTION 3
SEWERAGE DESIGN
Drawing No.:
III-3 Page 89 of 231



* UNLESS OTHERWISE NOTED ON PLANS - TYPICAL.

Date Revised:
Apr., 2003

By:
sh

Checked By:
JB

CITY OF OSAGE BEACH
TYPICAL DETAIL
STANDARD PRECAST MANHOLE

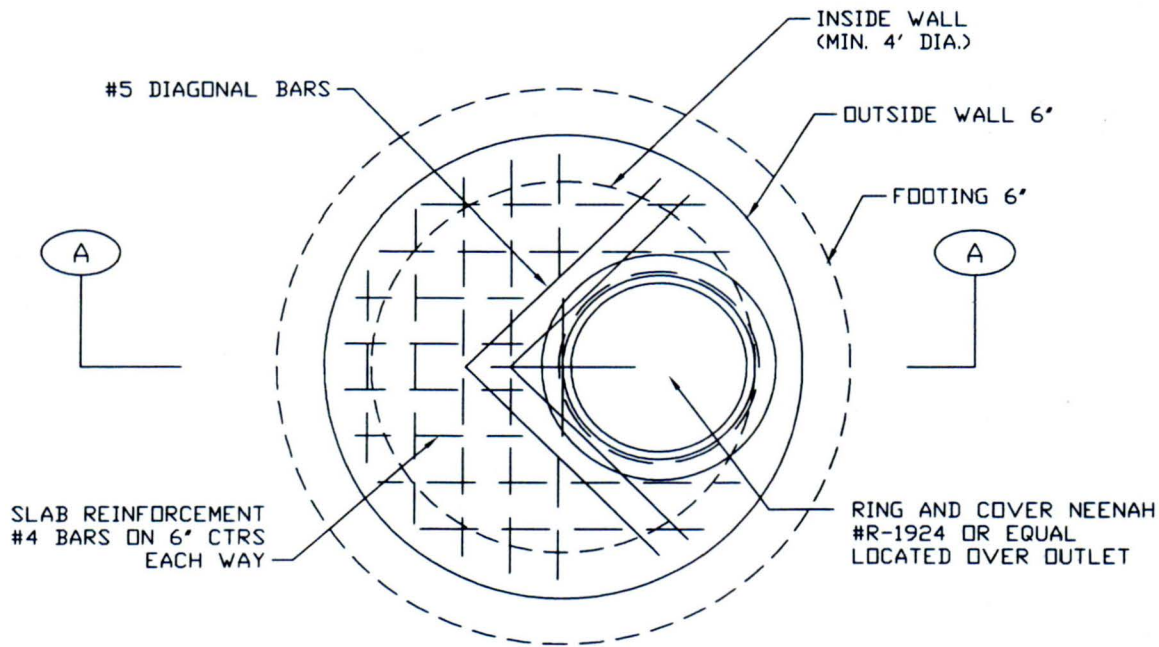
NOT TO SCALE

Design Guideline:
SECTION 3

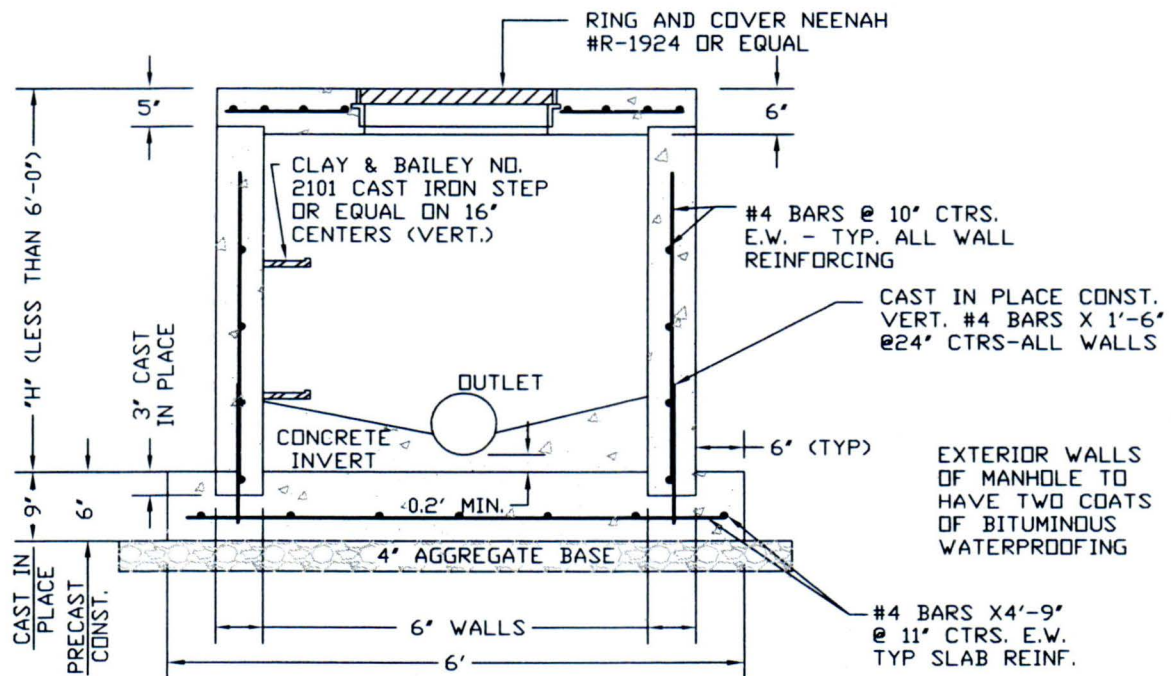
SEWERAGE DESIGN

Drawing No.:

III-4Page 90 of 231



TOP PLAN



SECTION A-A

Date Revised:
Oct., 2004

By:
sh

Checked By:
JB

CITY OF OSAGE BEACH
TYPICAL DETAIL
FLAT TOP MANHOLE

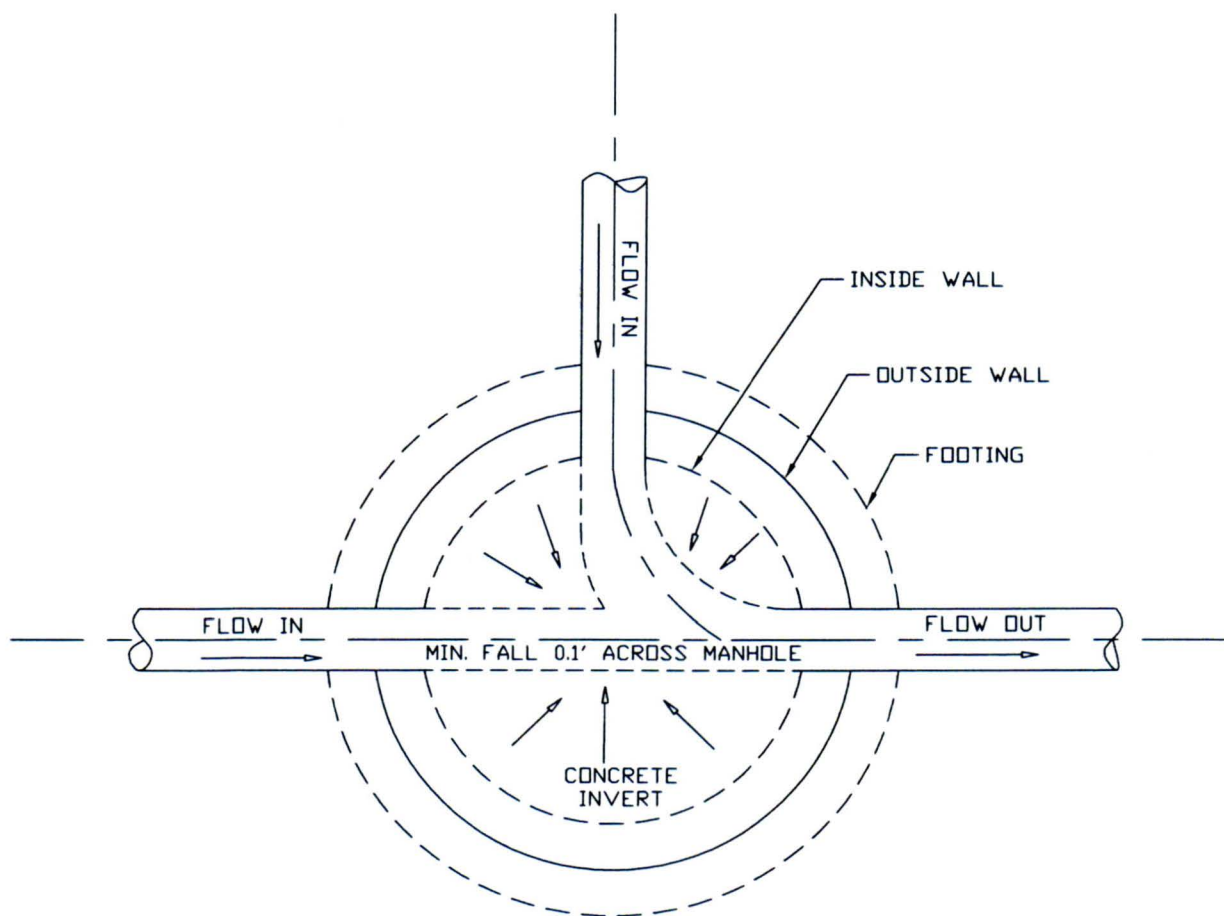
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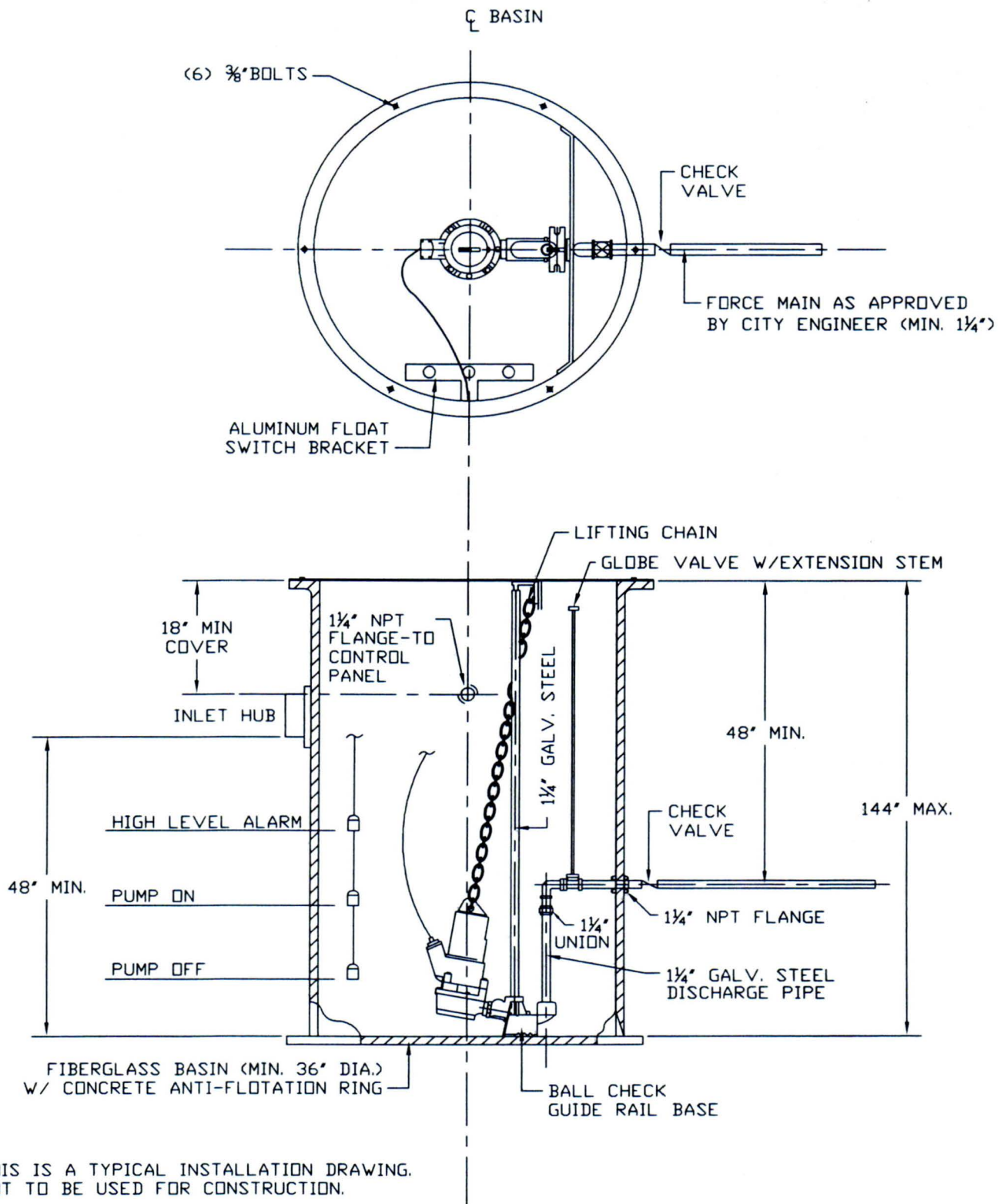
Design Guideline:
SECTION 3

SEWERAGE DESIGN

Drawing No.:

III-5 Page 91 of 231





Date Revised:
Feb., 2003

By:
sh

Checked By:
JB

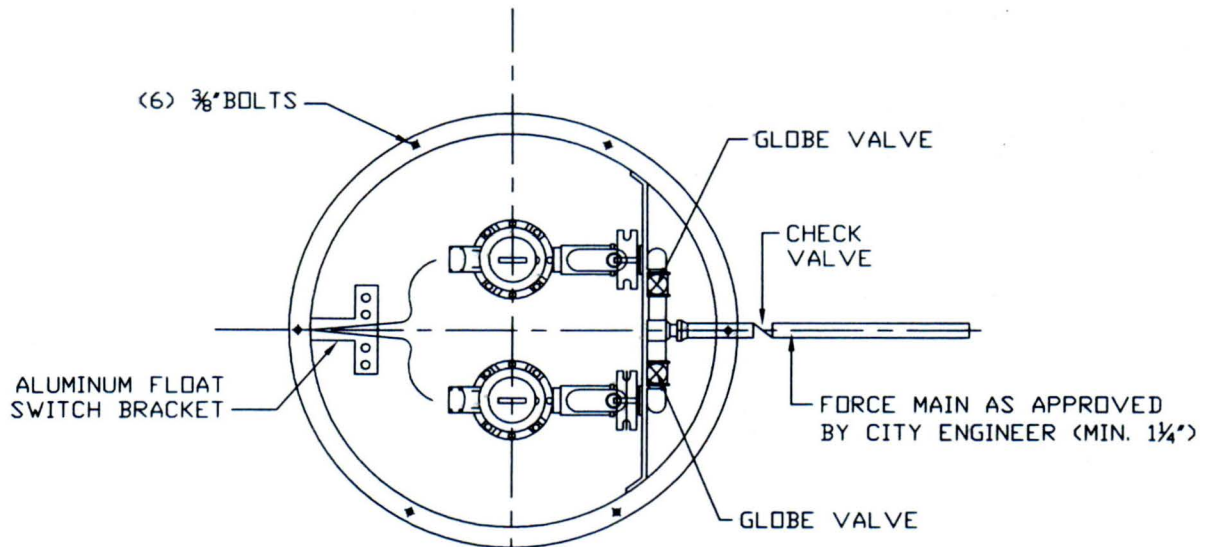
CITY OF OSAGE BEACH
TYPICAL DETAIL
SIMPLEX PUMP STATION

Design Guideline:
SECTION 3

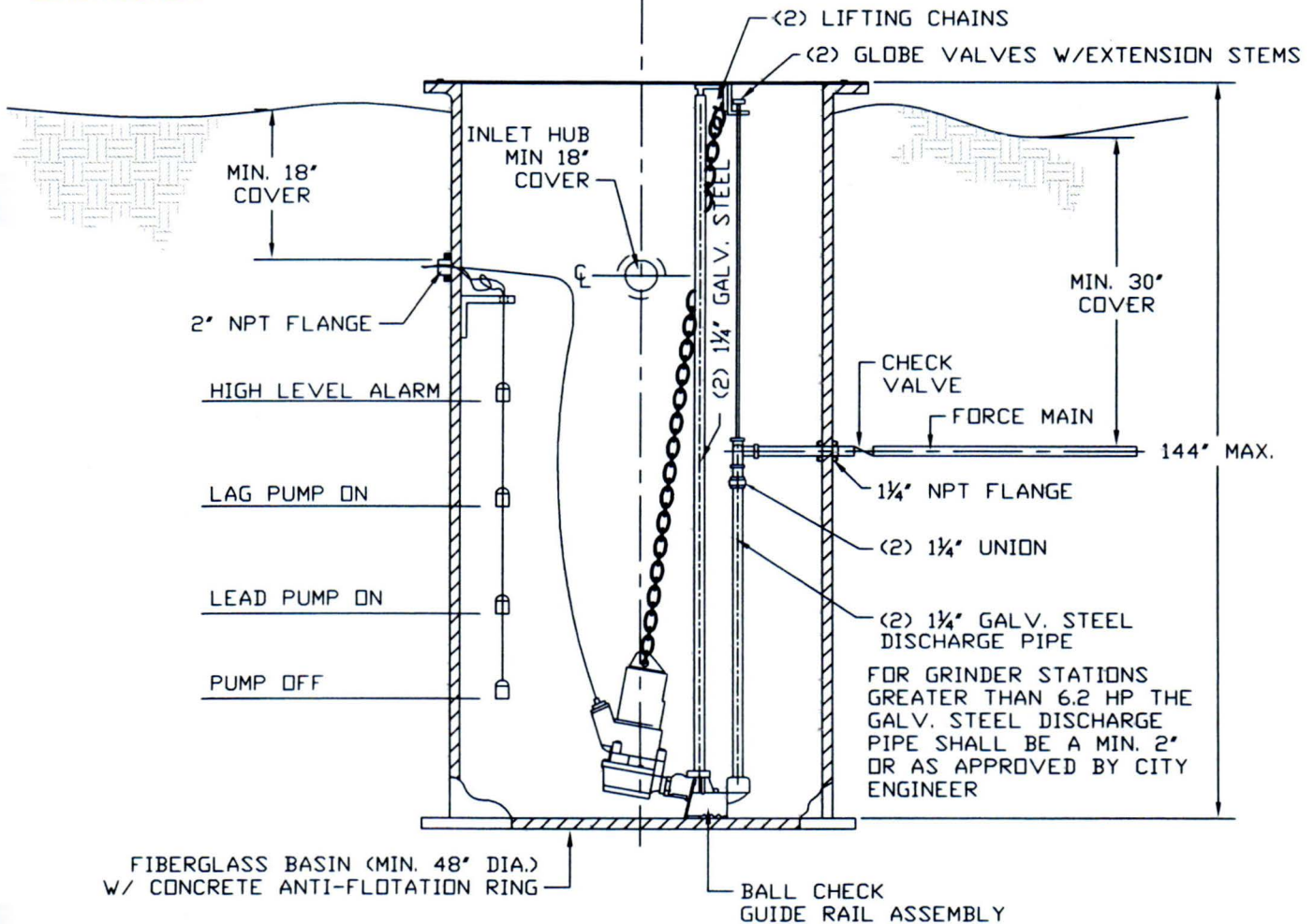
SEWERAGE DESIGN

Drawing No.:

III-7 Page 93 of 231



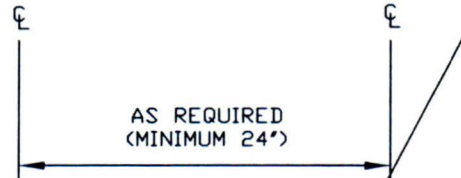
THIS IS A TYPICAL
INSTALLATION DRAWING.
NOT TO BE USED FOR
CONSTRUCTION.



Date Revised: OCT., 2004	CITY OF OSAGE BEACH TYPICAL DETAIL DUPLEX PUMP STATION	Design Guideline: SECTION 3
By: sh		SEWERAGE DESIGN
Checked By: JB		Drawing No.:
		III-8Page 94 of 231

FRAME SHALL BE 2" SQUARE STEEL TUBING (#9 GAUGE MINIMUM). HEAVY DUTY GALVANIZED UNI-STRUT MAY BE USED. ALL COMPONENTS SHALL BE HOT DIP GALVANIZED. FIELD CUTS MUST BE SAW CUT. SAW CUTS SHALL BE PAINTED WITH RUST-OLEUM OR GALVA-WELL. BELOW GRADE METAL COMPONENTS SHALL BE PAINTED WITH A MINIMUM OF TWO COATS OF KOPPERS SUPER SERVICE (blk.) OR TENEMEC #450 HEAVY TENEMECOL COATING/SEALER OR APPROVED EQUAL.

* ALL ELECTRIC WORK SHALL BE DONE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE AND ALL MATERIAL SHALL BE UL APPROVED.



THE PUMP CONTROL PANEL SHALL BE PROVIDED BY ABS OR AS SUPPLIED BY MUNICIPAL EQUIPMENT COMPANY, ST. LOUIS, MO., OF THE CORRECT MODEL TO MATCH THE PUMP. IT SHALL BE MOUNTED APPROXIMATELY 5' ABOVE FINISHED GRADE. EACH

FRAME SHALL BE 2" SQUARE STEEL TUBING
(#9 GAUGE MINIMUM). HEAVY DUTY GALVANIZED
UNI-STRUT MAY BE USED. ALL COMPONENTS
SHALL BE HOT DIP GALVANIZED. FIELD CUTS
MUST BE SAW CUT. SAW CUTS SHALL BE

* ALL ELECTRIC WORK SHALL BE
DONE IN ACCORDANCE WITH THE
NATIONAL ELECTRIC CODE AND
ALL MATERIAL SHALL BE UL
APPROVED

Design Guidelines
City of Osage Beach
SECTION 3 - SEWERAGE DESIGN

SECTION III – SEWER SYSTEM

OVERVIEW

The City of Osage Beach operates a sewage collection and treatment system in accordance with the Missouri Department of Natural Resources (MDNR) regulations. The system is comprised of pressure and gravity sewer lines, grinder stations, lift stations, and a jointly owned regional sewage treatment facility. The plant is managed by the Lake Ozark / Osage Beach Joint Sewer Board. The collection system within Osage Beach, and from the city to the plant, is owned and operated by the City of Osage Beach. At the current time, there are a few isolated areas within the city that are not served by the collection system. It is the policy of the city that all occupied facilities within the city will have city sewer service.

At the present time, there are over 1125 grinder stations and 56 sewage lift stations. These stations have been standardized to use ABS/Sulzer pumps and appurtenances. ~~Grinder station packages, including simplex and duplex stations, can be purchased from the City of Osage Beach. Packages include the standard depth basin (6 feet), electrical panel, pumps, base elbow, guiderail, lifting chain, floats and bracket. Contact Public Works at (573) 302-2020 for additional information or questions. Packages may be purchased from a supplier so long as they conform to the City's standards described by this section. The Public Works Operations Manager reserves the rights to redirect anyone to a supplier for the purchase of multiple packages at one time. This practice shall continue until determined by the city to be infeasible or otherwise unsatisfactory.~~

All modifications to the sewage treatment plant or the sewage collection system shall conform to the MDNR regulations and polices as supplemented herein.

REFERENCED CITY ORDINANCES

Chapter 400.110	Subdivision Regulations
Chapter 410.130	Contents (Location and design of water mains and appurtenances)
Chapter 410.190	Design Basic Standards
Chapter 410.260	Location of Utilities in Right-of-Ways
Chapter 410.330	Sanitary Sewers
Chapter 710	Sewers and Sewerage Systems

SEWERAGE DESIGN

Wastewater Treatment Facility

Modifications to the existing treatment facility must be made under the direction of the Lake Ozark/Osage Beach Joint Sewer Board. Such modifications must be designed in accordance with and approved by MDNR. If the City needs to have changes made in the plant, they must forward the request to the Lake Ozark/Osage Beach Joint Sewer Board.

Sewage Collection System

Modifications of and additions to the existing sewage collection system shall be made in accordance with MDNR regulations as supplemented herein.

Hydraulic Design

Design Guidelines
City of Osage Beach
SECTION 3 - SEWERAGE DESIGN

AVERAGE DAILY FLOWS

<u>Type of Establishment</u>	<u>Pounds BOD per Person</u>	<u>Gallons/Day per Person</u>
<i>Residential</i>		
Single Family	0.17	100
Apartments	0.17	100
Condos	0.17	100
<i>Commercial Food & Drink</i>		
Tavern	0.01	2
Fast Food	0.02	5
Restaurant w/ garbage grinder	0.04	5
Carwash (10.3 gpd/sf) (31.5 gpm Peak Hour/ Bay)	See Data To Left	
<i>Institutions</i>		
Day School w/ gym & showers	0.03	20
Day School w/ cafeteria (Add)	0.02	4
Day School w/ garbage grinding (Add)	0.02	1
Hospital (per bed)	0.22	200
Nursing Home	0.17	125
Park Restroom	0.02	5
Park Restroom w/ showers	0.06	25
Swimming Pool	0.06	25
Country Club (per resident)	0.17	100
Country Club (per member)	0.06	25
Service Station	0.01	5
Laundromat (per machine)	1.25	580
Hotels	0.15	50
Motel w/o Restaurant	0.1	40
Luxury Resort	0.17	75
Camp Trailer	0.08	30
Church (per seat)	0.01	5
Store/Shopping Center/Mall (per 1000 sf of floor area)	0.34	200
Stadium/Auditorium/Theater/Drive-In (per seat)	0.01	5
*Includes infiltration		

Hydraulic Design shall be based upon the following criterion:

EQUIVALENT POPULATION

<u>Facility</u>	<u>Persons/Unit</u>
------------------------	----------------------------

Design Guidelines
City of Osage Beach
SECTION 3 - SEWERAGE DESIGN

Single Family Residence	3.7
Apartment/Condo—One Bedroom	2
Apartment/Condo—Two Bedroom	3
Apartment/Condo—Three Bedroom	3.7
Mobile Home	3
Camper Trailer	3
Motels (per room)	3

Wastewater design shall be in accordance with MDNR's Wastewater Guidelines and Standards Document (PUB2754). For hydraulic capacity, refer to Table 1-1. Minimum Design Loadings in MoDNR's PUB2754. The designer shall provide data used for calculating the system flow data. For population per dwelling, refer to Table 1-2. Minimum Population Equivalent in the above referenced document.

Property Owners shall be responsible for improvements to existing stations due to increased flow volumes. If the City deems a property owner has changed the conditions of an existing station, a notice will be provided by the City's Compliance Officer. Common changes causing station upgrades includes, but are not limited to, overnight rentals, building expansion, excessive water use, change in dwelling type, etc.

PEAK HOURLY FLOW = 4 X AVERAGE DAILY FLOW

Gravity Sewers

Gravity Sewers design shall conform to the applicable MDNR regulations and as specified herein. The peak hourly flow shall be determined, and the gravity line sized accordingly with the following additions:

1. Gravity sewer laterals from a residence to grinder station or main:
 - a. Shall be not less than 4-inch pipe.
 - b. Shall have a cleanout located within 5 feet of the residence and at all vertical and horizontal bends; a sanitary tee within 5 feet of the grinder station or main; and a backflow valve adjacent the grinder station.
 - ~~c. Shall not exceed 150 feet in length. Residence service lines over 150 feet in length shall be treated as sewer mains.~~
 - d. Shall be SCH 40 with SCH 40 fittings or ASTM D3034 DR 26 PVC with sanitary sewer DR 26 PVC ~~or ductile iron~~ fittings.
 - e. All bends shall be long radius bends. Short radius 90° bends are specifically prohibited.
2. Gravity Sewer mains:
 - a. Sewer mains shall be designed for the peak hourly flow and shall be not less than 8-inch pipe.
 - b. Gravity sewer pipe shall be:
 - ~~i. Ductile iron, ASTM A746, Class 350 with cement lining. Ductile iron Push-on type joints and fittings shall be used, or~~
 - ~~ii. ASTM 2241, DR 21, Class 150 with approved fittings.~~
 - iii. **PVC**, ASTM D3034, SDR 26, with SDR 26 PVC sanitary fittings. **For depths greater than 8 feet.**
 - iv. ASTM D3034, SDR 35, with SDR 35 fittings where maximum depth of cover is eight (8) feet or less.
 - ~~v. SCH 40 PVC with SCH 40 fittings~~

Design Guidelines
City of Osage Beach
SECTION 3 - SEWERAGE DESIGN

- c. Manholes shall be constructed at the end of main and at changes in horizontal or vertical alignment, or not more than every 350 feet.
 - ~~d. When a residence service line will exceed 150 feet, a manhole shall be constructed with a 4-inch service line to the residence and a minimum eight-inch main to remainder of the system.~~
 - f. All bends shall be long radius bends. Short radius 90° bends are specifically prohibited.
3. **Residential lateral** connections to sewer mains shall be made using a sanitary wye tapping fitting.
4. Connections to grinder pump basins:
- a. Shall be made using a cast iron inlet hub of appropriate diameter and shall be bolted to the grinder basin and sealed with an approved silicone seal. A PVC backflow valve (check valve) shall be installed within 2 feet of the basin.
 - b. Inlet pipes shall be installed **18-inches to 30-inches below the grinder station lid. a minimum of 4 feet above the bottom of the grinder basin and not less than 18 inches below the top of the basin.**
5. Bedding:
- a. Shall be installed around the pipe from **3 6 inches below to 12 inches above the pipe. Bedding shall be nominal ½-inch minus crushed rock conforming to MoDOT Type 5 aggregate, Section 1007. 1004, Grade D, Chat, or pea gravel, or Osage River Sand. Any material used shall have a PI of 6 or less. Trench backfill shall not contain any material with a nominal particle size greater than six (6) inches.**
6. Detectable Marking Tape and Toning Wire:
- a. Metallic detectable marking tape, Type III, shall be placed in the trench above all sewers, gravity, and pressure, one foot above the pipe.
 - ~~b. Locator wire shall be standard tracer wire, a single No. 12 U.L. approved copper wire of the solid type with insulation for 600 volts. Wire for this service shall be green in color and provided in standard rolls of not less than five hundred (500) foot lengths. Locator wire shall be placed on top of the water main and secured with tape at 8-foot intervals. Locator wire shall extend to all terminus, such as manholes, valves, pump stations, and valve vaults. No. 12 solid copper Toning wire shall be located three inches above taped to the top of the sewer line and shall be continuous from terminus to terminus and shall include all city owned sewers.~~
 - i. ~~Splices shall only be allowed where accessible. Buried splices will not be allowed. If valve box locations are spaced more than 500 feet apart, contractor shall install a vertical piece of 6-inch diameter PVC adjacent to the water main topped with a cast iron bonnet and cover marked "water". The wire shall be run outside up alongside the valve box, then through a hole in the valve box just below ground level. The splice connector shall be left exposed at the top of the valve box. Wire contact points shall be provided at no more then 500-foot intervals.~~
 - ii. Prior to final acceptance by the City, the contractor shall demonstrate that the locator wire works to the satisfaction of the City Inspector or Public Works Operations Manager or designee.
7. Minimum grades for gravity sewers:
- a. 4-inch sewer shall be not less than 1.00%
 - b. 6-inch sewer shall be not less than 0.67%
 - c. 8-inch sewer shall be not less than 0.50%
 - d. 10-inch sewer shall be not less than 0.33%
 - e. Larger shall be as approved by the ~~City Engineer~~ **Public Works Operations Manager**

Design Guidelines
City of Osage Beach
SECTION 3 - SEWERAGE DESIGN

8. Minimum depth of cover for gravity sewers:
 - a. Shall be not less than ~~18 inches~~ 24 inches above the top of pipe.
9. Maximum depth of cover shall be 8 feet unless specifically authorized in writing by the ~~City Engineer~~ Public Works Operations Manager.
10. Manholes shall be as detailed (~~Drawing III-4/ III-5~~) in the Osage Beach Design Guidelines or as approved by the ~~City Engineer~~ Public Works Operations Manager.

Sewer manhole casting and cover specification:

- a. All Osage Beach sanitary castings/ frames shall be Neenah Cat R-1642 or approved equal.
 - b. Cover marked "Sanitary Sewer".
 - c. Concealed pick holes (2) per NF 1015
 - d. Mechanical Groove in lid for oil resistant T-gasket.
 - e. Bolts are not required unless called out in special conditions
11. Valve Boxes shall be a vertical piece of 6-inch diameter PVC pipe ~~Buffalo type~~ with cast iron bonnet and cover ~~lid~~ marked "sewer".
 12. Leak testing for gravity sewers may be tested by air or water method.
 - f. **Water Tests**
 - i. Gravity sewer lines shall be plugged at the bottom end and filled with water to the top of the next upstream manhole, left for 24 hours.
 - ii. If no manhole, to the top of the farthest upstream cleanout left for 24 hours.
 - iii. The line shall then be refilled with a measured amount of water.
 - iv. The allowable leakage shall be 1 gallon per 100 feet of line tested.
 - g. **Air Tests**
 - i. Test lines between manholes with low-pressure air.
 - ii. Safety requires a regulator or relief valve on pressurizing equipment, set at 8 psig
 - iii. No one will be allowed in manholes while there is air pressure against test plugs.
 - iv. Plug all pipe outlets to resist test pressure. Give special attention to laterals.
 - v. Plug all other pipes in both upstream and downstream manholes and fill manholes with clear water to just above the line plugged for testing. Any bubbles appearing during the test indicate leakage past a plug or in part of the test equipment.
 - vi. Compute the test pressure by multiplying 0.43 x the elevation difference (in feet) of the upstream manhole rim and the invert of the line under test at the downstream manhole. The result is in psig and may be rounded to the nearest half psig. The test pressure shall be not less than 3.5 psig, nor more than 6.0 psig. Total line length included in any test section shall not exceed 400 feet.
 - vii. Supply air into the line until test pressure is attained. Allow at least 5 minutes for air temperature in the test section to stabilize.
 - viii. Reestablish the test pressure and start a stopwatch. Determine the time required for pressure to drop 0.5 psig.
 - ix. If the pressure does not drop during the stabilization period and no additional air has been added, the section undergoing test will have passed without further testing.
 - x. The pipe section will also have passed if the time observed for the pressure to drop 0.5 psig is greater than that determined by using the following table:

Design Guidelines
City of Osage Beach
SECTION 3 - SEWERAGE DESIGN

<u>Pipe Size, Inches</u>	<u>Time</u>
4	4 minutes 2 seconds
6	6 minutes 0 seconds
8	7 minutes 37 seconds
10	9 minutes 8 seconds
12	10 minutes 58 seconds
14	12 minutes 30 seconds
16	14 minutes 32 seconds

*** When a combination of more than one pipe size is under test,
the calculated time for the larger pipe shall apply.**

- h. **Manholes** may be tested by vacuum or water method.
- i. Water Method - shall be tested by plugging inlet and outlet pipes and filling with water to the top of the manhole cover ring and letting set for 24 hours. The maximum leakage shall be a drop in water level of 3 inches.

Pressure Sewers

Pressure Sewers design shall conform to MDNR requirements and as supplemented herein. The design of additions to the City sewer system shall minimize the need for pressure sewer to the maximum extent practicable to reduce the number of lift or grinder stations to the minimum required. Pressure sewers shall conform to the following criterion:

1. Pressure sewers shall be designed for flow rates between 2.0 fps and a maximum of 5.0 fps. The minimum diameter of pipe used shall be 1-1/4 inches.
2. Pressure pipe:
 - a. Less than 4 inches in diameter shall be schedule 80 PVC or ASTM 2241, DR 21, Class 150, or HDPE AWWA C906, ~~DR 9 copper tube size. SDR 21 class 200, or DR9 CTS.~~
 - b. 4 inches and larger shall be: ~~AWWA C151 Class 350 ductile iron, or~~ AWWA C900 DR 18 Class ~~150 235~~ PVC.
3. Joints:
 - a. For SCH 80 pipe shall be solvent welded.
 - b. For other pipe shall be neoprene lined push-on type joints or as approved by the ~~City Engineer~~ **Public Works Operations Manager.**
4. Fittings:
 - a. For Schedule 80 pipe shall be Schedule 80 fittings.
 - b. For other pipe may be appropriately rated and compatible PVC or ductile iron on PVC ~~and shall be ductile iron on ductile iron sewers.~~ All fittings shall be neoprene gasket push-on type or as approved by the ~~City Engineer~~ **Public Works Operations Manager.**
 - c. Long radius bends or multiple fittings shall be used. Short radius 90° bends are specifically prohibited.
5. **The minimum cover for all pressure sewer is 36 inches.**

Design Guidelines
City of Osage Beach
SECTION 3 - SEWERAGE DESIGN

6. The maximum depth of cover for pressure sewers is 4 feet unless specifically authorized in writing by the ~~City Engineer~~ Public Works Operations Manager. Deeper main installation will be allowed to achieve minimum separation when crossing other utilities. Cover for crossing utilities shall not be greater than 8 feet.
7. Bedding shall be installed around the pipe from ~~3~~ 6 inches below to 12 inches above the pipe. Bedding shall be ~~nominal 1/2-inch minus~~ crushed rock conforming to MoDOT Type 5 aggregate, Section 1007. ~~Section 1004, Grade D, Chat, or pea gravel, or Osage River Sand. Any material used shall have a PI of 6 or less.~~ Trench shall not contain any material with a nominal particle size greater than six (6) inches.
8. Detectable marking tape and Toning Wire:
 - a. A metallic detectable marking tape, Type III, marked "Sewer Below" shall be placed in the trench 1 foot above all pressure sewers pipe.
 - ~~b. Locator wire shall be standard tracer wire, a single No. 12 U.L. approved copper wire of the solid type with insulation for 600 volts. Wire for this service shall be green in color and provided in standard rolls of not less than five hundred (500) foot lengths. Locator wire shall be placed on top of the water main and secured with tape at 8-foot intervals. Locator wire shall extend to al terminus, such as manholes, valves, pump stations, and valve vaults. No. 12 solid copper Toning wire shall be located three inches above taped to the top of the sewer line and shall be continuous from terminus to terminus and shall include all city owned sewers.~~
 - i. Splices shall only be allowed where accessible. Buried splices will not be allowed. If valve box locations are spaced more than 500 feet apart, contractor shall install a vertical piece of 6-inch diameter PVC adjacent to the water main topped with a cast iron bonnet and cover marked "water". The wire shall be run outside up alongside the valve box, then through a hole in the valve box just below ground level. The splice connector shall be left exposed at the top of the valve box. Wire contact points shall be provided at no more then 500-foot intervals.
 - ii. Prior to final acceptance by the City, the contractor shall demonstrate that the locator wire works to the satisfaction of the City Inspector or Public Works Operations Manager or designee.
- ~~9. The check valve shall be brass body, single flap type.~~
10. The inlet connection hub shall be cast iron inlet hub bolted to the basin. The back of the hub shall be sealed to the basin using approved silicone sealant. Appropriate inlet hubs are stocked by the ABS supplier.
11. An isolation valve shall be installed at the connection to the sewer main.
 - a. The valve shall be brass body, globe valve of the same nominal size as the pressure sewer.
 - b. Shall be installed at the connection to the sewer force main.
 - c. When possible, the valve should be located outside roadway or other similar traffic areas.
 - d. Globe valve shall have integral checks for open and closed positions.
 - e. Valve shall be placed upon a concrete, or approved, masonry pedestal to prevent settlement.
 - f. Shall be covered with a PVC piece of pipe and cast iron bonnet market "sewer" extended to 3 to 6 inch above finished surface.
 - g. If the finished surface is concrete or asphalt pavement, the valve box cover shall be flush with the paved surface.
 - h. Valve box covers on pressure sewers shall be marked "SEWER" and the markings shall be cast into the cover.

Design Guidelines
City of Osage Beach
SECTION 3 - SEWERAGE DESIGN

12. The tapping saddle:

- a. Shall be Brass similar and equal to Ford.
- b. Shall be sealed to the pipe by means of a rubber "O" ring seal to provide a connection suitable for a working pressure of 200 psi.
- c. Shall have flanged or threaded outlets conforming to ANSI B16.1.
- d. If possible, all tapping saddles shall be in the horizontal position.
- e. The Owner shall provide all equipment necessary to complete the tap, including saddle, corporation stop, valve and pipe.
- f. All wet taps 2-inch and smaller are to be performed by City Staff or a City approved contractor and witnessed by the City. Taps larger than 2-inch shall be performed by an approved contractor and witnessed by the City.
- g. Under no circumstances shall anyone make a wet tap without approval and authorization by the City Public Works ~~Director~~ Operations Manager or designee.

13. Leakage testing procedure is as follows:

- a. Upon completion of the ~~water~~ force main, it shall be cleaned, and all dirt, trash, debris, and deleterious materials removed from the line.
- b. Filled to capacity and all extraneous air removed.
- c. Pressurized to 75 psi above normal working pressure at the test location and hold for a period of not less than 2 hours.
- d. At end of testing period, the line shall be refilled with water and the amount of water to refill the line shall be measured and recorded.
- e. Amount of water to refill the line must be less than the maximum allowable leakage.
- f. Maximum allowable leakage shall be computed thusly:

$$Q_{Loss} = \frac{SDP}{1/2} / 133000$$

Where:

Q _{Loss}	=	Maximum allowable leakage
S	=	Length of the section tested in feet
D	=	Diameter of the pipe in inches
P	=	Test Pressure, PSI

DESIGN OF GRINDER PUMPS AND SEWAGE LIFT STATIONS

The design of grinder pump installation shall be certified by a Registered Professional Engineer and shall conform to the City and MDNR requirements. To reduce maintenance and operational cost, the City has selected ABS/Sulzer pumps and equipment as their standard. Accordingly, all grinder pumps and lift stations shall be designed using ABS/Sulzer equipment ~~unless specifically authorized by the City Engineer~~. The size, type, and capacity of the grinder pump, or lift station, shall be based upon the hydraulic loading and gradient necessary to pump sewage from the source to an appropriate location.

To all practical extents, development shall utilize an existing lift station or a new lift station to serve the property or properties. Multiple new grinder stations for a single development are subject to review and approval by the Public Works Operations Manager. See Typical Detail III-12 for Lift Station Requirements.

Design Guidelines
City of Osage Beach
SECTION 3 - SEWERAGE DESIGN

Hydraulic Design Considerations

1. Using the previously presented charts determine the following:
 - a. Average daily flow (ADF)
 - b. Peak hourly flow (PHF)
2. Calculate the following and provide calculations in the design submittal:
 - a. Total static head - from the proposed pump inlet to point of discharge. The point of discharge will be to the next lift station wet well on the sewer pressure main.
 - ~~b.~~ Total dynamic head - this must include total static head plus line friction losses for pipe, fittings, and connections from the proposed pump to the point of discharge. This also must include friction losses for flow in the main assuming that a portion of the downstream pumps are running. The **Public Works Operations Manager or a designee will assist with providing main pressure at a nearby lift station or connection point. City Engineer will be able to assist in this determination.**
 - c. Pumping rate based upon wet well size and a maximum cycle time at peak hourly flow of 6 times per hour.
 - d. Wet Well Capacity based upon a minimum storage above high pump off elevation of 2 hours of peak hourly flow or 45 minutes with SCADA installed. Wet well capacity shall be determined as follows:

$$VM = (QPHF \times 120) + VHPO$$

Where:

VM = Volume in wet well below inlet pipe
QPHF = Peak hourly flow in gpm
VHPO = Volume in wet well below emergency pump on

3. The wet well design shall also conform to the following:
 - a. Minimum diameter for simplex wet wells is 36 inches.
 - b. Minimum diameter for duplex wet wells is 48 inches.
 - c. Minimum depth **of the inlet pipe shall be 18 inches to 30 inches as measured from the station lid. from bottom invert of the inlet to bottom of the wet well is 48 inches.**
 - d. Maximum total depth of the wet well from lid to bottom is 12 feet.
4. Select the pump model and horsepower from the ABS pump curves.
5. Select the pressure line type and size as discussed under “pressure sewers” herein.

Additional Limitations or Specifications for Grinder Pumps

1. No more than 2 residences may be served by a simplex grinder station.
- ~~2.~~ No more than **15 10** single-family residences, or their equivalent, may be served by a single duplex grinder station. **This is subject to the review of the City Engineer. Multiple dwellings being served by a single simplex or duplex station is subject to review and approval by the Public Works Operations Manager.**

Design Guidelines
City of Osage Beach
SECTION 3 - SEWERAGE DESIGN

3. All commercial facilities shall have a duplex grinder pump station. ~~In instances where a commercial facility has an average daily flow of less than 16 gpm, and no further development or additional capacity is contemplated, a simplex pump and controls may be installed in a duplex basin.~~
4. Triplex package units or custom-built lift stations are subject to the review and approval of the City ~~Public Works Operations Manager~~ **Engineer**.
5. Each Grinder Pump Station shall include an ABS pump(s) fiberglass basin including internal piping, pump base and guide rail; and ABS Pump Control Panel as described in the specifications:
 - a. The basin will be an ABS basin, or the equivalent thereof, and either simplex or duplex as required.
 - b. All internal piping and pump guide rails shall be ~~galvanized~~ **stainless steel**.
 - c. Concrete anti-floatation ring shall be cast around the basin base.
 - d. Basin cover (lid) shall be of steel with minimum thickness of ¼ inch and coated with a high temperature baked epoxy or air-dried epoxy paint, green in color. **No fiberglass lids will be allowed for grinder stations.**
 - e. Lid shall be fully bolted and/or hinged secured.
6. All grinder stations of 6.2 HP or less shall have internal discharge piping of 1-1/4 inch stainless steel pipe.
7. All grinder stations of more than 6.2 HP shall have stainless steel discharge piping of minimum 2 inch; ~~or as approved by the City Engineer.~~
- ~~8. All grinder stations shall have a brass bodied globe valve installed in each discharge line within the grinder station at a location approved by the City Engineer.~~
9. Minimum distance from top of grinder basin cover to top of inlet pipe shall be ~~18~~ **24** inches.
10. Minimum distance from top of grinder basin to bottom of discharge pipe(s) shall be 48 inches.
11. Maximum depth of the grinder station basin shall be 12 feet.
- ~~12. A finished grade around the station shall be established to be 2-inches below the lid and a 5-foot flat working area surrounding the station.~~
- ~~13. Access shall be provided to any grinder station for City access. The access is subject to review and approval by the Public Works Operations Manager and/or his/her designee.~~

Electrical Service for Sewage Lift Stations and Grinder Stations

1. AmerenUE is the provider for electrical service. The owner, developer, or contractor shall make arrangements with AmerenUE for electrical service to the grinder station.
2. Electrical energy shall be provided on a direct individually metered service of the appropriate capacity for the facility to be served.
3. The use of "Add-a-Phase" or other artificial phasing devices is prohibited.

Design Guidelines
City of Osage Beach
SECTION 3 - SEWERAGE DESIGN

4. When three phase service is required the owner or developer shall make all necessary arrangements with AmerenUE to provide the required service.

Grinder Station Electrical Panel

1. ABS/~~Electric Control Company~~ panel supplier shall provide the standard panel developed for the City, of the correct model to match the pump(s).
2. Control panel shall be fully and completely compatible and parts interchangeable with existing ~~City owned~~ units or as directed by the ~~City Engineer~~ Public Works Operations Manager.
3. Shall be mounted on galvanized steel rack at a height of ~~four feet as measured from the top of station lid to the bottom of the station panel and four feet as measured horizontally away from the edge of the station. approximately 5 feet above finished grade.~~
4. Each control panel shall have a wiring diagram, or schematic, attached to the inside of the outer door of the control panel box.
5. All exterior wiring shall be run in rigid metal conduit ~~from the panel to the station and for at least 10 feet away from the panel in any direction. All ridged metal conduit installed below grade shall be wrapped or coated with a waterproofing sealer. No junction box will be allowed between the control panel and the station.~~
6. Each station shall have a City owned quick throw disconnect with the appropriate rating for the station's electrical requirements.
7. All work should be done in accordance with the National Electric Code and all material should be UL approved.
8. Control rack:
 - a. Shall be ~~a minimum of~~ 24-inch frame width.
 - b. Frame shall be 2-inch square steel tubing (#9 gauge minimum).
9. All components shall be hot dip galvanized.
10. Field cuts must be saw cut and saw cuts shall be painted with Rust-Oleum or Galva-Well.
11. Below grade metal components shall be painted with a minimum of two coats of Koppers Super Service (blk) Tenemec #450 Heavy Tenemecol coating/sealer or approved equal.
12. Legs shall be set in concrete and concrete shall be a minimum of 18 inches deep and 12 inches in diameter.
13. Electrical service wires, pump service wires, and float control wires, shall be run in minimum 2-inch galvanized rigid steel conduit. ~~Minimum of two (2) conduits shall be run to the station, one (1) conduit for pump wires and one (1) conduit for communication controls.~~

Design Guidelines
City of Osage Beach
SECTION 3 - SEWERAGE DESIGN

14. All bends and fittings shall be long radius bends. ~~A maximum of one (1) sweep will be allowed between the panel vertical bend and the grinder station perforations.~~
15. An explosion proof wye fitting shall be installed 6 inches below the control panel.
16. No splice boxes will be permitted within the grinder pump basin.
17. Riser for ground wire shall be in ½ inch rigid, galvanized steel, conduit with grounded bushings, with stubbed and bonding jumper.
18. Grounding Rod:
 - a. Shall be copper clad grounding rod.
 - b. ½ inch by 8 feet in length.
 - c. Rod shall be driven vertically into the ground or as directed by the ~~City Engineer~~ Public Works Operations Manager or designee.
19. Electric meter, meter base, disconnect, and panel shall comply with AmerenUE Service Manual, ~~latest edition. Section 5.3.1 (bypass requirements).~~
20. ~~SCADA shall be provided by Systems Manufacturing, 14042 W 107th St. Lenexa, KS, 66215; phone (913) 485-3307. Where SCADA is required the controls must be approved by the Public Works Operations Manager prior to installation.~~

REQUIRED INSPECTIONS, TESTING, AND START UP PROCEDURES

1. Construction Drawings are required for all gravity and pressure sewers and all grinder or sewage lift stations. Such drawings shall be designed and sealed by a Registered Professional Engineer in the State of Missouri. ~~Construction of one- and two-family dwellings and their accessory structures are excluded from this requirement, unless the design requires an extension to the City's system.~~
2. ~~All~~ The design and materials ~~and equipment~~ shall conform to ~~these~~ the City of Osage Design Guidelines. ~~Such drawings shall be reviewed and approved by the Public Works Operations Manager or designee prior to any onsite construction.~~
3. All gravity and pressure sewers shall be inspected by ~~the City Inspector Public Works Department Personnel~~ prior to backfill.
4. All gravity and pressure sewers, manholes, and wet wells shall be tested for leakage as specified herein and shall be performed in the presence of City personnel.
5. Grinder and sewage lift stations shall be fully tested for performance and operation in the presence of City personnel. Such testing shall include:
 - a. Pumping rates
 - b. Pumping cycle tests including emergency alarm and startup of standby equipment (if so equipped)
 - c. Electrical current and voltage checks.
 - d. The contractor/developer shall provide the services of a manufacturer's factory representative to be present during the tests.

Design Guidelines
City of Osage Beach
SECTION 3 - SEWERAGE DESIGN

6. Upon completion of all testing startup procedures the City will issue a certificate of acceptance. The system will not be connected to City Service or accepted by the City until the acceptance certificate is issued. ~~If the system cannot be accepted, no building occupancy permit will be issued.~~

AS CONSTRUCTED DRAWINGS AND MAINTENANCE DOCUMENTS

The contractor/developer shall provide the City with not less than two full sized "As Constructed" drawings certified as being correct record drawings by a Registered Professional Engineer in the State of Missouri.

The contractor/developer shall provide one copy of a certified and recorded utility easement for all sewer lines and grinder station sites to be turned over to the City. Easements shall be prepared and sealed by a Registered Land Surveyor in the State of Missouri.

TYPICAL DETAILS FOR SEWER APPURTENANCES

Sewer appurtenances shall conform to the typical details attached hereto.

PUBLIC INFORMATION PACKET – SEWER DESIGN

Applicants for a building or zoning permit will be provided with a “Sewer Information Packet” which reflects the requirements contained in this design manual and pertinent City ordinances. Such packet shall be considered as an approved part of the Design Guidelines.

SEPTIC TANK SYSTEMS

City Code Section 710-~~090~~ requires that any facility constructed within 300 feet of an existing City sewer must connect to such sewer. There are a few locations within the City where City sewer is not available. In those cases, the owner may be authorized by the City to construct or repair a septic system.

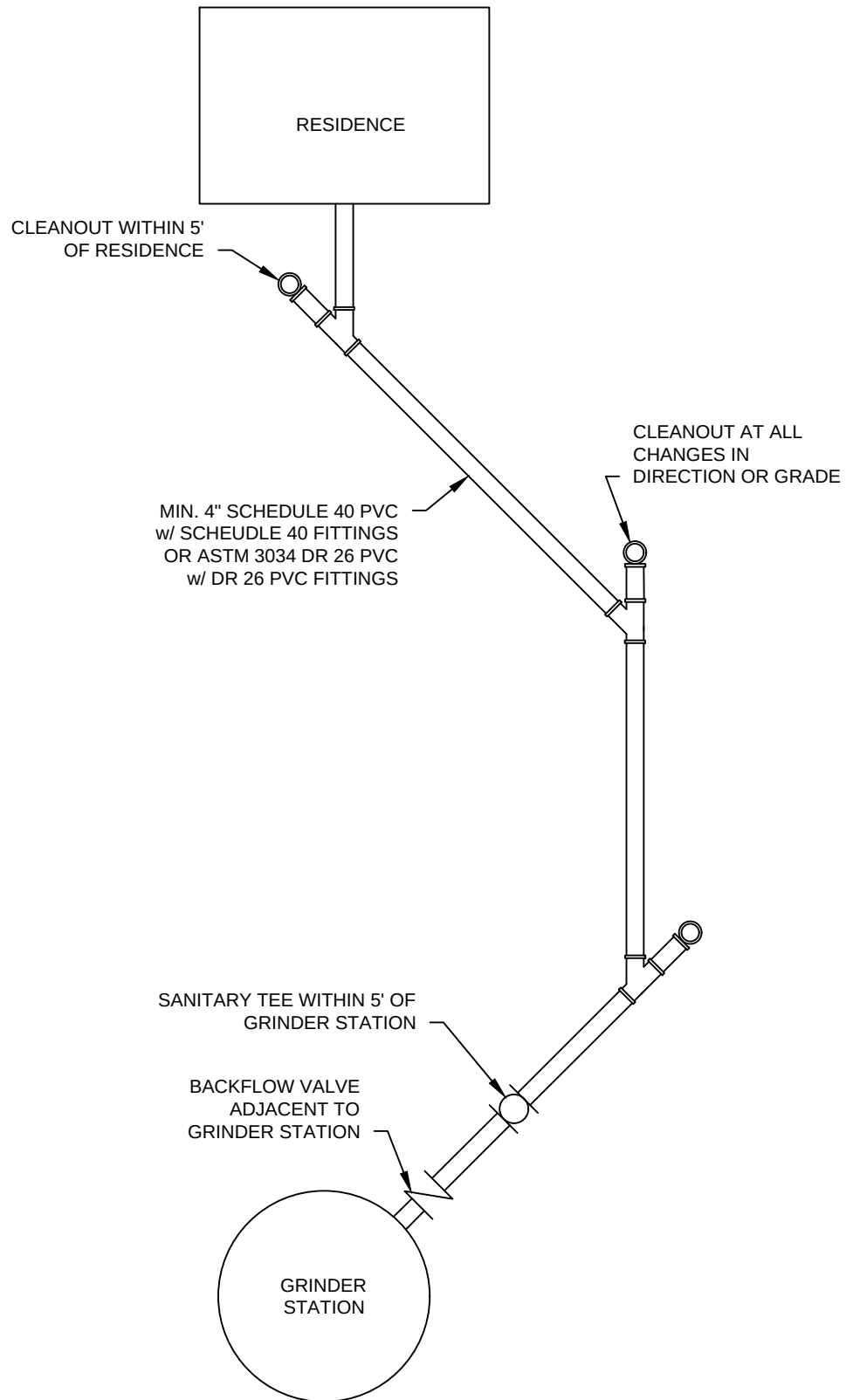
REQUIREMENTS FOR AUTHORIZED PRIVATE SEWAGE DISPOSAL SYSTEMS

A Septic Tank Permit from the City is required prior to construction. Approved soil morphology, permeability tests and soil percolation tests, site topography, septic tank, and absorption system, designed by a Registered Professional Engineer in the State of Missouri are required for the permit.

1. The system must be designed by a Registered Professional Engineer in accordance with Missouri Department of Health Regulations ~~710.025 through 710.059~~, Missouri Laws for On-site Sewage Disposal Systems, and 19 CSR 20-3.060 Minimum Standards for On-site Sewage Disposal Systems.
2. Soil morphology, permeability tests and soil percolation tests shall be made by a Registered Professional Engineer in the State of Missouri or State Certified Soil Scientist. Tests and reports shall be in accordance with 19 CSR 20-3, Para (2) Site Evaluation.
3. The minimum setback distances shown in 19 CSR 20-3, Table 1 Minimum Setback Distances shall be strictly followed.

Design Guidelines
City of Osage Beach
SECTION 3 - SEWERAGE DESIGN

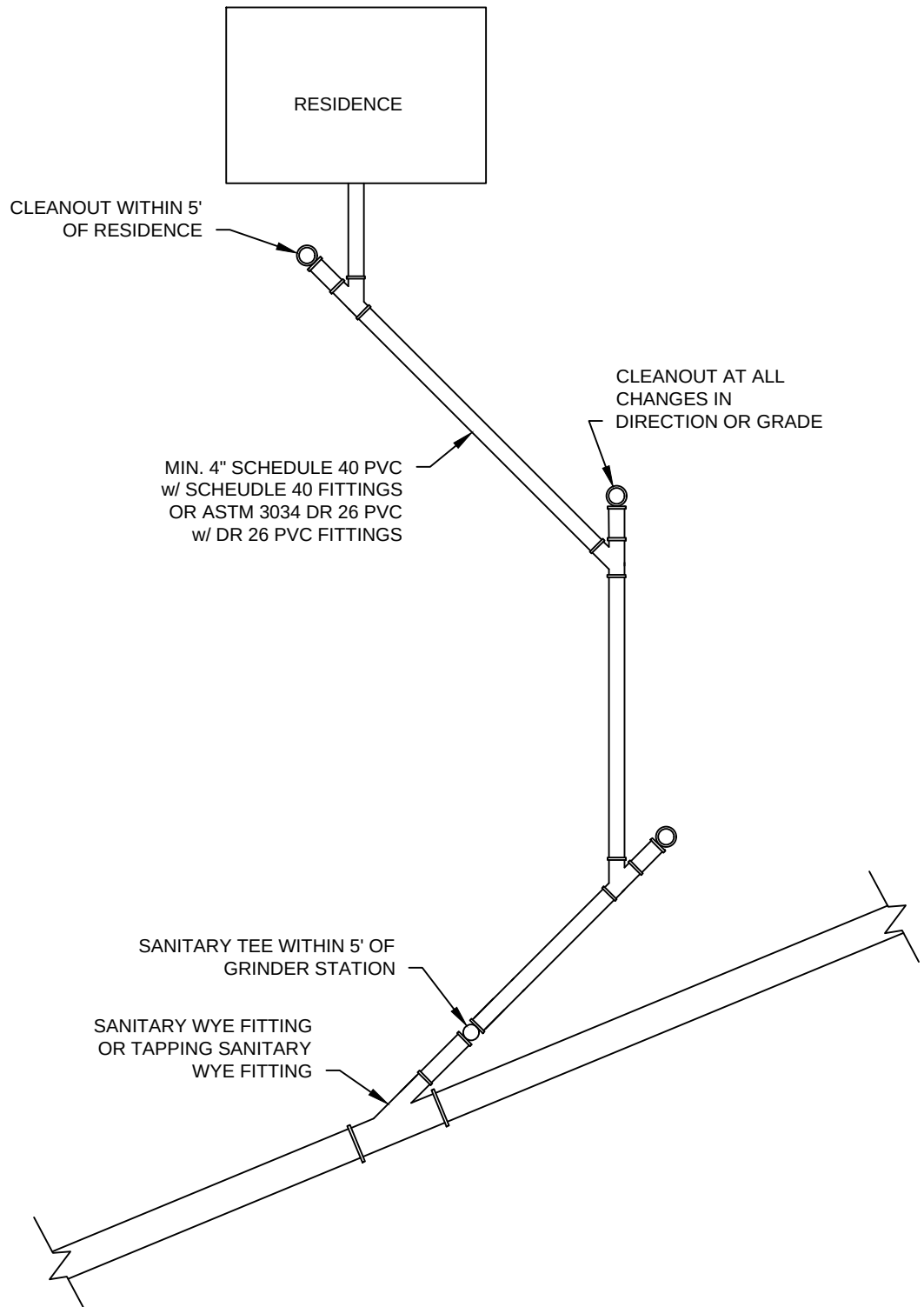
4. Flow rates or volumes shall be computed based on 120 gal/day/bedroom or 60 gal/day/person, the minimum flow from a residence shall be 240 gal.
5. The minimum septic tank capacity shall be 1250 gallons. Septic tanks shall be constructed in strict conformance to 19 CSR 20-3, Para. (4) **Sewage Tanks**.
6. Absorption systems shall be in accordance with 19 CSR 20-3, Para. (5) Absorption Systems.
7. Alternative systems shall be in accordance with 19 CSR 20-3, Para (6) Alternative Systems.



Date Revised:	MARCH, 2007
By:	sh
Checked By:	JB

CITY OF OSAGE BEACH
TYPICAL DETAIL
RESIDENTIAL SERVICE CONNECTION

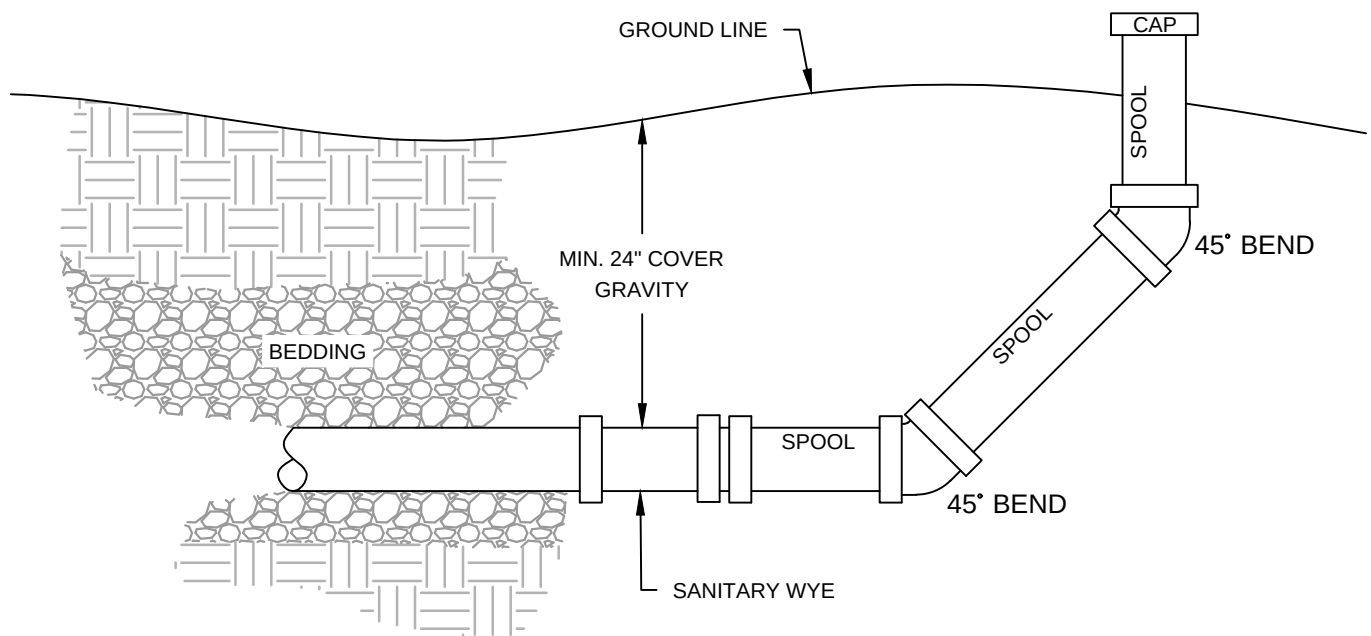
Design Guideline:	SECTION 3
	SEWERAGE DESIGN
Drawing No.:	III-1



Date Revised:	MARCH, 2007
By:	sh
Checked By:	JB

CITY OF OSAGE BEACH
TYPICAL DETAIL
RESIDENTIAL SERVICE CONNECTION

Design Guideline:	SECTION 3
	SEWERAGE DESIGN
Drawing No.:	III-2



Date Revised:

Oct., 2004

By:

sh

Checked By:

JB

**CITY OF OSAGE BEACH
TYPICAL DETAIL
SANITARY SEWER CLEANOUT DETAIL**

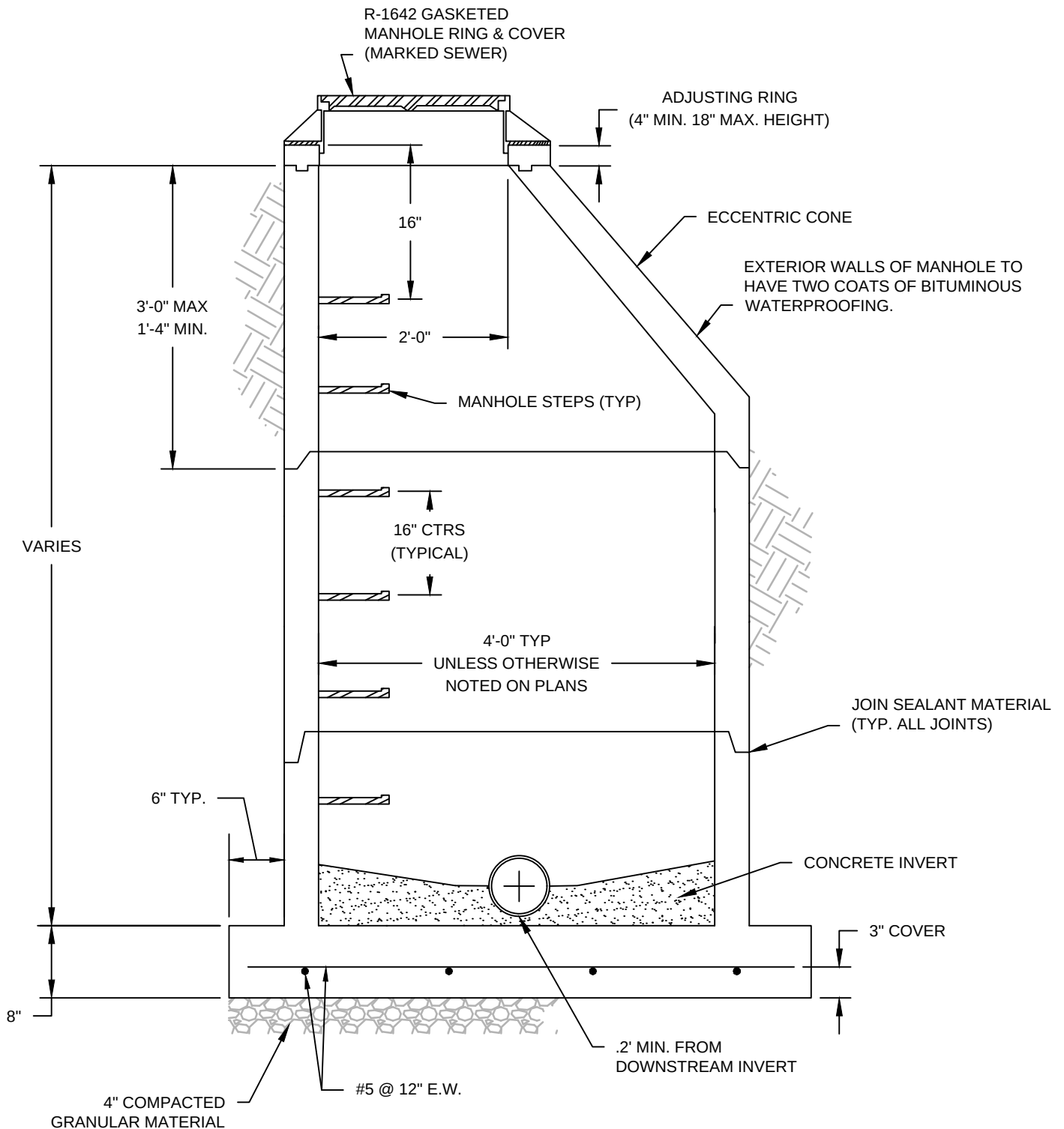
Design Guideline:

SECTION 3

SEWERAGE DESIGN

Drawing No.:

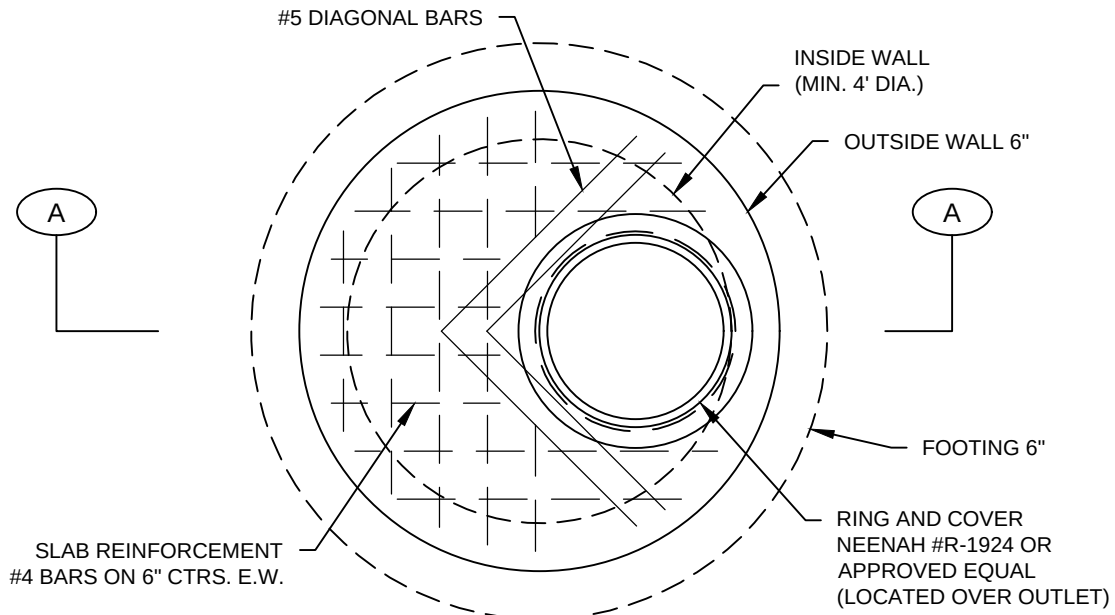
III-3



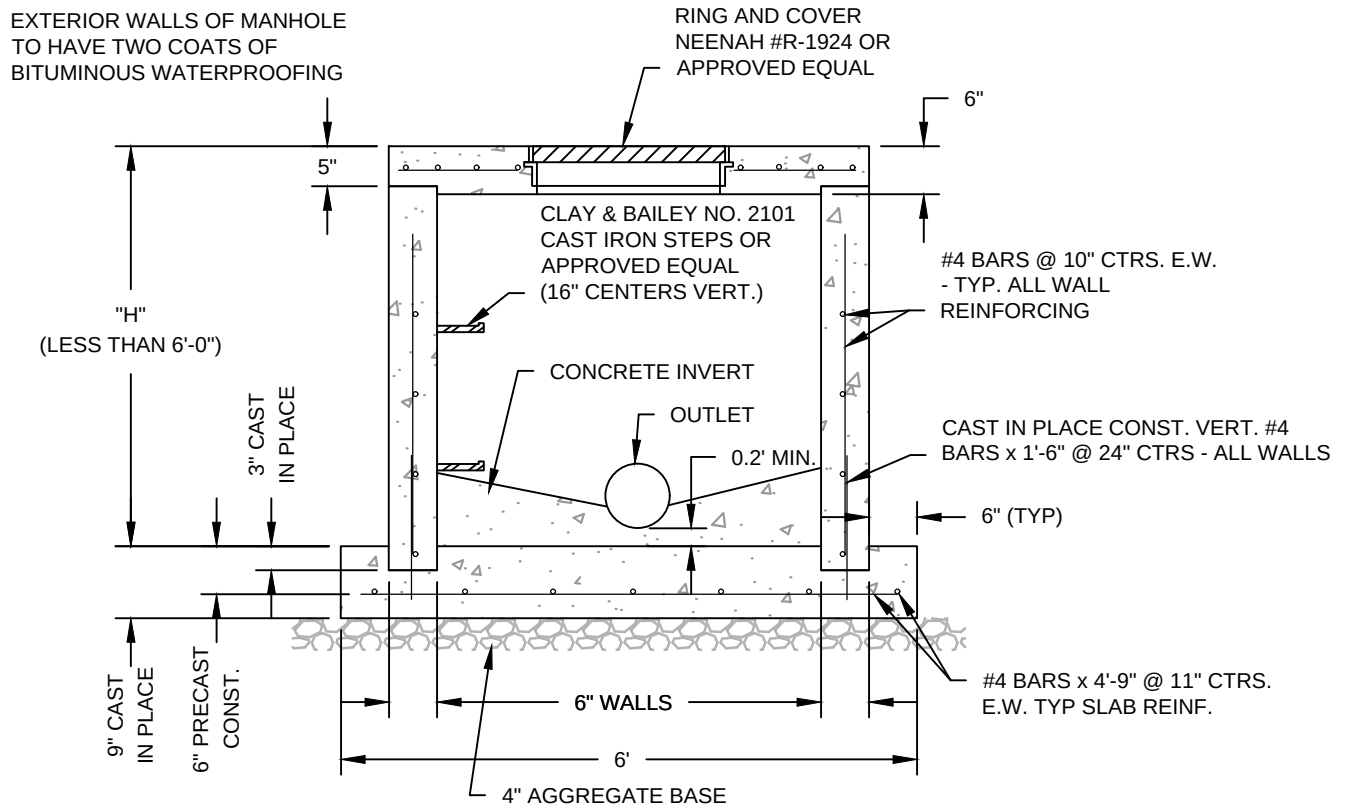
Date Revised:	MARCH, 2023
By:	NCW
Checked By:	DPV

CITY OF OSAGE BEACH TYPICAL DETAIL STANDARD PRECAST MANHOLE

Design Guideline:	SECTION 3
	SEWERAGE DESIGN
Drawing No.:	III-4



PLAN VIEW



SECTION A-A

Date Revised:

AUG., 2008

By:

jdb

Checked By:

nle

**CITY OF OSAGE BEACH
TYPICAL DETAIL
FLAT TOP MANHOLE**

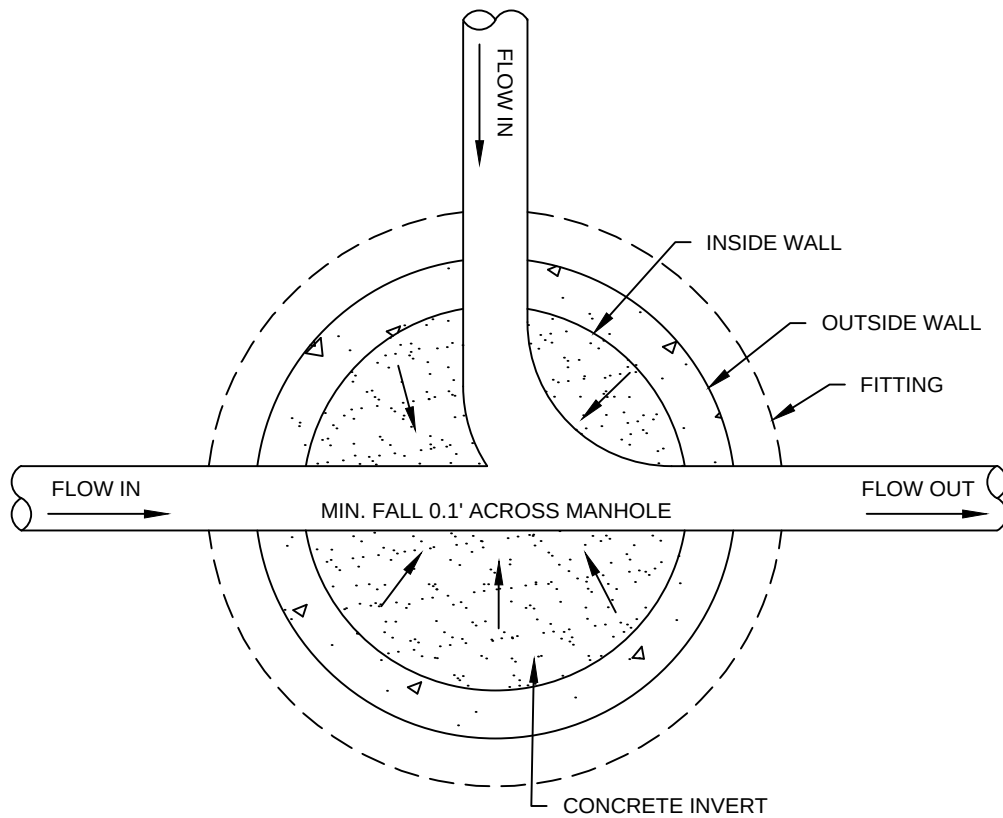
Design Guideline:

SECTION 3

SEWERAGE DESIGN

Drawing No.:

III-5

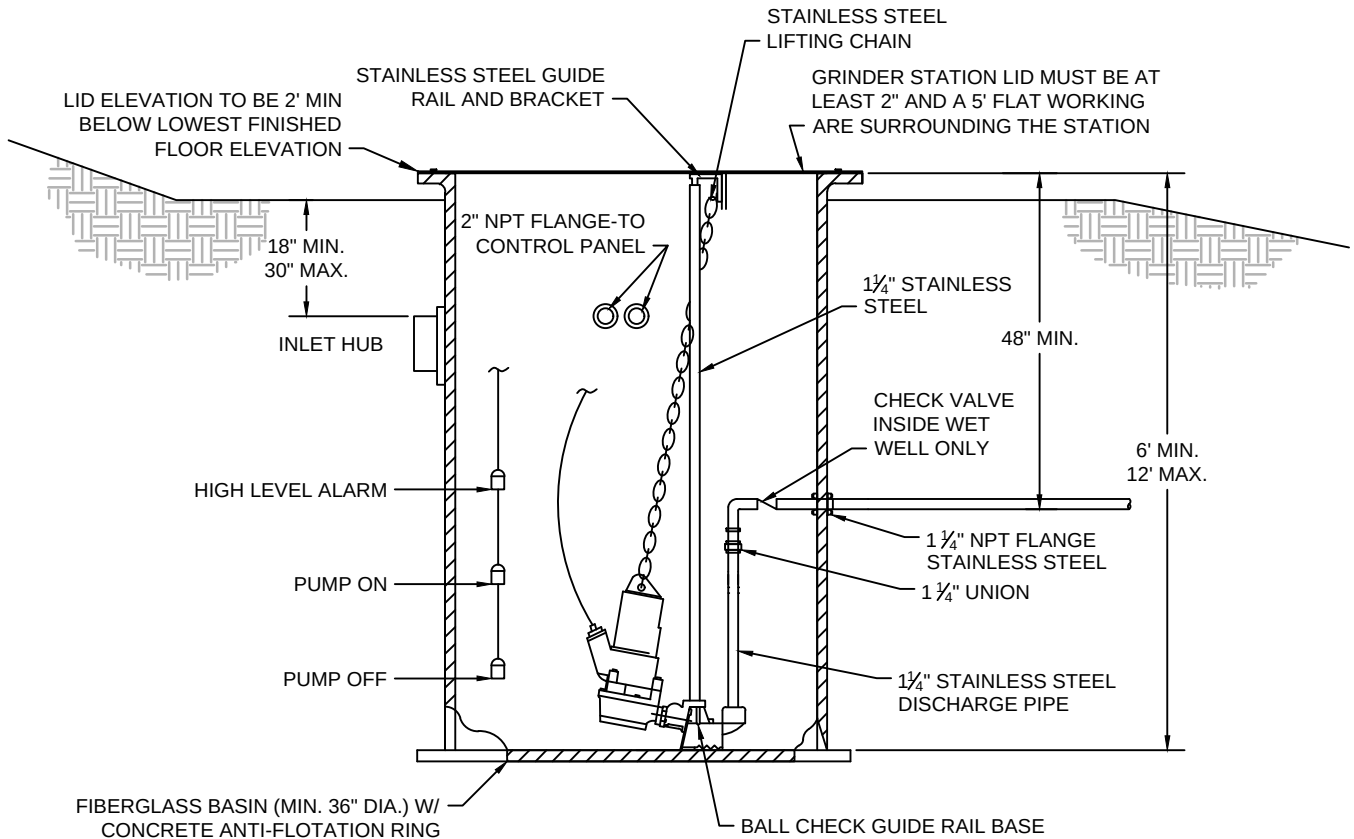
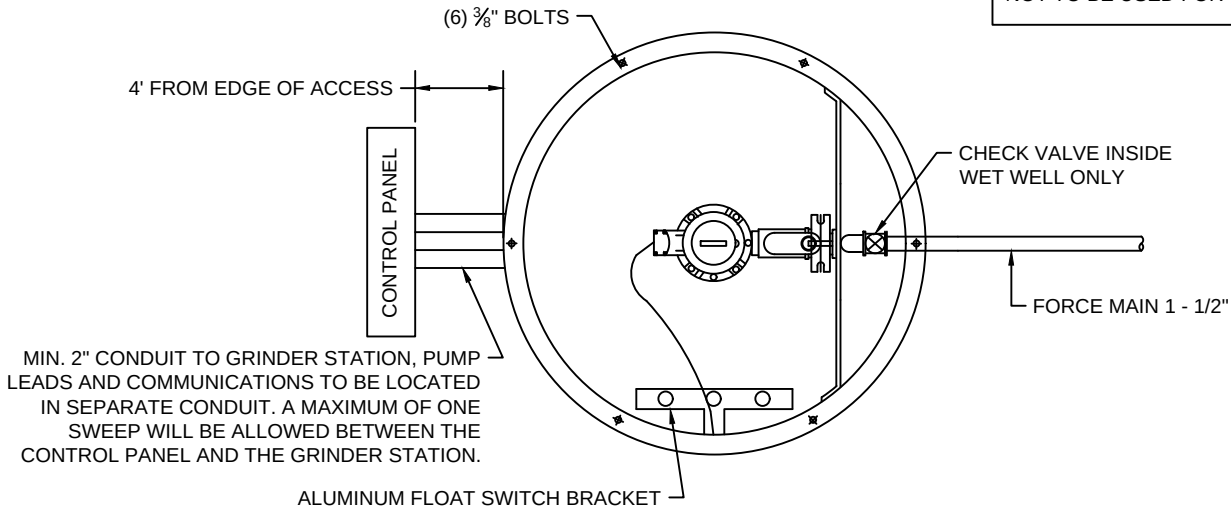


Date Revised:	Oct., 2004
By:	sh
Checked By:	JB

CITY OF OSAGE BEACH
TYPICAL DETAIL
MANHOLE INVERT DETAIL

Design Guideline:	SECTION 3
	SEWERAGE DESIGN
Drawing No.:	III-6

THIS IS A TYPICAL INSTALLATION DRAWING.
NOT TO BE USED FOR CONSTRUCTION.



Date Revised:

MARCH, 2023

By:

NCW

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DPV

CITY OF OSAGE BEACH TYPICAL DETAIL SIMPLEX PUMP STATION

Design Guideline:

SECTION 3

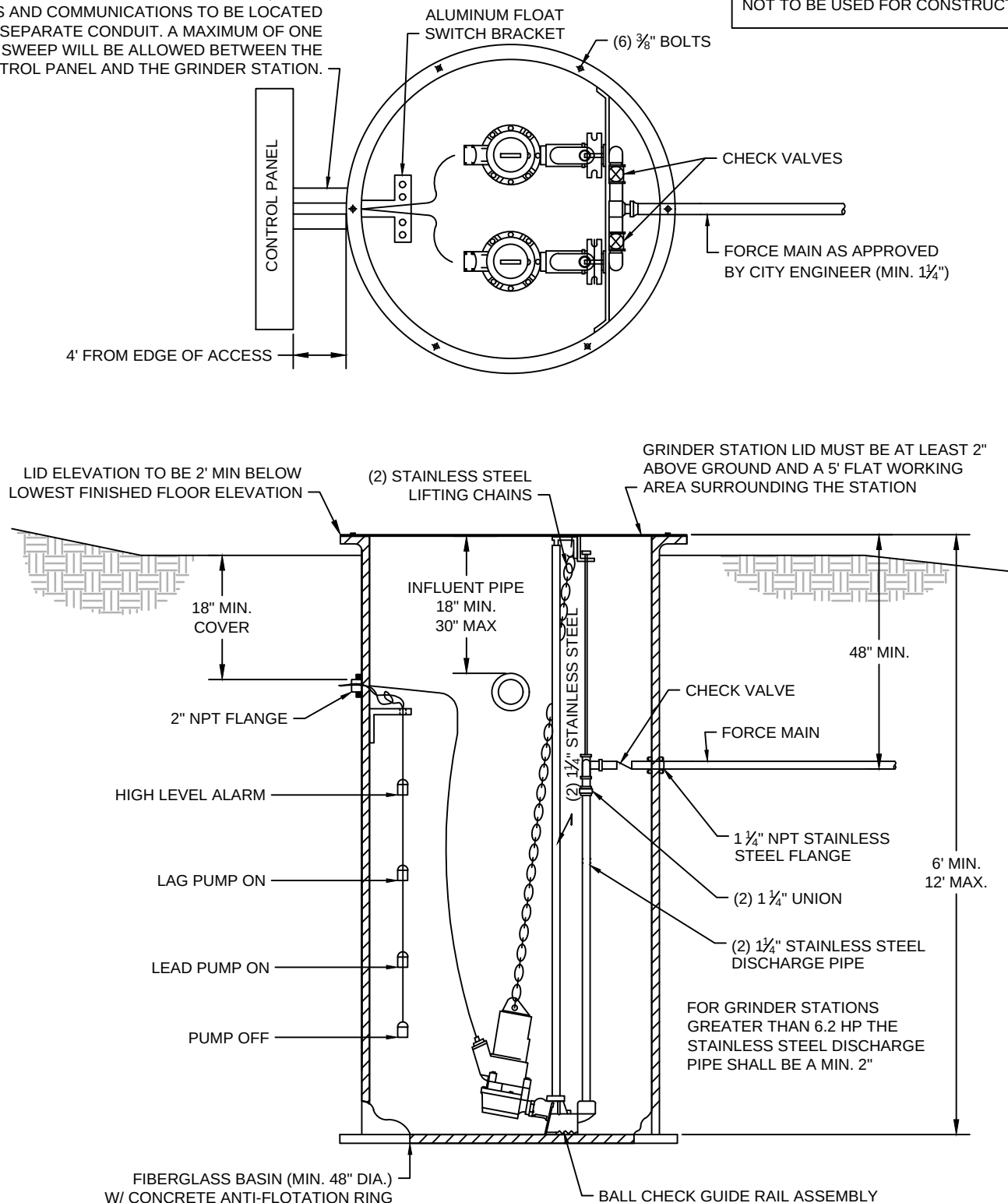
SEWERAGE DESIGN

Drawing No.:

III-7

MIN. 2" CONDUIT TO GRINDER STATION, PUMP
LEADS AND COMMUNICATIONS TO BE LOCATED
IN SEPARATE CONDUIT. A MAXIMUM OF ONE
SWEEP WILL BE ALLOWED BETWEEN THE
CONTROL PANEL AND THE GRINDER STATION.

THIS IS A TYPICAL INSTALLATION DRAWING.
NOT TO BE USED FOR CONSTRUCTION.



Date Revised:

MARCH, 2023

By:

NCW

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DPV

CITY OF OSAGE BEACH TYPICAL DETAIL DUPLEX PUMP STATION

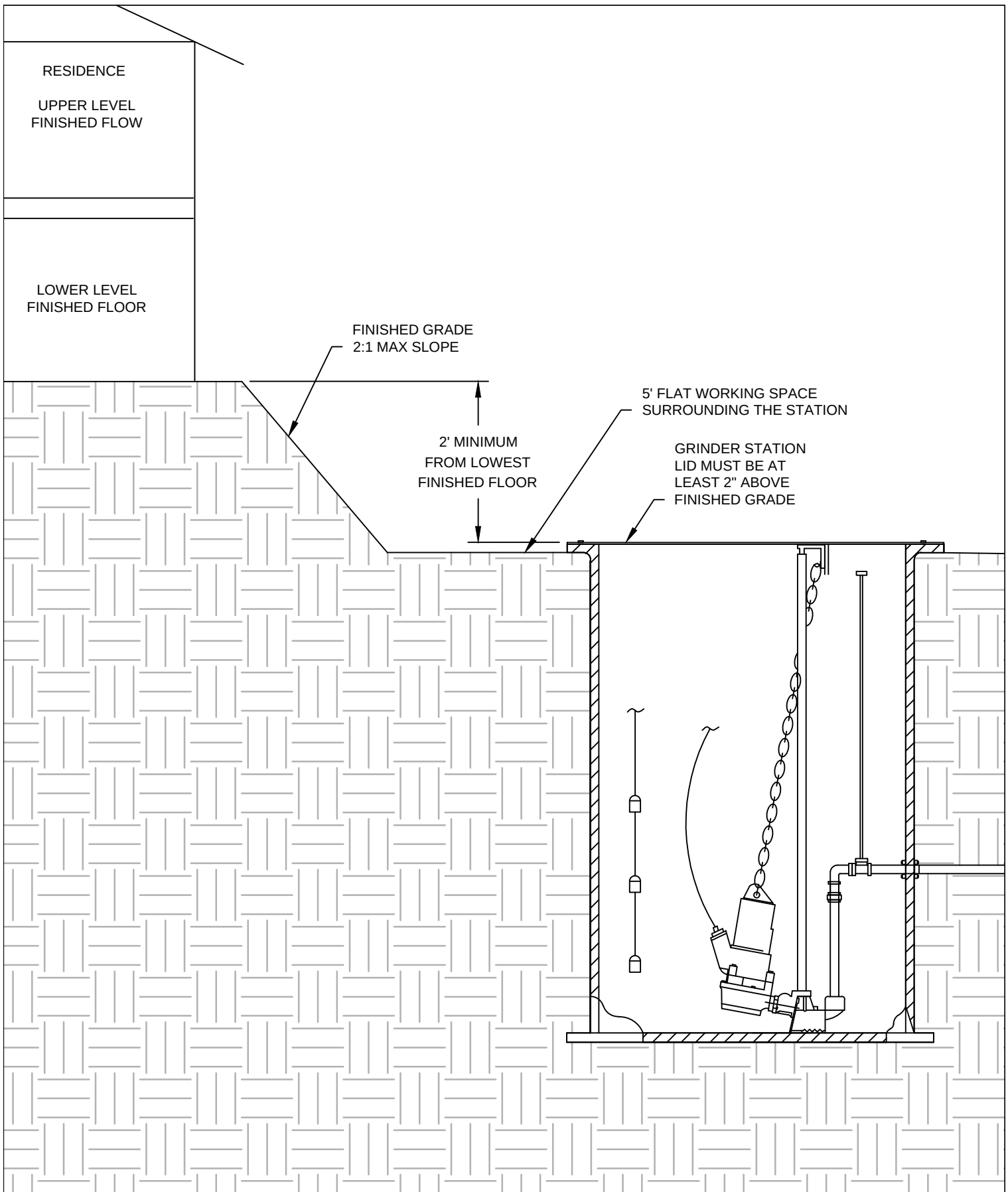
Design Guideline:

SECTION 3

SEWERAGE DESIGN

Drawing No.:

III-8



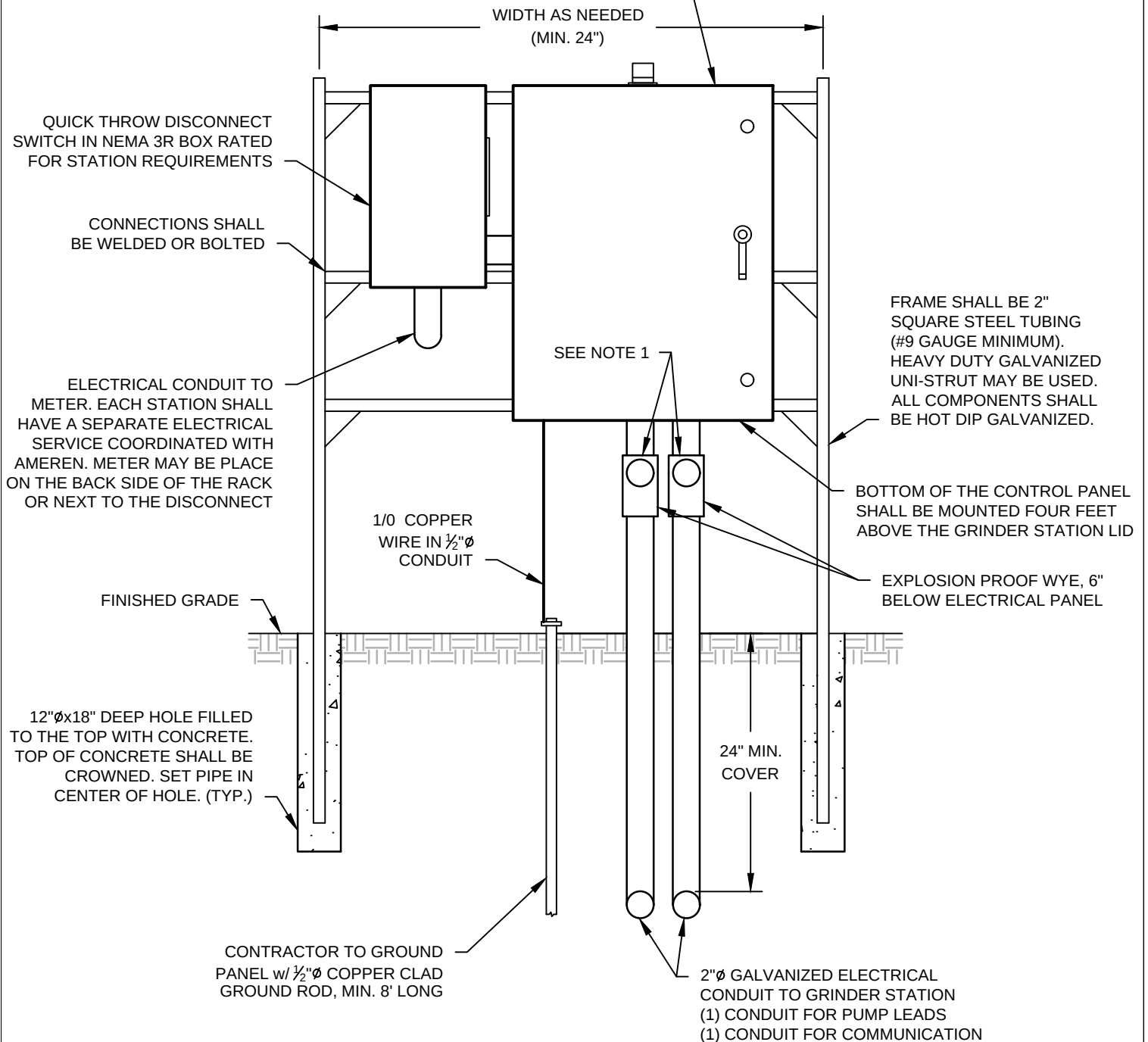
Date Revised:	NOV.,2009
By:	cps
Checked By:	

CITY OF OSAGE BEACH
TYPICAL DETAIL
WET WELL ELEVATION

Design Guideline:	SECTION 3
	SEWERAGE DESIGN
Drawing No.:	III-9

ALL ELECTRIC WORK SHALL BE DONE IN ACCORDANCE WITH THE NATION ELECTRIC CODE AND ALL MATERIAL SHALL BE UL APPROVED.

STATION CONTROL PANEL SHALL BE PROVIDED BY MUNICIPAL EQUIPMENT COMPANY, ST. LOUIS, MO., OF THE CORRECT MODEL TO MATCH THE PUMP. IT SHALL BE MOUNTED APPROXIMATELY 5' ABOVE FINISHED GRADE. EACH CONTROL PANEL SHALL HAVE A WIRING DIAGRAM OR SCHEMATIC ATTACHED TO THE INSIDE OF THE OUTER DOOR OR THE CONTROL PANEL BOX.



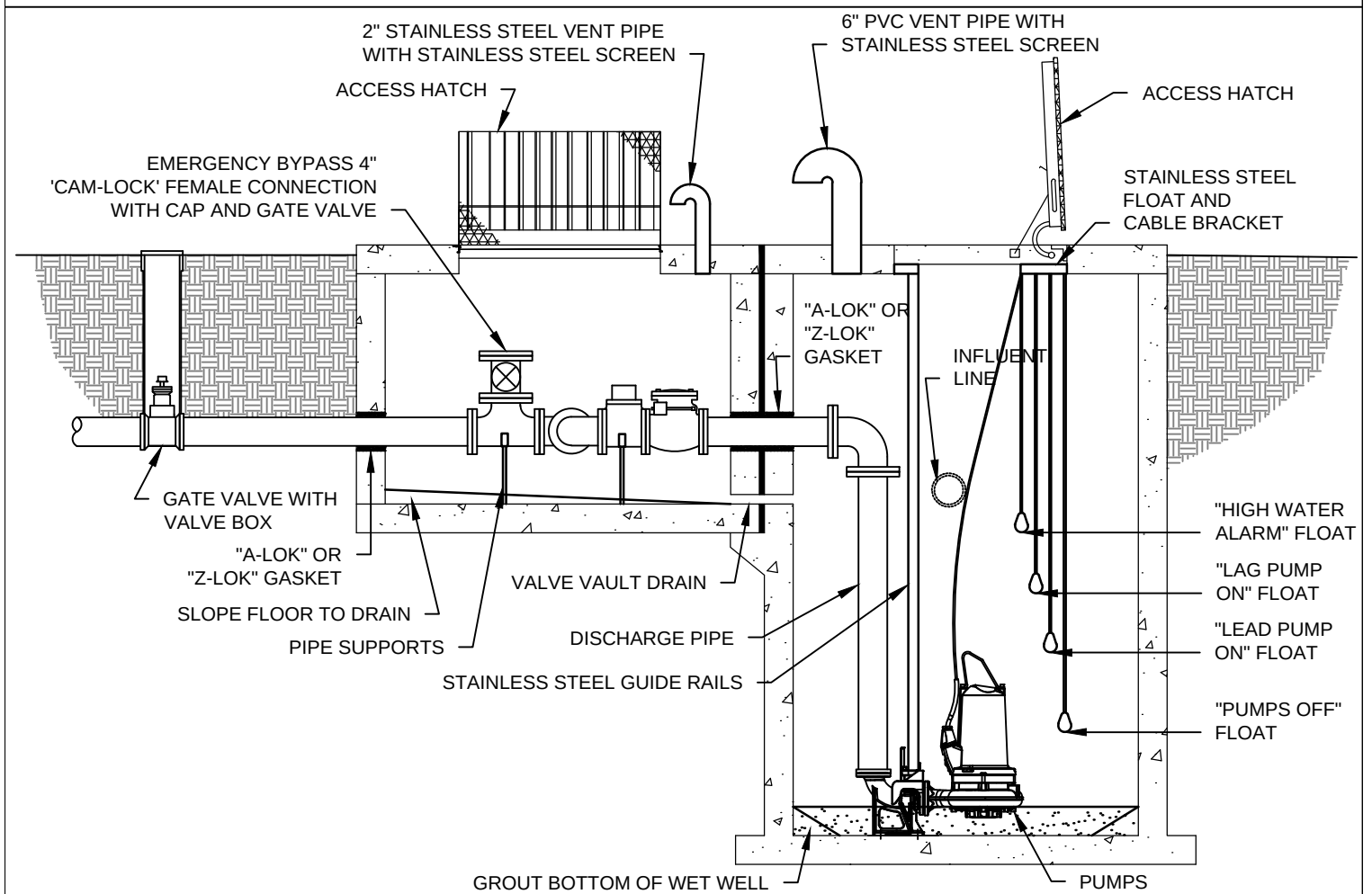
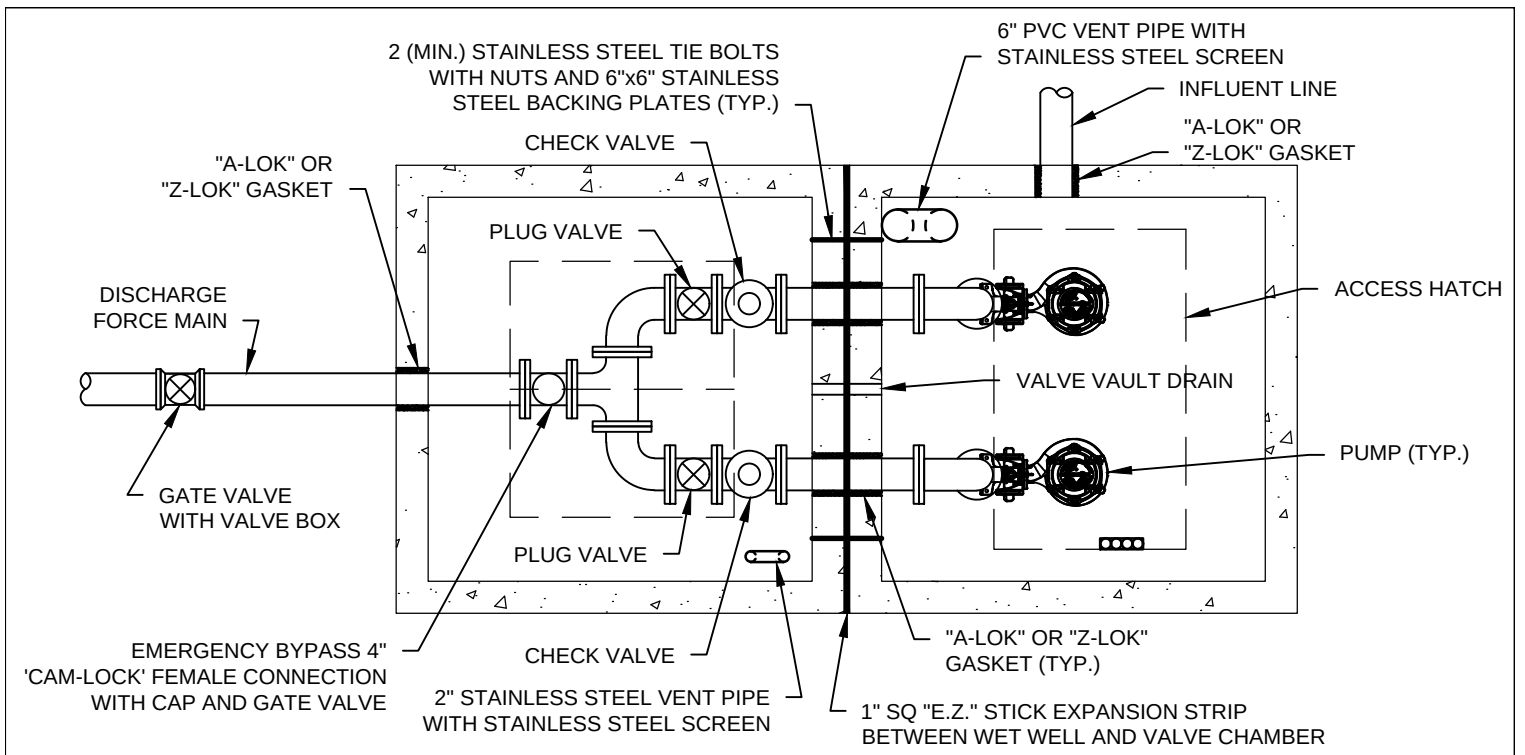
NOTE:
1. CONDUIT ENTRANCE AT TOP OF BOX TO BE SEALED AIRTIGHT TO PREVENT WET WELL GASES FROM ENTERING CONTROL PANEL

ALL GALVANIZED CONDUIT INSTALLED BELOW FINISHED GRADE SHALL HAVE WATERPROOF COATING OR WRAP.

Date Revised:	OCT., 2004
By:	sh
Checked By:	JB

CITY OF OSAGE BEACH TYPICAL DETAIL GRINDER STATION RACK

Design Guideline:	SECTION 3
	SEWERAGE DESIGN
Drawing No.:	III-10



Date Revised:	APRIL 2023
By:	NCW
Checked By:	DPV

CITY OF OSAGE BEACH
TYPICAL DETAIL
LIFT STATION

Design Guideline:	SECTION 3
	SEWERAGE DESIGN
Drawing No.:	III-11

Design Guidelines
City of Osage Beach
SECTION 4 - STORM DRAINAGE

(Revised 21 OCT 04 - SH)

OVERVIEW

Storm runoff accumulates pollutants, sediment, and debris as it flows over the landscape until it reaches a receiving waterway - the Lake of the Ozarks. These pollutants, sediments, and debris include oils and petroleum residues, animal refuse, garbage, organic debris from vegetation, silts, sands, and other objectionable materials. The U.S. Environmental Protection Agency (EPA) and the Missouri Department of Natural Resources, Water Pollution Control Division, considers these pollutants to have adverse effects upon the human and aquatic life that uses the lake for habitat or recreational needs. The water quality of the Lake of the Ozarks is vital to the health and economic well being of our residents, visitors, and community.

Storm drainage within the City of Osage Beach falls under regulatory authority of the U.S. Environmental Protection Agency (EPA) and the Missouri Department of Natural Resources (MDNR). The provisions of the U.S. Clean Water Act of 1978, Section 402 mandates the National Pollutant Discharge Elimination System (NPDES) and requires permitting for specific types of non-point pollutant sources under Phase II (Final Rule dated December, 1999) for areas where more than one acre of natural ground cover is disturbed. In addition, it mandates other control measures for designated cities, industries, and locations. The City of Osage Beach is not currently designated as a small city with a separate storm water system (MS4) or required to have a NPDES Permit. Several of the Phase II requirements do apply to the city. It is the policy of the City to reduce the contamination of the Lake of the Ozarks to comply with NPDES Phase II to the extent practicable for the city

The City of Osage Beach complies with these requirements through City Code, Title IV Land Use, Section 410.340, 410.350, 410.360, and 410.370 and the applicable portions of the Osage Beach Design Guidelines.

GOALS AND OBJECTIVES

The goal and objective of the City of Osage Beach's Storm Water Management Plan is to manage storm water drainage within the city limits so as to minimize the pollution of the Lake of the Ozarks and to prevent storm water run-off damage to the maximum extent practicable.

The primary source of visible pollutants during storm runoff is through sediment and debris picked up on construction sites or locations where the natural vegetation has been removed. The major secondary source is through volatile fuels, oils, animal wastes, and refuse picked up by storm runoff as it flows off large parking areas, roofs and over the terrain in route to the lake. These sources of contamination will be addressed separately through the application of a Sediment Control Plan and/or a Storm Drainage Plan.

Design Guidelines
City of Osage Beach
SECTION 4 - STORM DRAINAGE

Recent developments in the Storm Drainage Compliance area have lead to the development of “Best Management Practices” (BMP’s) and less emphasis on retention facilities. Also the trend is toward reduction of contamination by: 1) reducing the quantity of storm water runoff, 2) reducing or removing the contamination of the runoff, and 3) by conveying the storm run-off without further contamination.

Our goal is to reduce the pollution of the lake through public education, awareness, and the application of MDNR Best Management Practices (BMP’s). Our immediate objective is to manage the storm drainage system such that no collectable sediment or pollutants reach the lake and/or causes damage to adjacent or downstream properties.

The following design guidelines will establish the minimum steps or procedures required to reach these goals and objectives.

SEDIMENT CONTROL PLAN

- A. The Sediment Control Plan shall be submitted as a part of the building permit process and shall be reviewed and approved by the City Engineer prior to the start of any onsite work for any and all projects involving two or more lots or ½ acre, whichever shall be the smaller.

Note: The MDNR requires a Sediment Control Permit for all construction projects of one acre or more in area.

1. The Sediment Control Plan must be prepared by a Registered Professional Engineer stating the goals of the plan and depicting the locations and details of the construction of all sediment control devices to be utilized on the project.
2. The plan shall clearly set out the contractor’s schedule and requirements for maintaining the integrity of the plan.
3. The primary goal of the plan is to assure that no visible or measurable sediment or debris is allowed to leave the developed area.
4. The devices and measures utilized shall follow the recommended “Best Management Practices” as described in the publication “Protecting Water Quality” by MDNR and as directed herein. At the minimum the following shall be required:
 - a. Silt fencing shall be installed around the downhill edges of the disturbed area.
 - b. Earth berms and swales shall be used to reduce sheet flow volumes and velocities.
 - c. Straw bale check dams, earth berms and other BMP’s shall be utilized as necessary to prevent run-off from carrying sediment and debris off site.
 - d. Check dams or other BMP’s shall be used to assure velocities do not exceed 5 fps.

Design Guidelines
City of Osage Beach
SECTION 4 - STORM DRAINAGE

- e. Approved engineering fabric or erosion control matting shall be used in all drainage courses or ditches where flow velocities exceed 5 fps.
 - f. All denuded slopes or embankments shall be protected from erosion by the installation of earthen berms, straw bale dikes, or other appropriate BMP.
 - g. Temporary catch basins, drop inlets and/or storm drains (culverts) shall be utilized as necessary.
 - h. All denuded slopes or areas shall be reseeded with appropriate seed, fertilized and mulched within four weeks of the time the original ground cover was removed. Jute mesh, "Petro-mat" or other approved slope stabilization fabric shall be installed on all slopes steeper than 3:1.
5. In the event that the plan is deficient or inadequate to prevent sediment escaping the jobsite, the Owner/Developer shall immediately take any and all measures necessary to stop and prevent further contamination, and to clean up contaminated areas.

STORM DRAINAGE PLAN

- A. A Storm Drainage Plan is required for all new construction sites within the jurisdictional boundaries of the City of Osage Beach in which the construction or clearing for construction disturbs an area exceeding two lots or one half acre, whichever shall be the smaller.
- 1. The Storm Drainage Plan shall be prepared by a Registered Professional Engineer stating the goals of the plan and depicting the locations and details of construction of all sediment and drainage control devices, and BMP's, to be utilized in the plan.
 - 2. The plan shall clearly state owners schedule and requirements for maintaining the components of the system.
 - 3. The devices and measures utilized shall follow the recommended "Best Management Practices" as described in the publication "Protecting Water Quality" by and available through MDNR, the City of Osage Beach City Code and the City of Osage Beach Design Guidelines
 - 4. At the minimum the Storm Drainage Plan shall provide the following technical data:
 - a. Clearly depict the entire drainage area effecting the development site including downstream areas that will be effected by storm water run-off or drainage.
 - b. Accurately calculate the anticipated storm run-off from a theoretical twenty (20) year storm event.
 - c. Establish the percolation rates for all infiltration, percolation, and filtration devises.

Design Guidelines
City of Osage Beach
SECTION 4 - STORM DRAINAGE

- d. Determine the anticipated flows and capacities of all channels, culverts and conveyance devices.
 - e. Clearly identify and provide flow data for all velocity control and/or energy dissipation devices.
5. At the minimum the Storm Drainage Plan shall provide the following sediment and drainage controls:
- a. Provide removal or containment of all silt, sediment, and debris carried onto or across the development so as to assure that no silt, sediment, or debris is allowed off the developed area.
 - b. Assure that all storm run-off is controlled such that no damage will occur to adjacent downstream properties or facilities.
 - c. Where parking areas for more than twenty cars exist provide for removal of oils, grease and volatile wastes to the maximum practicable extent by the use of BMP's.
 - d. Assure that conveyance discharges into the Lake of the Ozarks will have a velocity of less than 5 fps.

This can be accomplished by the use of BMP's, infiltration, percolation, filtration devices, retainage and sedimentation collection basins, filtered curb inlets/manholes or other devices as approved by the City Engineer.

STORM DRAINAGE COMPUTATIONS

- A. The methodology used by the City of Osage Beach for computation of storm run-off shall be similar to that discussed in Chapter IX of the Missouri Department of Transportation (MoDOT) Project Development Manual and as modified herein.
- 1. The base storm event for computation of run-off volumes shall be a twenty-year (20) storm event.
 - 2. The Rational Method of computation shall be used as herein modified.

$$Q=CIA$$

Where:

- Q = Peak runoff in cubic feet per second (cfs)
- I = 2.5 inches per hour shall be used as the Rainfall Intensity.¹
- A = Area of watershed in acres. This area includes the actual area drained through or in addition to the developed area.
- C = An adjustment coefficient used to account for soil and terrain absorption as established herein.²

Design Guidelines
City of Osage Beach
SECTION 4 - STORM DRAINAGE

¹ Normally the Time of Concentration (t_s) would be computed and the value for "I" taken from the appropriate table dependant upon the MoDOT District involved. Due to the short travel distances for run-off on most of our projects that procedure would give an unrealistically high value. We have selected the 2.5 inches per hour as a valid value for our use.

²Osage Beach Values of C for use on City Projects:

<u>Type or Location of Project</u>	<u>Value of C</u>
Single family residential lots	0.4
Multi-unit Residential (less than 20 units)	0.5
Condominium Developments where parking areas and building foot print occupy less than 50% of the development site	0.6
Commercial or condominium sites where parking areas and building or developed space covers more than 50% of the developed area	0.7

DESIGN OF DRAINAGE STRUCTURES AND DEVICES

- A. Culverts and Storm Drainage Piping Systems shall be designed using the Manning equation for open channel flow. Inlet conditions should be investigated and openings designed to handle the peak runoff condition. In addition the following conditions shall be met:
1. The minimum pipe size shall be 18-inch diameter.
 2. Bedding shall be installed around the pipe from 4 inches below to 12 inches above the pipe. Bedding shall be nominal $\frac{1}{2}$ inch minus crushed rock conforming to MDOT Section 1004, Grade D, Chat, or pea-gravel, or Osage River Sand. Any material used shall have a PI of six or less.
 3. The minimum grade shall guarantee a minimum velocity of 2.0 fps.
 4. Manholes shall be constructed at not more than 350-foot intervals and at all bends and changes of grade.
 5. Pipe may be run on the curve so long as the manufacture's maximum deflection at each joint is not exceeded. All other pipe shall be run true to line and grade between manholes or inlets.
 6. Outlets shall have intrusion gates to prevent entry by children or animals.
 7. Outlets shall end in an energy-dissipating device that will reduce the outlet flow velocity to less than 5 fps.
 8. Piping shall be designed to sustain any anticipated loading conditions
- B. Curb Inlets of the "Kansas City Type" are preferred. See Drawing No. IV-11

Design Guidelines
City of Osage Beach
SECTION 4 - STORM DRAINAGE

1. The length of Curb Inlet opening shall be determined as in Chapter IX of the MoDOT Project Development Manual.
2. Floor of Inlet shall be shaped with invert to provide smooth flow.
3. Locate manhole ring and cover over outlet.
4. Each Inlet shall have cast iron steps spaced at 1'-4" centers vertically.
5. Bevel all exposed edges with $\frac{3}{4}$ " chamfer or $\frac{1}{2}$ " tooled edge.
6. On grade Inlets shall conform to the street grade and sump Inlets shall be level.
7. The length plus the width shall not exceed 15' without special design.
8. Each Inlet shall be placed on a 4" compacted aggregate base.
9. Each Inlet shall have a steel inlet frame.
10. Each Inlet shall be designed to sustain any anticipated loading conditions. In no case shall materials and design not be sufficient to support an ASHTO H-44-20 loading.
11. Transition curb in 10' on upstream side of inlet and in 5' on the downstream side. 10' transition on both sides for sump inlet. See detail.

OVERLAND FLOW OR SHEET FLOW CONTROL

- A. Reduce available sediment and debris (Land Form Controls)
 1. Insure that no areas are left denuded. Prepare seed bed, fertilize, mulch, and install erosion mat or fabric within 30 days of clearing operations.
 2. Provide vegetation belts of shrubbery, small trees, etc. to retard sheet flow.
 3. Provide erosion mat or fabric at all areas where erosion is apparent.
- B. Reduce quantity of overland or sheet flow by utilizing the following methods:
 1. Flow control swales to reduce down hill sheet flow velocities and promote short-term ponding and infiltration. See Drawing No. IV-3 & 9.
 2. Vegetation belts. Plant a band of shrubbery, flowers, and etc. transverse to the slope to reduce sheet flows. See Drawing No. IV-4 & 10.
 3. Infiltration trenches to infiltrate a portion of the sheet flow into the ground water. Infiltration rates should be tested for and volumes computed as a part of the overall Storm Water Management Plan. Design infiltration rate will generally be less than 1.0 gal/sf/hr and will tend to decrease over time. See Drawing No. IV-5.
- C. Velocity Control – reduce pick up of sediment and debris (Land Form and Site Grading)
 1. Grass Drainage Swales control direction and velocity of sheet or small rivulets flows by keeping flow velocities under 5 fps. See Drawing No. IV-6.

Design Guidelines
City of Osage Beach
SECTION 4 - STORM DRAINAGE

2. Riprap Drainage Swales control larger volumes of sheet flow and rivulets by keeping flow velocities under two fps. See Drawing No. IV-7.
3. Open Channel Drainage Channels shall be designed using the manning equation for open channel flow. The channel shape maybe trapezoidal, rectangular or circular at the designer's discretion.
 - a. The channel depth shall be designed so that the peak runoff flow will be accommodated at $2/3^{\text{rd}}$ of the channel depth.
 - b. Where channel depth will exceed one foot, a trapezoidal section with a maximum of 1:1 side slopes shall be used.
 - c. Where flow velocity will exceed 2 fps engineering fabric or erosion mat shall be utilized.
 - d. Where velocity will exceed 5 fps riprap shall be installed to eliminate scouring. See Drawing No. IV-7.

D. Silt, Sediment, and Debris Control – Filtering Systems

1. In order to avoid the use of sedimentation basins or retention ponds it shall be required that appropriate filtration methods are used in order to assure that silt, sediment, and debris do not get into the conveyed storm drainage flow. The above measures will control sediment for sheet or cross-country flows. However, construction parking areas and other manmade surfaces will require the collection and isolation of silts, sediments, debris, oils, and volatile materials. One method of accomplishing this is by construction filtering systems. There are several commercial products available to accomplish this goal. Grasspave, Gravelpave, and Grasscrete are patented soil stabilization products that are designed to serve as a paving or traffic-bearing surface. Approved filtering systems are as follows:
 - a. Constructed Filter Strip. In large parking areas, or relatively flat open areas, a cut-off curb can be constructed with a filtration strip of variable width constructed in front of it. Such strip would have a traffic bearing infiltratable surface such as Gravelpave underlain by a clean open graded gravel medium around a perforated collection pipe laid to grade to drain to a central or periphery drainage system. The medium would be enclosed in an engineering fabric envelope. Design infiltration rates would vary with materials and should be designed in accordance with the manufacture of the traffic bearing media recommendation. Flow in the neighborhood of 0.25 gpm can be anticipated. It will be necessary to remove the accumulated sediment and debris and very top portion of the gravel or replace the grass layer as appropriate in order to maintain adequate infiltration. The required maintenance interval will depend upon the rate of collection of sediment. See Drawing No. IV-8.

Design Guidelines
City of Osage Beach
SECTION 4 - STORM DRAINAGE

- b. Porous Pavement. The use of porous pavements for large parking areas is a viable alternative method of providing filtered run-off from the parking areas. Cross country run-off should be diverted from the paved area and treated separately in order to avoid rapid plugging and increased maintenance costs. In the general application in Osage Beach the preferred methodology would be to drain the porous pavement to a clean aggregate percolation bed that drained to collection piping manifolded into the overall storm drainage system and discharged to the Lake or other approved surface system. In isolated cases it may be preferable to discharge to the ground water table with a surface overflow for over design storm peak flows. Each porous pavement application must be approved by the City Engineer prior to use.

2. Fabricated Filtration Manholes or Curb Inlets

- a. Several patented filtration devices are now available that can effectively reduce sediment discharges such as:
 - 1) Treatment systems such as Stormceptor
 - 2) Catch Basin or Curb Inlet inserts such as Flowgard Plus manufactured by Hancor, Inc. or Hydro-Kleen manufactured by ACF Environmental.
 - 3) Surface drainage systems such as Drain-rite manufactured by Hancor Inc.
 - 4) Or several non-patented devices by various highway departments, etc.

RETENTION FACILITIES

- A. In the event that the developer prefers to construct a retention facility the following shall be complied with:
 - 1. The maximum allowable flow velocity through the basin shall be 0.3 fps.
 - 2. The inlet should be designed to prevent short-circuiting between entrance and discharge to the maximum extent practicable. This can be accomplished by providing baffles in the channel, turns in the channel, etc.
 - 3. The shape of the storage basin should allow for easy cleanout of sediment and debris. Terrain and other site conditions will tend to dictate the shape of the facility. Deep, steep sided ponds should be avoided or covered for safety of children and animals.
 - 4. Outlet or Discharge Facility shall allow the slow discharge of retained flow over time so that a stagnant pool is not created.

Design Guidelines
City of Osage Beach
SECTION 4 - STORM DRAINAGE

The details of the design are at the discretion of the designer subject to approval of the City Engineer.

CONSTRUCTION MATERIALS

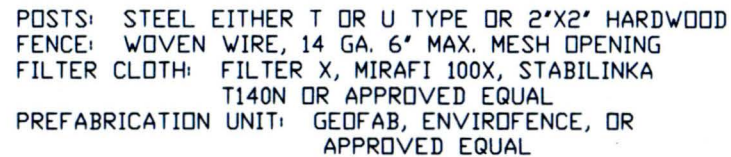
- A. Drainage ditches maybe stabilized earth, riprap, concrete, or other durable material.
- B. Retention basin inlets, basin, and outlet structures maybe of any durable material subject to the approval of the City Engineer.
- C. Storm drainage pipe and culvert pipe may be concrete, Corrugated Metal Pipe (CMP), or reinforced plastic subject to approval.
 - 1. All pipes at a minimum must be capable of sustaining an ASHTO - H 44-20 loading.
 - 2. The use of reinforced plastic pipe for storm drainage at drop inlets or in areas where leaf burning is allowed is prohibited.
- D. Curb Inlets
 - 1. Shall be prefabricated or cast-in-place.
 - a. Shall be place on a 4" compacted aggregate base.
 - b. Reinforcement in footing shall be #4 bars on 6" centers both ways.
 - c. Reinforcement in walls shall be #4 bars on 12" centers both ways.
 - d. Reinforcement in lid shall be a minimum of six #4 bars placed at 45 degree angle. See detail.
 - 2. Shall have a 10" throat galvanized steel inlet frame.
 - 3. Cast iron manhole ring and cover, Neenah R-1537 or approved equal.
 - 4. Cast iron step, Clay & Bailey No. 2101 or approved equal.

STORM DRAINAGE CONSTRUCTION DETAIL DRAWINGS

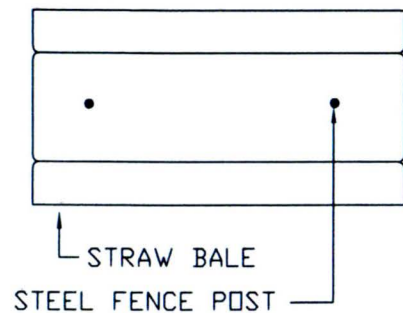
Construction details and sketches are attached.

END

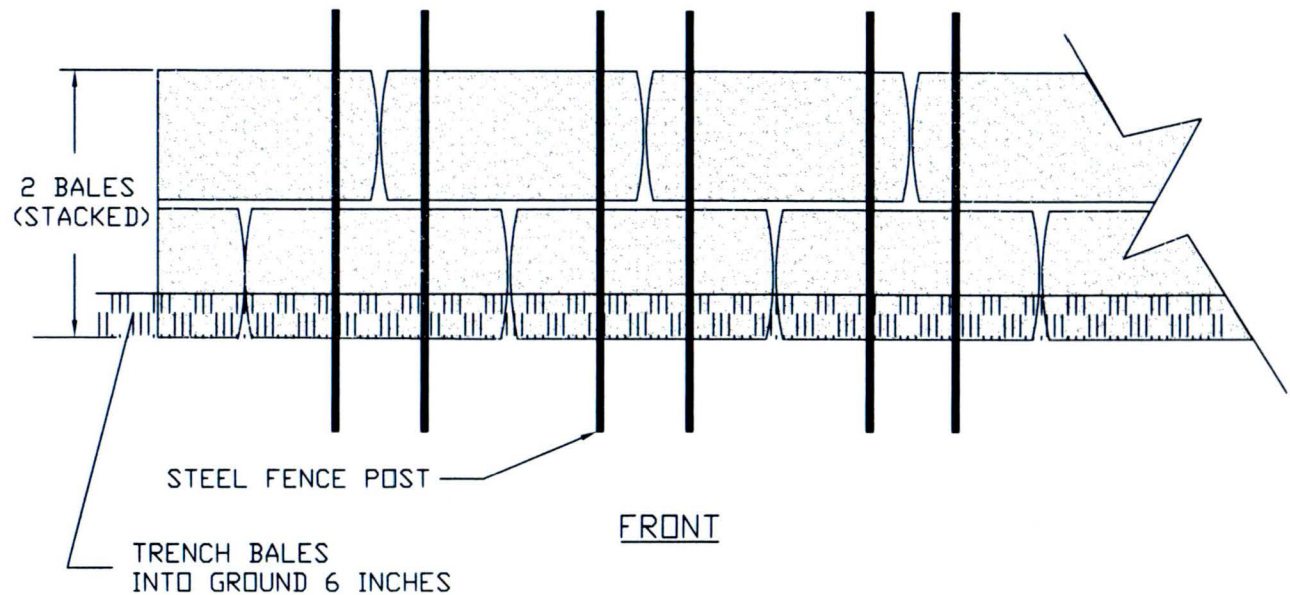
1. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES.
2. FILTER CLOTH TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID SECTION.
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER, THEY SHALL BE OVERLAPPED BY 6" AND FOLDED.
4. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.



Date Revised: July, 2002	CITY OF OSAGE BEACH TYPICAL DETAIL SILT FENCE	Design Guideline: Section 4
By: sh		STORM DRAINAGE
Checked By: jb		Drawing No. IV-1



PLAN

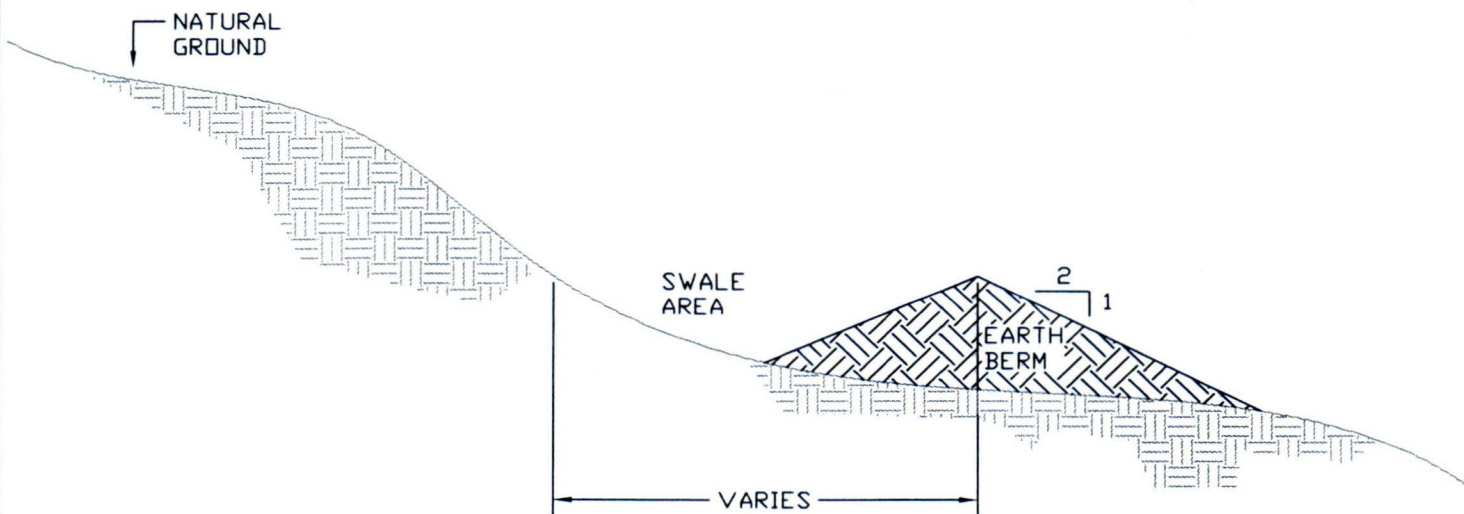
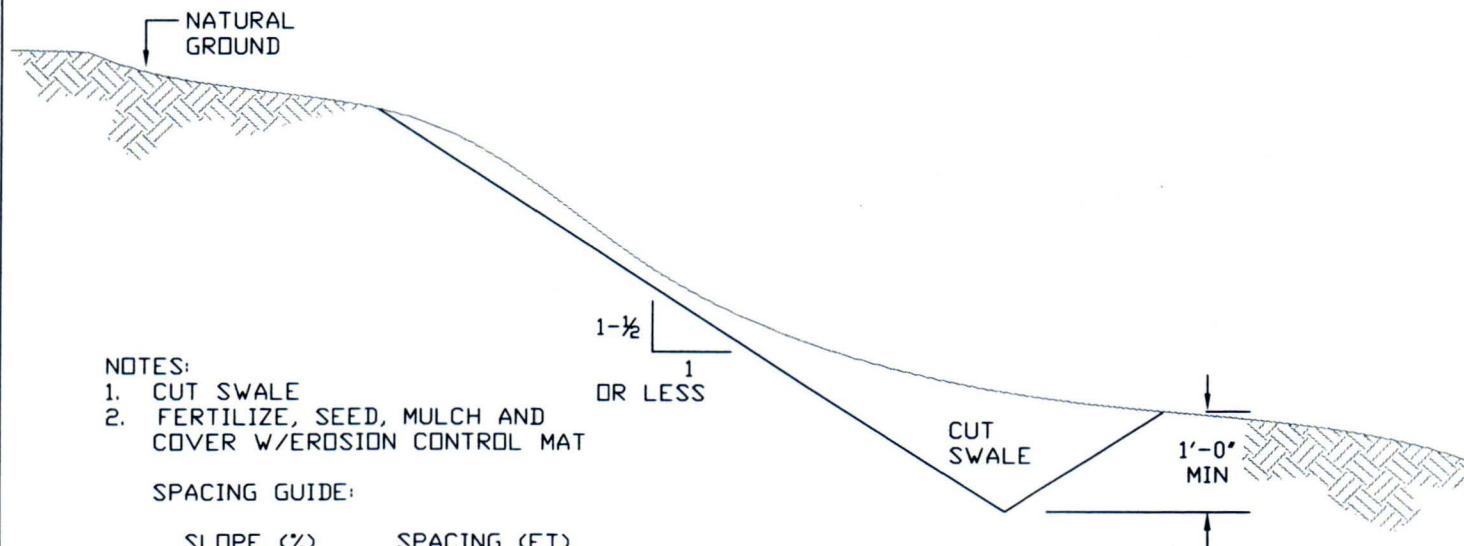


FRONT

Date Revised:	July, 2002
By:	sh
Checked By:	jb

CITY OF OSAGE BEACH
TYPICAL DETAIL
STRAW BALE CHECK FENCE

Design Guideline:	Section 4
	STORM DRAINAGE
Drawing No.	IV-2



Revised:
March, 2003

By: sh

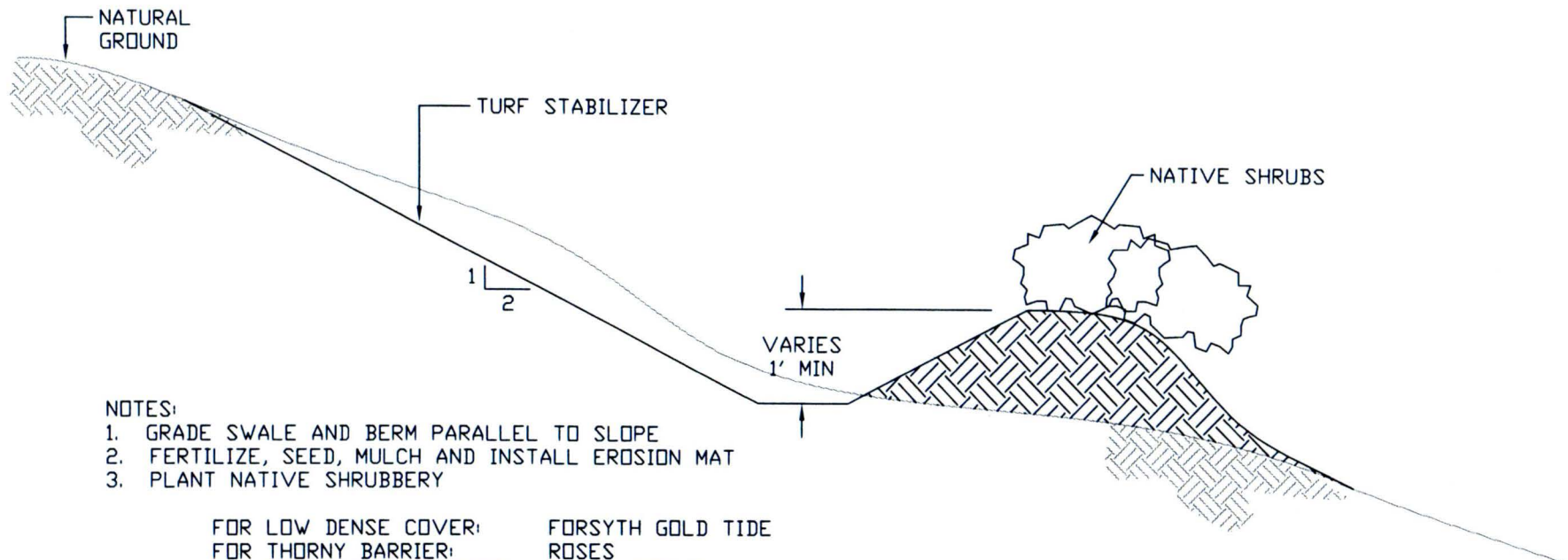
Checked By: jk

CITY OF OSAGE BEACH
TYPICAL DETAIL
SWALE

Design Guideline:
SECTION 4

STORM DRAINAGE

Drawing No:
IV-3



<u>SLOPE (%)</u>	<u>GRASS AREA</u>	<u>SHRUBS/TREES</u>
0-5	10'	15'
OVER 5	20'	40'

Date Revised:
March, 2003

By:
sh

Checked By:
jb

CITY OF OSAGE BEACH
TYPICAL DETAIL
VEGETATION BARRIER & SWALE

Design Guideline:
SECTION 4

STORM DRAINAGE

Drawing No:
IV-4

CLEAN 3/4"
MINUS AGGREGATE

NOTES:

1. FIELD TEST TO DETERMINE
INFILTRATION RATE
± 1 GAL/SF/MIN
2. DO NOT USE ABOVE RETAINING
WALLS, BASEMENTS OR OTHER
GROUND WATER SENSITIVE
LOCATIONS

12"
MIN.

4'-0"

Revised:
March, 2003

By:
sh

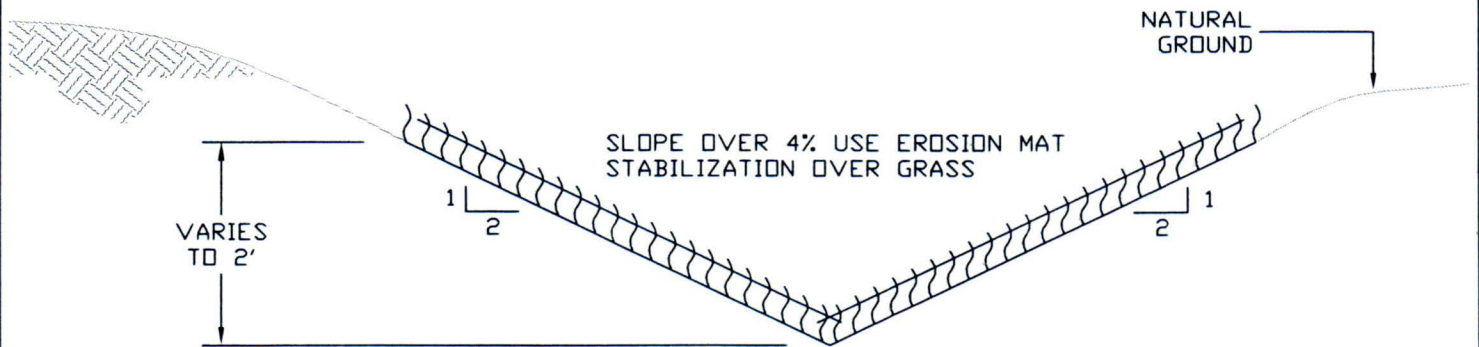
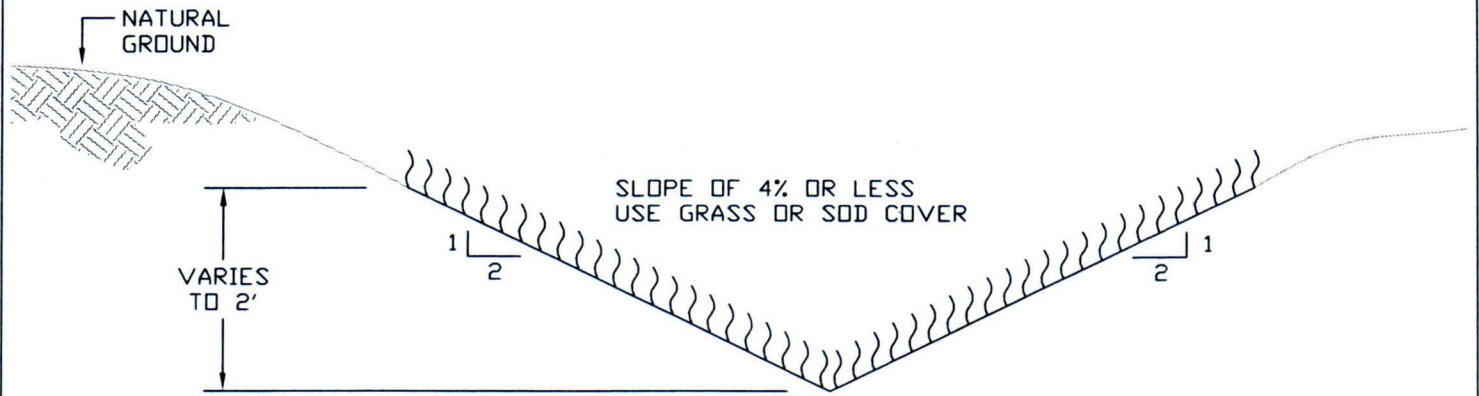
Checked By:
jb

CITY OF OSAGE BEACH
TYPICAL DETAIL
INFILTRATION TRENCH

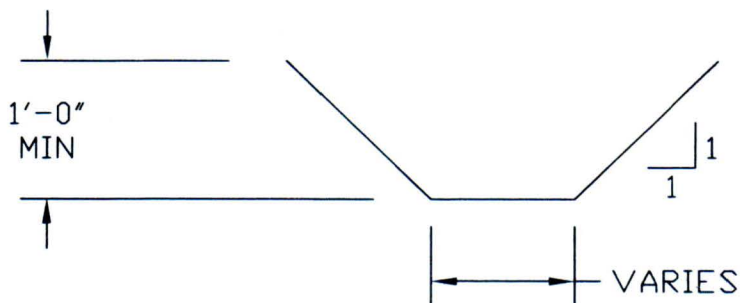
Design Guideline:
SECTION 4

STORM DRAINAGE

Drawing No:
IV-5



Date Revised: March, 2003	CITY OF OSAGE BEACH TYPICAL DETAIL DRAINAGE SWALE-GRASS OR TURF	Design Guideline: SECTION 4
By: sh		STORM DRAINAGE
Checked By: jk		Drawing No: IV-6



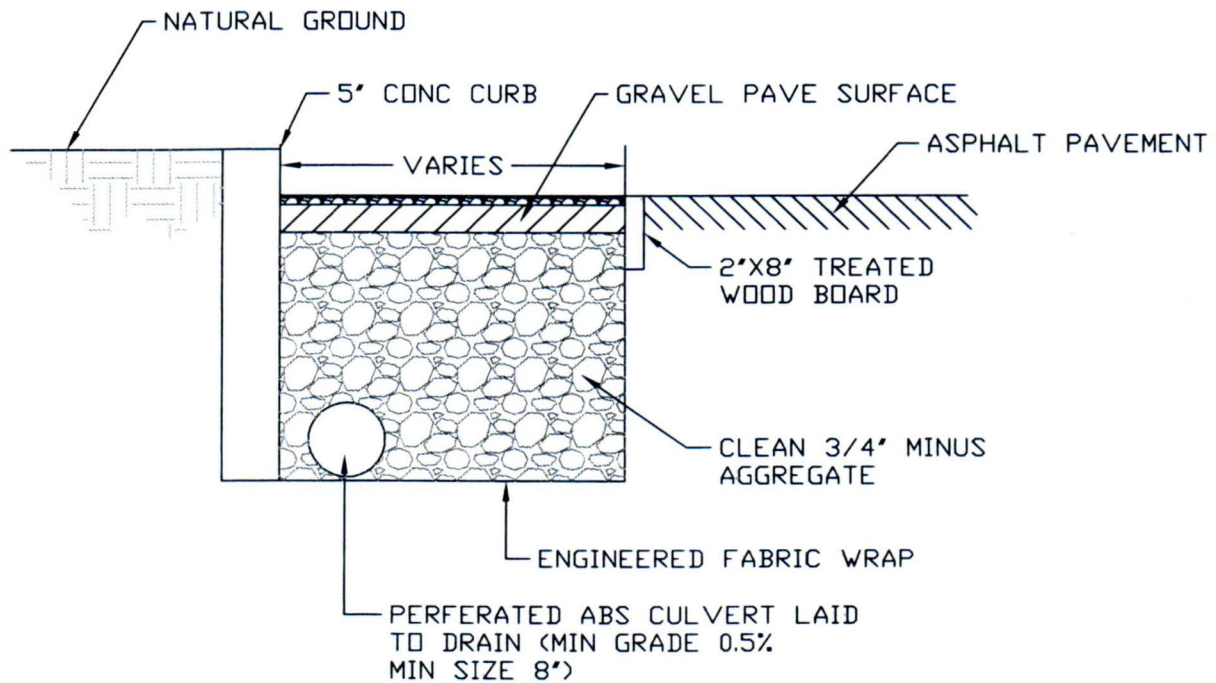
NOTES:

1. VELOCITY LESS THAN 2 FPS-GRASS OR TURF
2. VELOCITY 2-5 FPS-TURF AND EROSION MAT
3. VELOCITY OVER 5 FPS-RIP RAP MIN SIZE 3" SMALLEST DIMENSION.

Revised:	March, 2003
By:	sh
Checked By:	jb

CITY OF OSAGE BEACH
TYPICAL DETAIL
OPEN DRAINAGE CHANNEL

Design Guideline:	SECTION 4
	STORM DRAINAGE
Drawing No:	IV-7



NOTES:

1. WIDTH VARIES DEPENDENT UPON DRAINAGE AREA (PER MANUFACTURES RECOMENDATIONS-0.25 GPM/SF TARGET VALUE)
2. DIAMETER OF DRAIN DPENDS ON FLOW
3. DEPTH DEPENDS ON SIZE OF DRAIN-MIN 16"

Revised:
March, 2003

By:
sh

Checked By:
jb

CITY OF OSAGE BEACH
TYPICAL DETAIL
FILTER STRIP

Design Guideline:
SECTION 4

STORM DRAINAGE

Drawing No:
IV-8

SPACING GUIDE:

SLOPE (%)	SPACING (FT)
33-50	20
25-33	40
15-25	60
10-15	80
6-10	120
3-6	200

TYPICAL FLOW CONTROL
SWALE LOCATIONS

MAJOR CONTOUR

MINOR CONTOUR

Revised:

March, 2003

By:

sh

Checked By:

jlb

CITY OF OSAGE BEACH
TYPICAL DETAIL
SWALE LOCATION

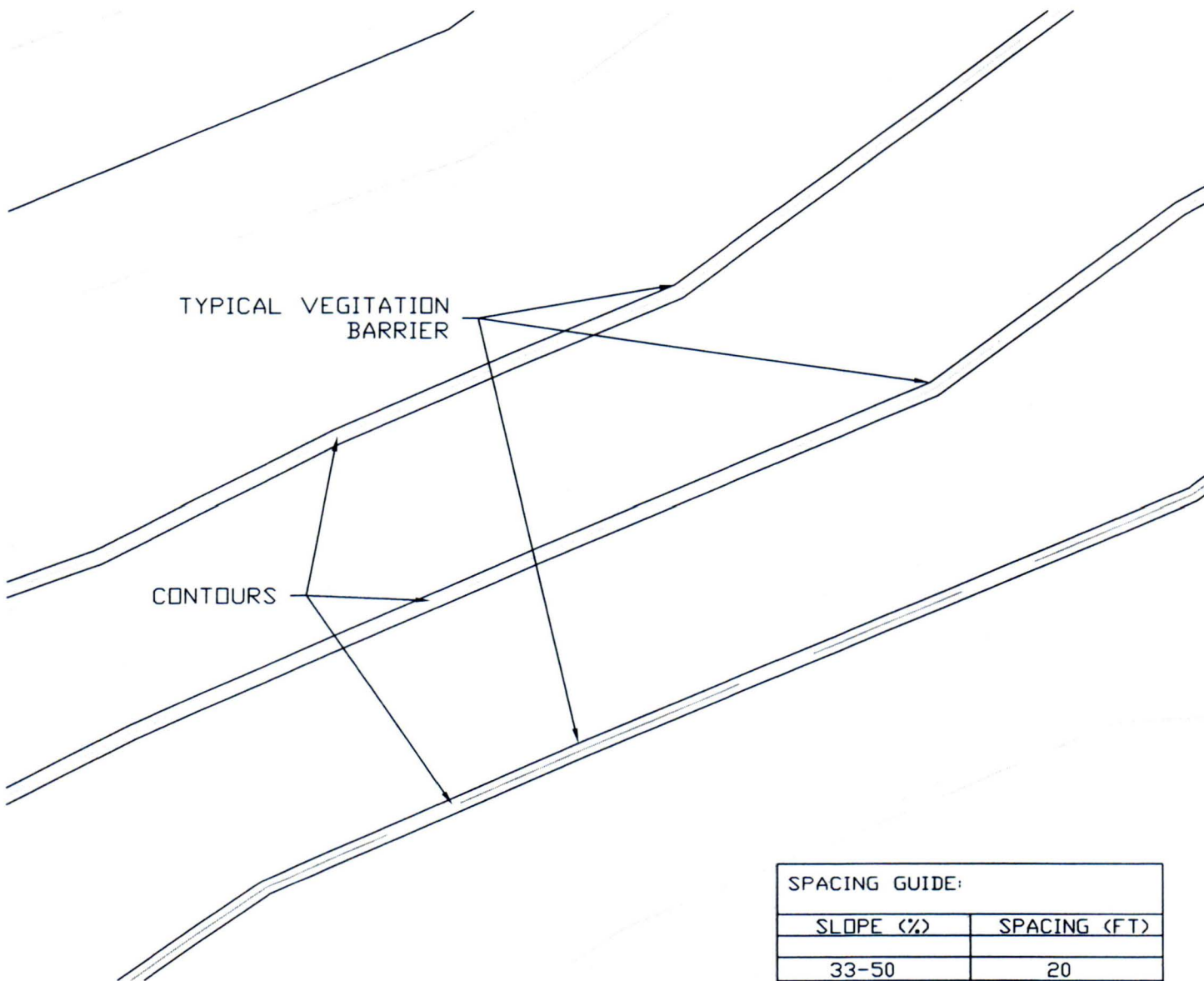
Design Guideline:

SECTION 4

STORM DRAINAGE

Drawing No:

IV-9

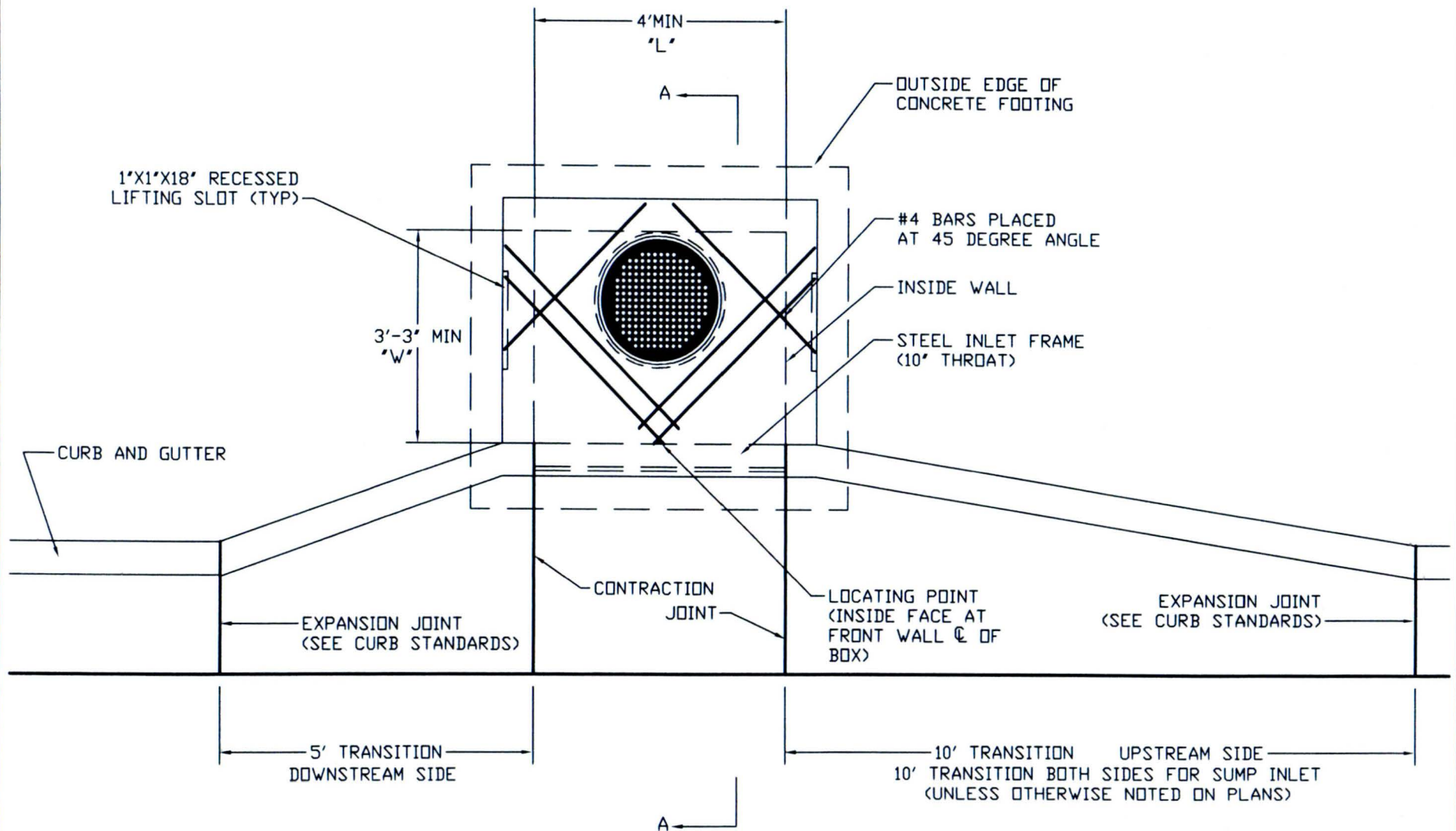


SPACING GUIDE:	
SLOPE (%)	SPACING (FT)
33-50	20
25-33	40
15-25	60
10-15	80
6-10	120
3-6	200

Revised:	March, 2003
By:	sh
Checked By:	jb

CITY OF OSAGE BEACH
TYPICAL DETAIL
VEGETATION BARRIER LOCATION

Design Guideline:	SECTION 4
	STORM DRAINAGE
Drawing No:	IV-10



Date Revised:
OCT., 2004

By:
sh

Checked By:
jb

CITY OF OSAGE BEACH
TYPICAL DETAIL
CURB INLET

Design Guideline:
SECTION 4

STORM DRAINAGE

Drawing No:
IV-11



POSITIONING

RING AND COVER
NEENAH #R-1737
OR EQUAL

5'

6'

#4 BARS @ 10' CTRS.
E.W. - TYP. ALL WALL
REINFORCING

CAST IN PLACE CONST.
VERT. #4 BARS X 1'-6"
@ 24' CTRS-ALL WALLS

#4 BARS X 4'-9"
@ 11' CTRS. E.W.
TYP SLAB REINF.

3' CAST
IN PLACE

PRECAST
CONST.
6'

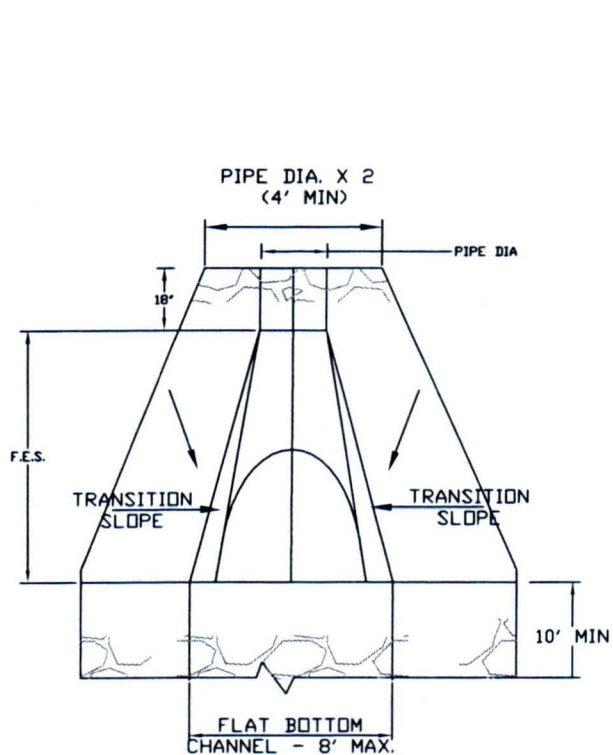
CAST IN
PLACE
9'

6' 6' WALL 6' WALL 6'

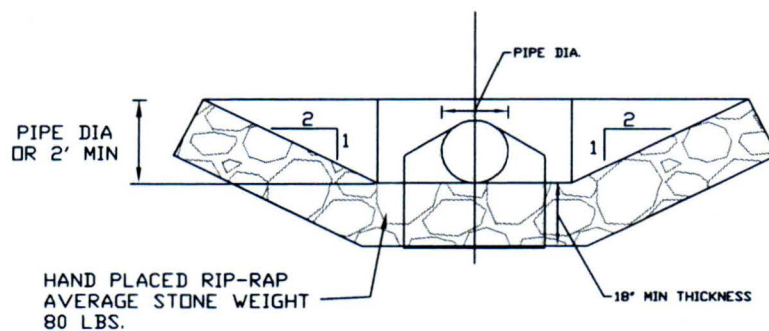
5' SQUARE

SECTION A-A

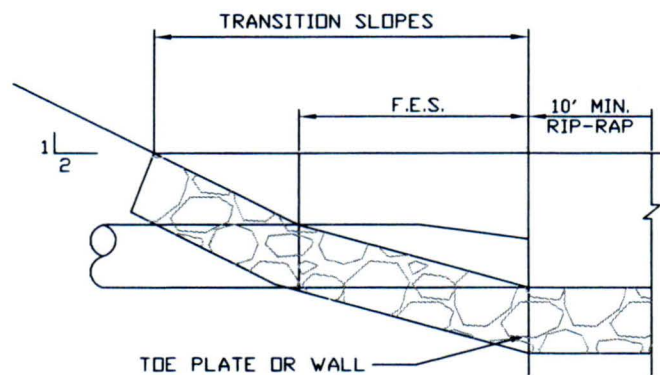
Page 143 of 231



PLAN



END



SECTION

Revised:
March, 2003

By:
sh

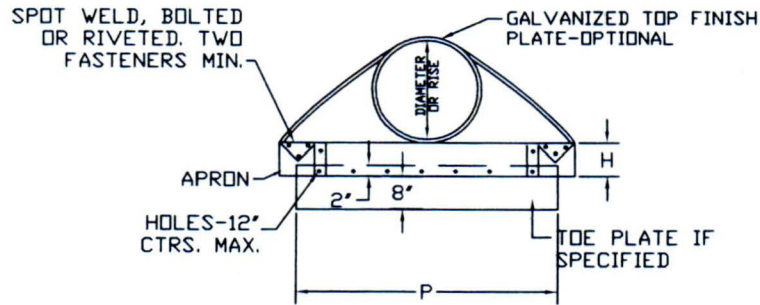
Checked By:
jb

CITY OF OSAGE BEACH
TYPICAL DETAIL
FLARED END SECTION W/RIP RAP

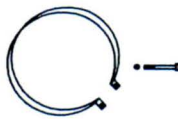
Design Guideline:
SECTION 4

STORM DRAINAGE

Drawing No:
IV-14

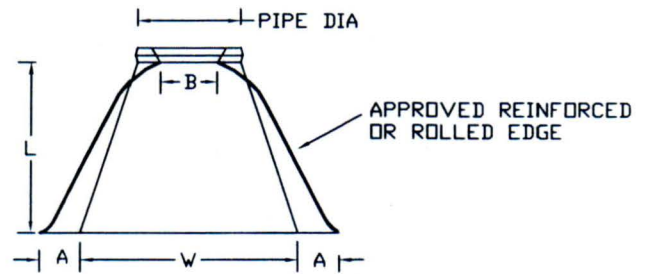


ELEVATION

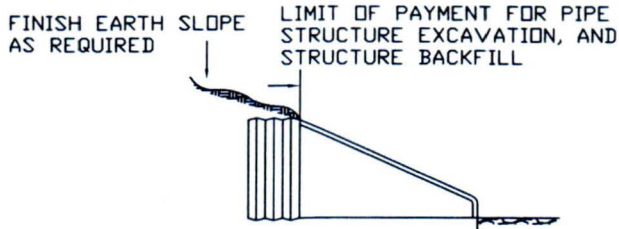


1 INCH WIDE 0.109" THICK CONNECTOR STRAP OF COMMERCIAL QUALITY STEEL. GALVANIZED WITH SAME WEIGHT COATING AS PIPE, AND 6" X 1/2" GALVANIZED BAND BOLT AND NUT. USE AS ALTERNATE ON CONNECTION.

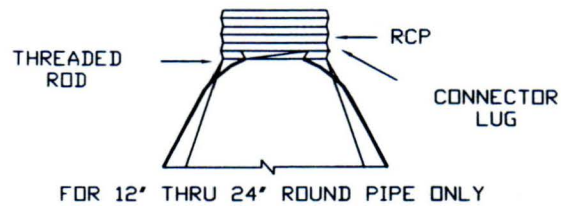
CONNECTOR STRAP



PLAN



TYPICAL CROSS-SECTION



CONNECTION

END SECTION FOR ROUND PIPE								
PIPE DIA. (IN)	GALV. SHEET THICK (IN)	DIMENSIONS (IN)					APPROXIMATE SLOPE (V:H) (1:SLOPE)	TOE PLATE IF SPECIFIED P (IN)
		A 1" TOL.	B MAX.	H 1" TOL.	L 1-1/2" TOL.	W 2" TOL.		
18	0.064	8	10	6	31	36	2-1/2	46
21	0.064	9	12	6	36	42	2-1/2	52
24	0.064	10	13	6	41	48	2-1/2	58

CITY OF OSAGE BEACH
TYPICAL DETAIL
CMP FLARED END SECTION

Design Guideline:
SECTION 4

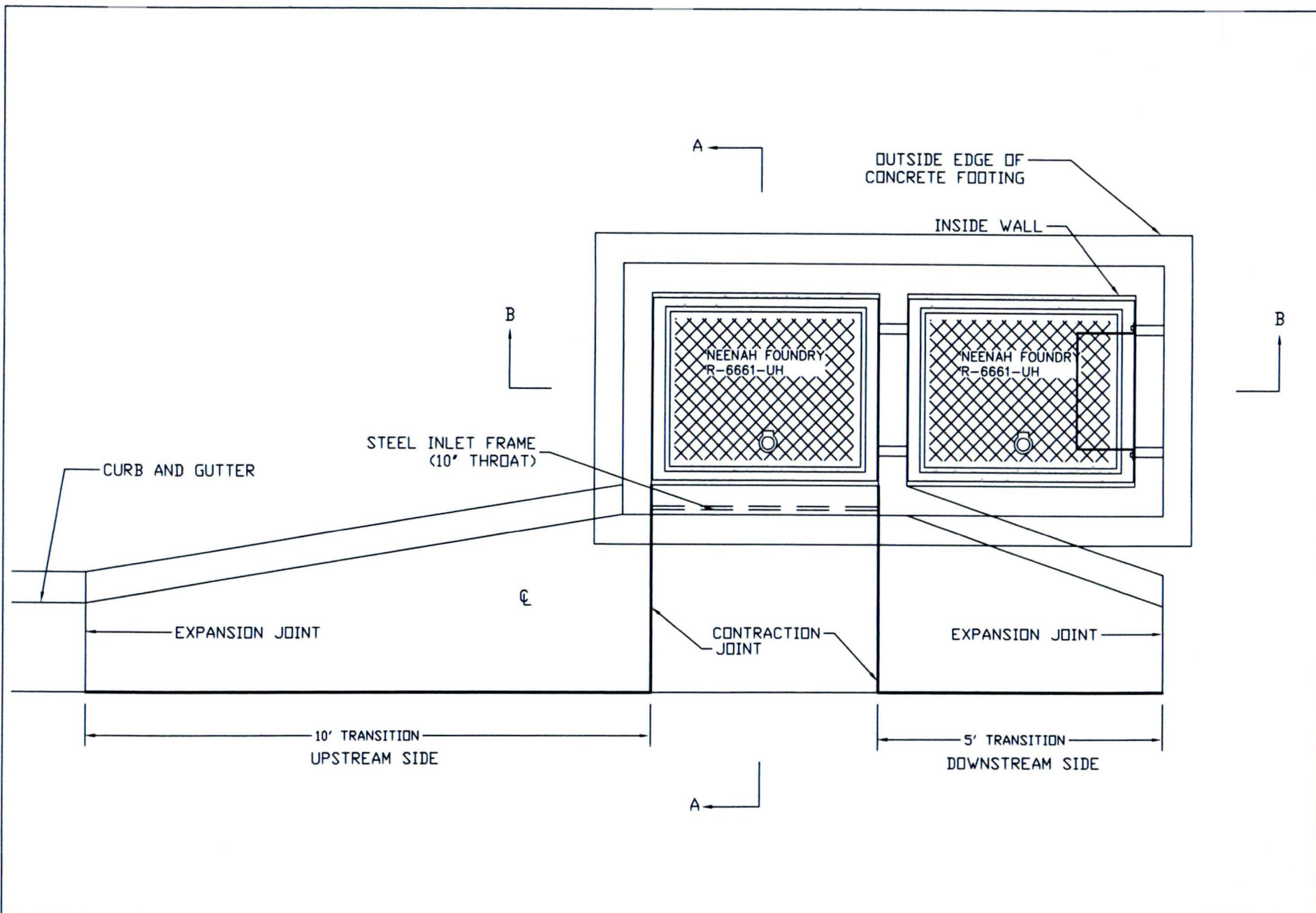
STORM DRAINAGE

Drawing No:
IV-15

Revised:
October 2004

By: sh

Checked By: jk



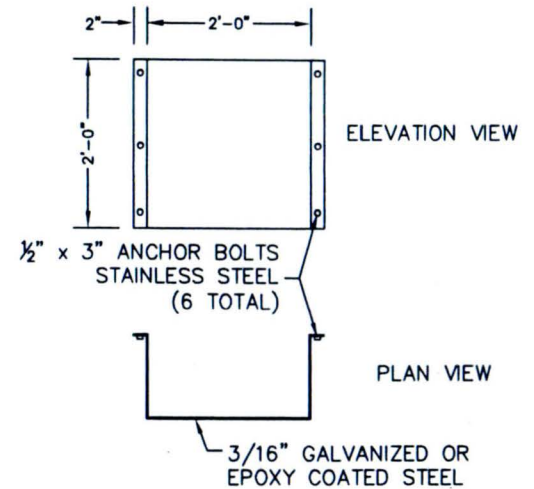
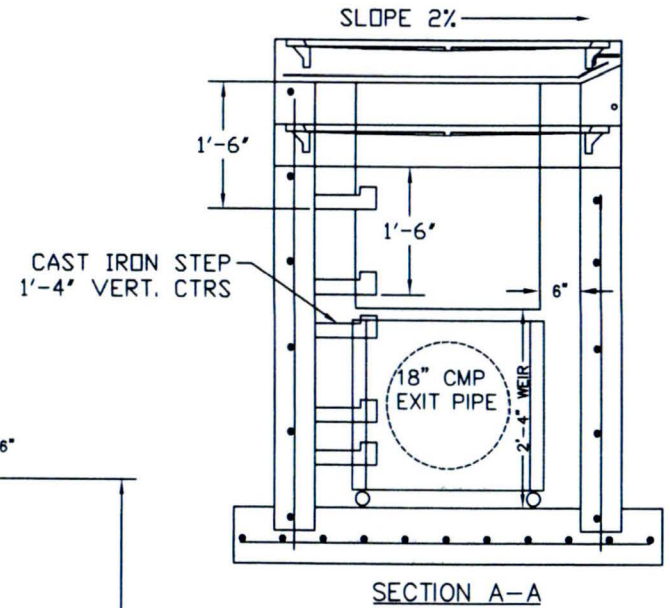
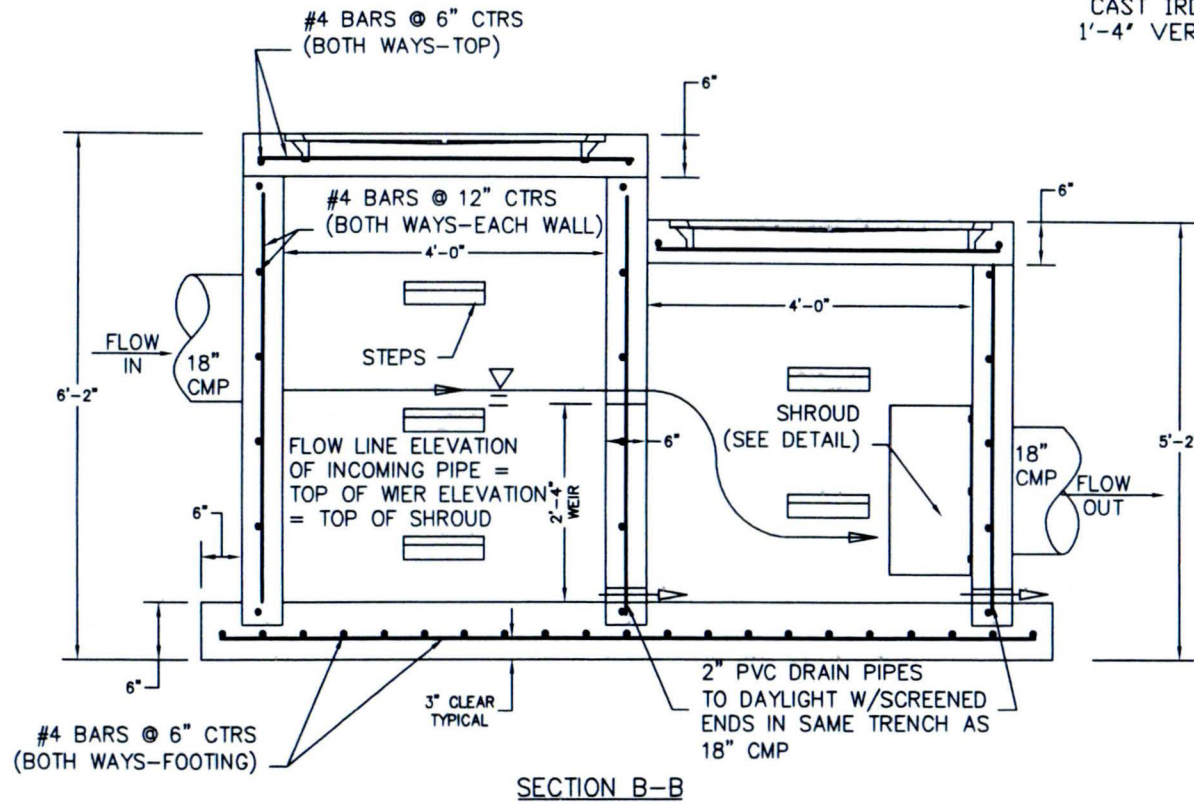
Date Revised:	OCTOBER 2004
By:	sh
Checked By:	jb

CITY OF OSAGE BEACH
TYPICAL DETAIL
DISSIPATION BOX

Design Guideline:	SECTION 4
	STORM DRAINAGE
Drawing No:	IV-16

NOTE:

1. BEVEL ALL EXPOSED EDGES WITH $\frac{3}{4}$ " CHAMFER OR $\frac{1}{2}$ " TOOLED EDGE.



SHROUD DETAIL

Date Revised:
OCTOBER 2004

By:
sh

Checked By:
jb

CITY OF OSAGE BEACH
TYPICAL DETAIL
DISSIPATION BOX

Design Guideline:
SECTION 4

STORM DRAINAGE

Drawing No:
IV-17

Design Guidelines
City of Osage Beach
SECTION 4 - STORM DRAINAGE

(Revised October 2023)

OVERVIEW

Storm runoff accumulates pollutants, sediment, and debris as it flows over the landscape until it reaches a receiving waterway - the Lake of the Ozarks. These pollutants, sediments, and debris include oils and petroleum residues, animal refuse, garbage, organic debris from vegetation, silts, sands, and other objectionable materials. The U.S. Environmental Protection Agency (EPA) and the Missouri Department of Natural Resources, Water Pollution Control Division, considers these pollutants to have adverse effects upon the human and aquatic life that uses the lake for habitat or recreational needs. The water quality of the Lake of the Ozarks is vital to the health and economic well being of our residents, visitors, and community.

Storm drainage within the City of Osage Beach falls under regulatory authority of the U.S. Environmental Protection Agency (EPA) and the Missouri Department of Natural Resources (MDNR). The provisions of the U.S. Clean Water Act of 1978, Section 402 mandates the National Pollutant Discharge Elimination System (NPDES) and requires permitting for specific types of non-point pollutant sources under Phase II (Final Rule dated December, 1999) for areas where more than one acre of natural ground cover is disturbed. In addition, it mandates other control measures for designated cities, industries, and locations. The City of Osage Beach is not currently designated as a small city with a separate storm water system (MS4) or required to have a NPDES Permit. Several of the Phase II requirements do apply to the City. It is the policy of the City to reduce the contamination of the Lake of the Ozarks to comply with NPDES Phase II to the extent practicable for the city

The City of Osage Beach complies with these requirements through City Code, Title IV Land Use, Section ~~410.350 thru 410.380 410.340, 410.350, 410.360, and 410.370~~ and the applicable portions of the Osage Beach Design Guidelines.

GOALS AND OBJECTIVES

The goal and objective of the City of Osage Beach's Storm Water Management Plan is to manage storm water drainage within the city limits so as to minimize the pollution of the Lake of the Ozarks and to prevent storm water run-off damage to the maximum extent practicable.

The primary source of visible pollutants during storm runoff is through sediment and debris picked up on construction sites or locations where the natural vegetation has been removed. The major secondary source is through volatile fuels, oils, animal wastes, and refuse picked up by storm runoff as it flows off large parking areas, roofs and over the terrain in route to the lake. These sources of contamination will be addressed separately through the application of a Sediment Control Plan and/or a Storm Drainage Plan.

Design Guidelines
City of Osage Beach
SECTION 4 - STORM DRAINAGE

Recent developments in the Storm Drainage Compliance area have lead to the development of “Best Management Practices” (BMP’s) and less emphasis on retention facilities. Also the trend is toward reduction of contamination by: 1) reducing the quantity of storm water runoff, 2) reducing or removing the contamination of the runoff, and 3) by conveying the storm run-off without further contamination.

Our goal is to reduce the pollution of the lake through public education, awareness, and the application of MoDNR Best Management Practices (BMP’s). Our immediate objective is to manage the storm drainage system to reduce collectable sediment or pollutants entering the lake and/or causing damage to adjacent or downstream properties.

The following design guidelines will establish the minimum steps or procedures required to reach these goals and objectives.

EROSION & SEDIMENT CONTROL PLAN

- A. The Erosion and Sediment Control Plan shall be submitted as a part of the building permit process and shall be reviewed and approved by the City Engineer prior to the start of any onsite work for any and all projects involving two or more lots or ½ acre, whichever shall be the smaller.

Note: The MoDNR requires a Land Disturbance Permit for construction disturbance activities of one or more acres. Permitting with MoDNR is the responsibility of the property owner or their representative.

1. The Sediment Control Plan must be prepared by a Registered Professional Engineer in the State of Missouri stating the goals of the plan and depicting the locations and details of the construction of all sediment control devices to be utilized on the project during construction.
2. The plan shall clearly set out the contractor’s schedule and requirements for maintaining the integrity of the plan.
3. The primary goal of the plan is to assure that no visible or measurable sediment or debris is allowed to leave the developed area.
4. The devices and measures utilized shall follow the recommended “Best Management Practices” as described in the publication “Protecting Water Quality” by MDNR and as directed herein. At the minimum the following shall be required:
 - a. Wire backed silt fencing with steel tee-posts **or an approved equal method** shall be installed around the downhill edges of the disturbed area.
 - b. Earth berms and swales shall be used to reduce sheet flow volumes and velocities.
 - c. Straw bale check dams, earth berms and other BMP’s shall be utilized as necessary to prevent run-off from carrying sediment and debris off site.
 - d. Check dams or other BMP’s shall be used to reduce velocities in areas of concentrated flow.

Design Guidelines
City of Osage Beach
SECTION 4 - STORM DRAINAGE

- e. Approved engineering fabric or erosion control matting shall be used in all drainage courses or ditches where flow velocities exceed 5 fps. Velocities shall be calculated and included with permit submittal.
 - f. All denuded slopes or embankments shall be protected from erosion by the installation of earthen berms, straw bale dikes, or other appropriate BMP's.
 - g. Temporary catch basins, drop inlets and/or storm drains (culverts) shall be utilized as necessary to convey concentrated flow and prevent erosion.
 - h. Temporary sediment basins shall be provided for each drainage area with one or more acres disturbed at one time. Basins shall be maintained until final stabilization is achieved as approved by the City Engineer. Each sediment basin shall be sized, at a minimum, to provide a total storage volume of 4,000 cubic feet per acre of contributing area. The sediment basin shall include an outlet structure designed for the slow release of stored runoff to allow for sedimentation in the basin. A perforated riser wrapped in filter fabric and covered with a mound of clean 2-inch stone is the City's preferred outlet structure.
 - i. Depict existing and proposed contours.
 - j. Clearly depict the entire drainage area effecting the development site including downstream areas that will be affected by storm water run-off or drainage and upstream areas that contribute to the site.
 - k. The installation of all BMP's shall be inspected and approved by the City Engineer and the Engineer of Record prior to commencing land disturbance activities. The Engineer of Record shall provide a letter to the City stating he or she approves the installation of the BMP's. Phased projects may require multiple approvals.
 - l. Where soil disturbing activities on site have ceased either temporarily or permanently and will not resume for a period of 14 calendar days, stabilization shall be initiated immediately and completed within 14 calendar days. All denuded slopes or areas shall be reseeded with appropriate seed, fertilizer, and for final stabilization, approved slope stabilization fabric or stone armoring shall be installed on all slopes steeper than 3:1.
 - m. Phased clearing and grading of sites is encouraged to minimize denuded areas and potential for erosion.
5. In the event that the plan is deficient or inadequate to prevent sediment escaping the jobsite, the Owner/Developer shall immediately take any and all measures necessary to stop and prevent further contamination, and to clean up contaminated areas.

Design Guidelines
City of Osage Beach
SECTION 4 - STORM DRAINAGE

All calculation necessary for the Erosion and Sediment Control Plan shall be signed and sealed by an Engineer licensed in the State of Missouri and submitted with the permit application for review by the City Engineer. Calculations shall be prepared in a report format.

The City's Standard Erosion and Sediment Control Plan Note Block shall be included on the Plans prior to approval.

STORM DRAINAGE PLAN

- A. A Storm Drainage Plan is required for all new construction sites within the jurisdictional boundaries of the City of Osage Beach in which the construction or clearing for construction disturbs an area exceeding two lots or one half acre, whichever shall be the smaller.
1. The Storm Drainage Plan shall be prepared by a Registered Professional Engineer in the state of Missouri stating the goals of the plan and depicting the locations and details of construction of all permanent sediment and drainage control devices, and post construction BMP's, to be utilized in the plan. The Storm Drainage Plan shall depict permanent drainage structures and post-construction BMP's.
 2. The plan shall clearly state owners schedule and requirements for maintaining the components of the system.
 3. The devices and measures utilized shall follow the recommended "Best Management Practices" as described in the publication "Protecting Water Quality" by and available through MDNR, the City of Osage Beach City Code and the City of Osage Beach Design Guidelines
 4. At the minimum the Storm Drainage Plan shall provide the following technical data:
 - a. Clearly depict all permanent drainage structures, conveyance devices, and post construction BMP's.
 - b. Clearly depict the entire drainage area effecting the development site including downstream areas that will be affected by storm water run-off or drainage and upstream areas that contribute to the site.
 - c. Accurately calculate the anticipated storm run-off from a theoretical twenty-five (25) year storm event. Storm duration shall be calculated to correspond to the time of concentration for the tributary drainage area.
 - d. Determine the anticipated flows and capacities of all channels, culverts and conveyance devices. Conveyance structures shall be designed utilizing the criteria in A.4.c of this Section.
 - e. Clearly identify and provide flow data for all velocity control and/or energy dissipation devices.

Design Guidelines
City of Osage Beach
SECTION 4 - STORM DRAINAGE

5. At the minimum the Storm Drainage Plan shall provide the following post construction sediment and drainage controls:
- a. Provide removal or containment of all silt, sediment, and debris carried onto or across the development so as to assure that no silt, sediment, or debris is allowed off the developed area. See Post Construction Water Quality.
 - b. Assure that all storm run-off is controlled such that no damage will occur to adjacent downstream properties or facilities. Stormwater detention requirements are as follows:
 - 1. The rates (pre-developed and post-developed) of runoff shall be determined for the 2-year, 25-year and 100-year rainfall frequencies. The storm duration shall be calculated to correspond to the time of concentration of the tributary area. Minimum storm duration shall be 20 minutes.
 - 2. Storm water shall be detained on site or on adjacent property under agreement and released at the rate of an undeveloped site for the above frequencies and minimum duration to prevent possible flooding and erosion downstream.
 - 3. In the event the natural downstream channel or storm sewer system is inadequate to accommodate the release rate provided above, then the allowable release rate shall be reduced to that rate permitted by the capacity of the downstream channel or storm sewer system.
 - 4. Detention basin volume and outlet structure will be based on routing each post-developed runoff through the detention facility while not exceeding the pre-developed run-off. The routing computation shall be based on an application of the continuity principle. The discharge rate shall be based on the maximum head conditions in the detention facility.
 - 5. Project site discharging via right-of-way, easement, or land owned by developer to the Lake of the Ozarks shall be exempt from stormwater detention requirements.
 - 6. Project sites with a differential runoff of less than 2 cfs for the 25-year event shall be exempt from stormwater detention requirements.
 - 7. All calculations necessary for stormwater detention design shall be signed and sealed by an Engineer licensed in the State of Missouri and submitted with the permit application for review by the City Engineer. Calculations shall be prepared in report format.
 - c. Where parking areas for more than twenty cars exist provide for removal of oils, grease and volatile wastes to the maximum practicable extent by the use of post construction BMP's.

Design Guidelines
City of Osage Beach
SECTION 4 - STORM DRAINAGE

- d. Assure that conveyance discharges into the Lake of the Ozarks will have a velocity of less than 5 fps.

This can be accomplished by the use of BMP's, filtration devices, retainage and sedimentation collection basins, filtered curb inlets/manholes or other devices as approved by the City Engineer.

STORM DRAINAGE COMPUTATIONS

- A. The Rational Method shall be used for computation of stormwater run-off.
1. The base storm event for computation of run-off volumes shall be a twenty five-year (25) storm event.
 2. The Rational Method of computation shall be used as herein.

$$Q=CIA$$

Where:

- Q = Peak runoff in cubic feet per second (cfs)
I = Rainfall Intensity.¹
A = Area of watershed in acres. This area includes the actual area drained through or in addition to the developed area.
C = Coefficient (weighted by area)²

¹ Storm duration shall be calculated to correspond to the time of concentration for the tributary drainage area.

²Values of C categorized by surface:

<u>Surface Type</u>	<u>Value of C</u>
Impervious (asphalt pavement, concrete pavement, stone/rock surfaces, rooftops, etc.)	0.95
Pervious (greenspace, lawns, unimproved areas)	0.35

If more than one surface type is included in the drainage area, the designer shall calculate the weighted coefficient for use in runoff calculations.

All stormwater calculation shall be signed and sealed by an Engineer licensed in the state of Missouri and submitted with the permit application for review by the City Engineer. Calculations shall be prepared in a report format.

DESIGN OF DRAINAGE STRUCTURES AND DEVICES

- A. Culverts and Storm Drainage Piping Systems shall be designed using the Manning equation for open channel flow. Inlet conditions should be investigated and openings designed to handle the peak runoff condition. In addition, the following conditions shall be met:
1. The minimum pipe size shall be 18-inch diameter.
 2. Bedding shall be installed around the pipe from ~~four~~ 6 inches below to 12 inches above the pipe. Bedding shall be ~~nominal ½-inch minus~~ crushed rock conforming to MoDOT Type 5 aggregate, **Section 1007**.
 3. The minimum grade shall guarantee a minimum velocity of 2.0 fps.
 4. Manholes or inlets shall be constructed at not more than 350-foot intervals and at all bends and changes of grade.
 5. All pipe shall be run true to line and grade between manholes or inlets.
 6. Outlets shall have intrusion gates to prevent entry by children or animals.
 7. Outlets shall end in an energy-dissipating device that will reduce the outlet flow velocity to less than 5 fps.
 8. Piping shall be designed to sustain any anticipated loading conditions
- B. Curb Inlets of the “Kansas City Type” are preferred. See Drawing No. IV-11
1. The length of Curb Inlet opening shall be determined as in Chapter IX of the MoDOT Project Development Manual.
 2. Floor of Inlet shall be shaped with invert to provide smooth flow.
 3. Locate manhole ring and cover over outlet.
 4. Each Inlet shall have cast iron steps spaced at 1’-4” centers vertically.
 5. Bevel all exposed edges with ¾” chamfer or ½” tooled edge.
 6. On grade Inlets shall conform to the street grade and sump Inlets shall be level.
 7. The length plus the width shall not exceed 15’ without special design.
 8. Each Inlet shall be placed on a 4” compacted aggregate base.
 9. Each Inlet shall have a steel inlet frame.
 10. Each Inlet shall be designed to sustain any anticipated loading conditions. In no case shall materials and design not be sufficient to support an ASHTO HS-20 loading.
 11. Transition curb in 10’ on upstream side of inlet and in 5’ on the downstream side. 10’ transition on both sides for sump inlet. See detail.
- C. Open Channel Design
1. Open Channel Drainage shall be designed using the Mannings Equation for open channel flow. The channel shape maybe trapezoidal, rectangular or circular at the designer’s discretion.
 - a. The channel depth shall be designed so that the peak runoff flow will be accommodated at 2/3rd of the channel depth.

Design Guidelines
City of Osage Beach
SECTION 4 - STORM DRAINAGE

- b. Where channel depth will exceed one foot, a trapezoidal section with a maximum of 1:1 side slopes shall be used.
- c. Where flow velocity will exceed 2 fps engineering fabric or erosion mat shall be utilized. Selected fabric or mat shall be rated for the intended application. Velocities shall be calculated and included with permit submittal.
- d. Where velocity will exceed 5 fps riprap shall be installed to eliminate scouring. See Drawing No. IV-7. Velocities shall be calculated and included with permit submittal.

All stormwater calculation shall be signed and sealed by an Engineer licensed in the State of Missouri and submitted with the permit application for review by the City Engineer. Calculations shall be prepared in a report format.

POST CONSTRUCTION WATER QUALITY

1. It shall be required that appropriate filtration methods are used in order to assure that silt, sediment, and debris do not get into the conveyed storm drainage flow. Parking areas, roof tops and other similar surfaces (not including single or two family residential), will require the collection and isolation of silts, sediments, debris, oils, and volatile materials. Also see Storm Drainage Plan A.5.c. New developments that disturb less than 1 acre and are not part of a larger common plan of development that will disturb 1 or more acres over the life of the project are not required to meet the post construction water quality requirement. Water quality requirements shall not apply to City streets or new constructed streets to be dedicated to the City.

Approved filtering systems are as follows:

2. Fabricated Filtration Manholes or Curb Inlets
 - a. Several patented filtration devices are now available that can effectively reduce sediment discharges such as:
 - 1) Treatment systems such as Stormceptor
 - 2) Catch Basin or Curb Inlet inserts such as FloGard manufactured by Hancor, Inc. or Hydro-Kleen manufactured by ACF Environmental.
 - 4) Or several non-patented devices by various highway departments, etc.
3. Post Construction Sediment Basin
 - a. Sediment Basin volume, or WQV, shall be based on the following calculation:

Design Guidelines
City of Osage Beach
SECTION 4 - STORM DRAINAGE

$$WQV (ft^3) = (P/12)(R_v)(A*43,560)$$

Where

P = rainfall depth = 1 inch

R_v = volumetric runoff coefficient = $0.05 + 0.009I$

I = percent impervious cover (in percent, e.g. 80% = 80)

A = total site area in acres

- b. The inlet should be designed to prevent short-circuiting between entrance and discharge to the maximum extent practicable. This can be accomplished by providing baffles in the channel, turns in the channel, etc.
- c. The shape of the storage basin should allow for easy cleanout of sediment and debris. Proper maintenance is the responsibility of the property owner. Terrain and other site conditions will tend to dictate the shape of the facility. Sediment Basins with water depth greater than 4' shall be fenced for safety.
- d. The sediment basin shall include an outlet structure designed for the slow release of stored runoff to allow for sedimentation in the basin. A perforated riser wrapped in filter fabric and covered with a mound of clean 2-inch stone is the City's preferred outlet structure. Basin shall be designed to prevent permanent standing water.

The details of the design are at the discretion of the designer subject to approval of the City Engineer.

All stormwater calculation shall be signed and sealed by an Engineer licensed in the state of Missouri and submitted with the permit application for review by the City Engineer. Calculations shall be prepared in a report format.

CONSTRUCTION MATERIALS

- A. See Drainage ditches maybe stabilized earth, riprap, concrete, or other durable material.
- B. Retention basin inlets, basin, and outlet structures maybe of any durable material subject to the approval of the City Engineer.
- C. Storm drainage pipe and culvert pipe shall be reinforced concrete, or dual wall polypropylene pipe.
 - 1. All pipes at a minimum must be capable of sustaining an ASHTO HS-20 loading.
 - 2. The use of polypropylene pipe for storm drainage at drop inlets or in areas where leaf burning is allowed is prohibited.

Design Guidelines
City of Osage Beach
SECTION 4 - STORM DRAINAGE

D. Curb Inlets

1. Shall be prefabricated or cast-in-place.
 - a. Shall be place on a 4" compacted aggregate base.
 - b. Reinforcement in footing shall be #4 bars on 6" centers both ways.
 - c. Reinforcement in walls shall be #4 bars on 12" centers both ways.
 - d. Reinforcement in lid shall be a minimum of six #4 bars placed at 45 degree angle. See detail.
2. Shall have a 10" throat galvanized steel inlet frame.
3. Cast iron manhole ring and cover, Neenah R-1537 or approved equal.
4. Cast iron step, Clay & Bailey No. 2101 or approved equal.

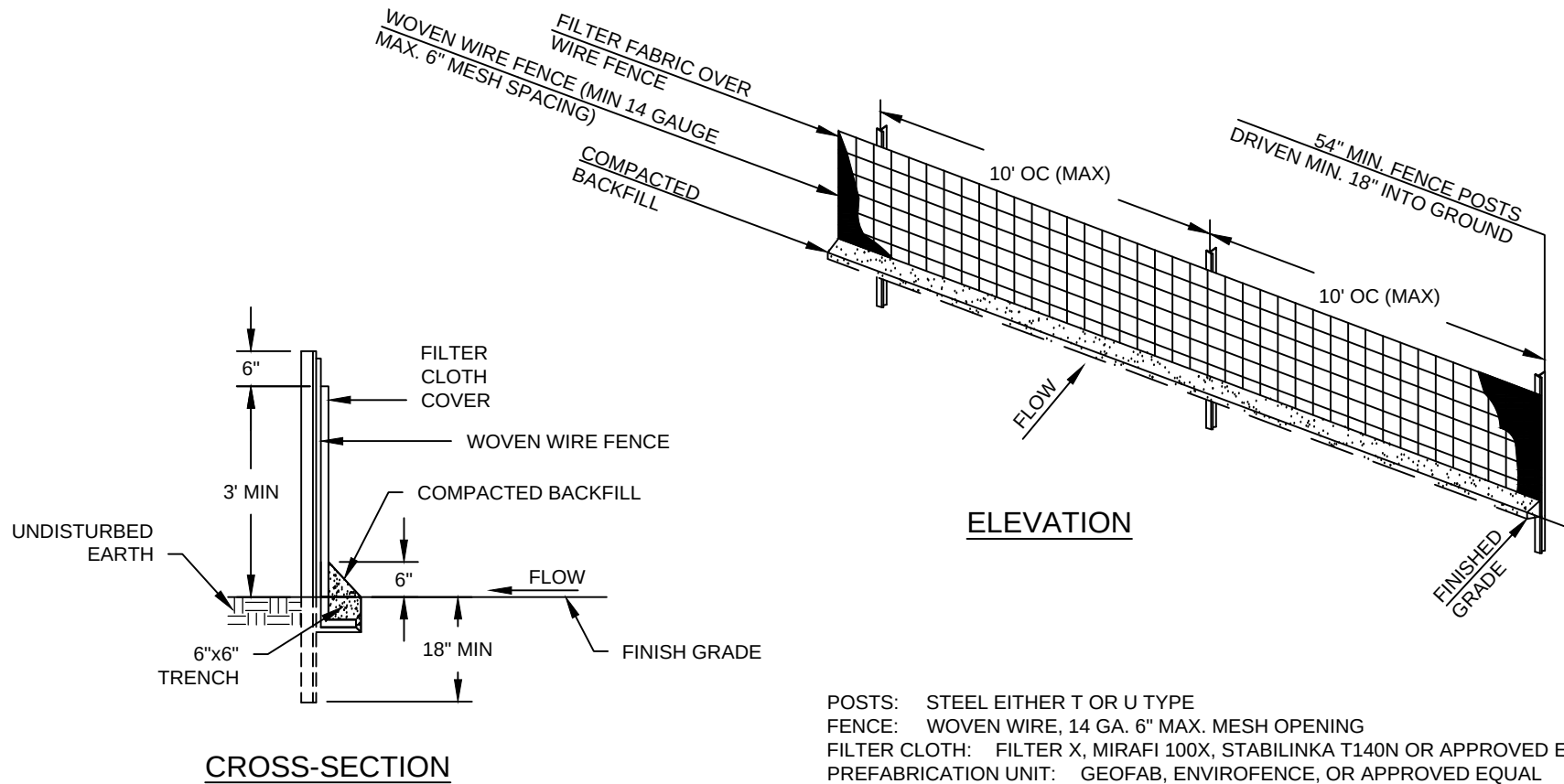
STORM DRAINAGE CONSTRUCTION DETAIL DRAWINGS

Construction details and sketches are attached.

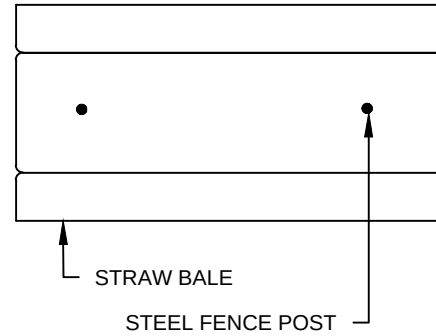
END

NOTES:

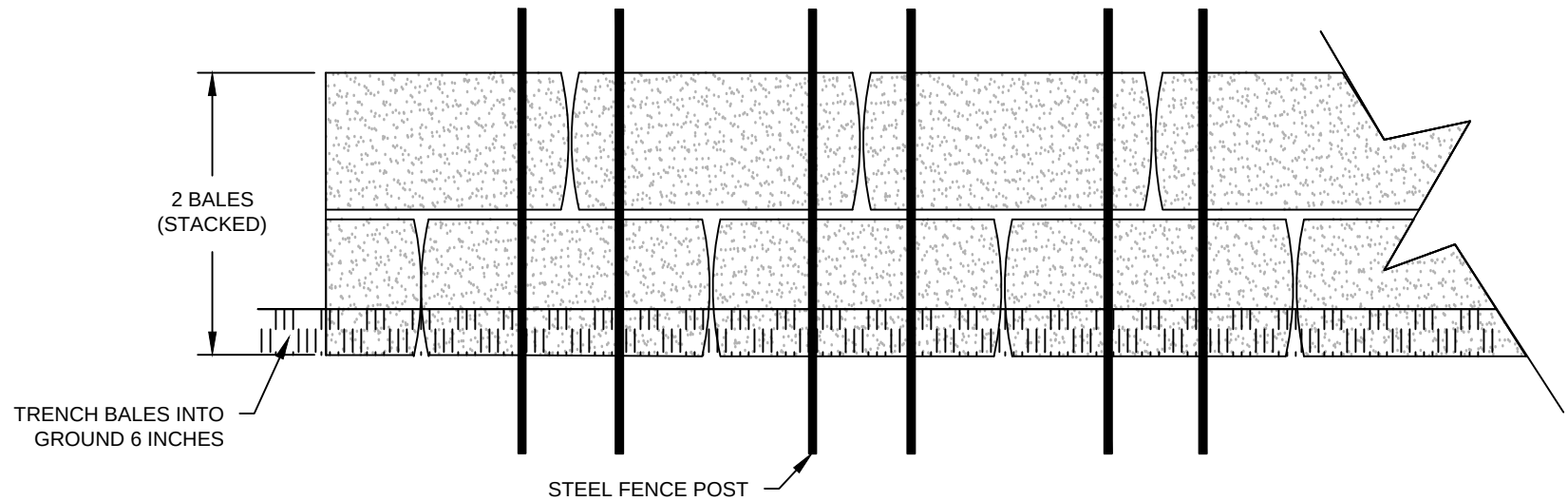
1. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES.
2. FILTER CLOTH TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID SECTION.
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER, THEY SHALL BE OVERLAPPED BY 6" AND FOLDED.
4. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.



Date Revised: March, 2014	CITY OF OSAGE BEACH TYPICAL DETAIL SILT FENCE	Design Guideline: SECTION 4
By: SH		STORM DRAINAGE
Checked By: JB		Drawing No: IV-1

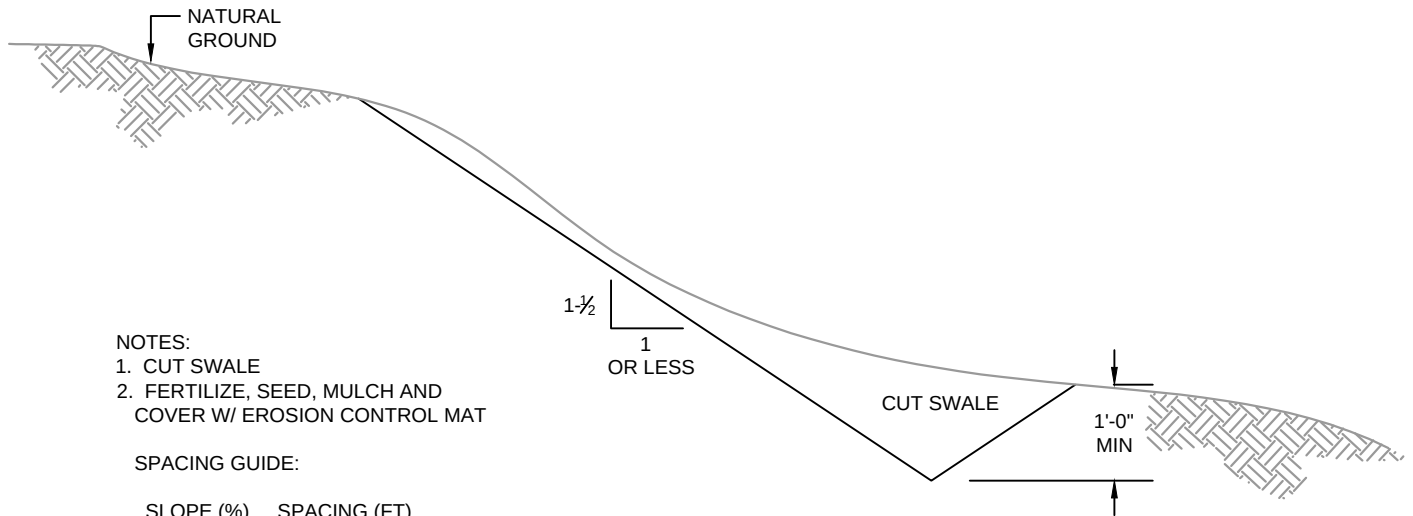


PLAN



FRONT

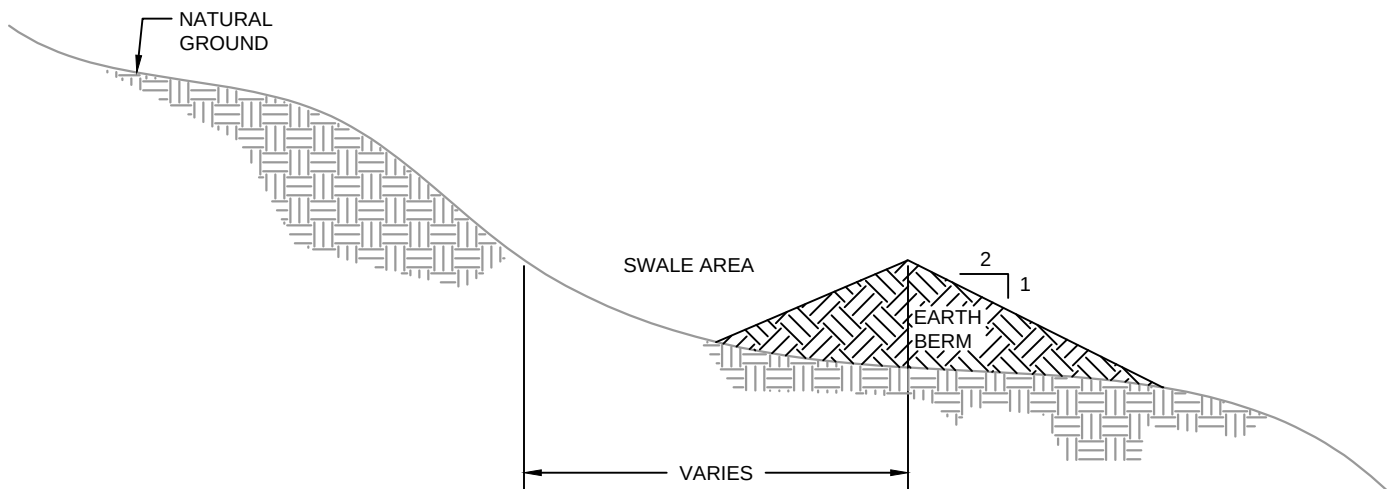
Date Revised: March, 2014	CITY OF OSAGE BEACH TYPICAL DETAIL STRAW BALE CHECK FENCE	Design Guideline: SECTION 4
By: SH		STORM DRAINAGE
Checked By: JB		Drawing No: IV-2



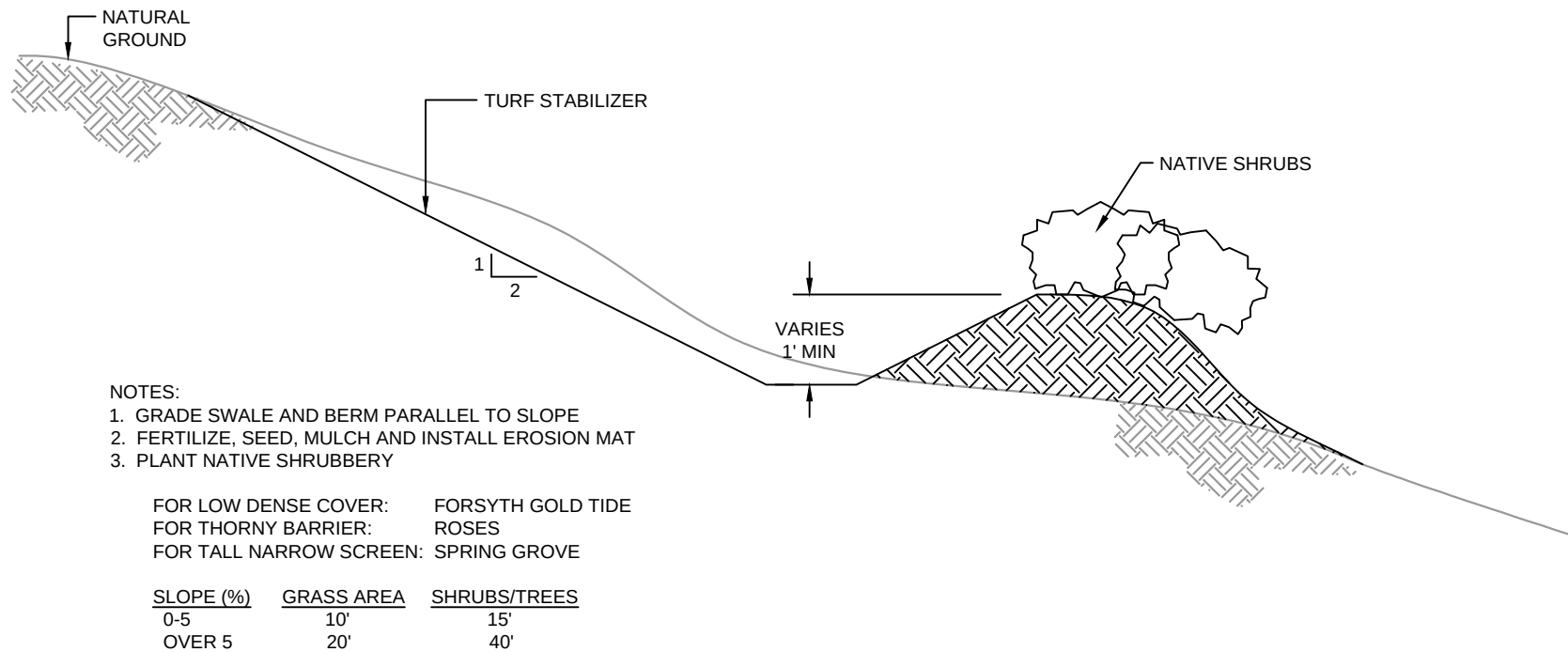
- NOTES:
 1. CUT SWALE
 2. FERTILIZE, SEED, MULCH AND COVER W/ EROSION CONTROL MAT

SPACING GUIDE:

SLOPE (%)	SPACING (FT)
33-50	20
25-33	40
15-25	60
10-15	80
6-10	120
3-6	200

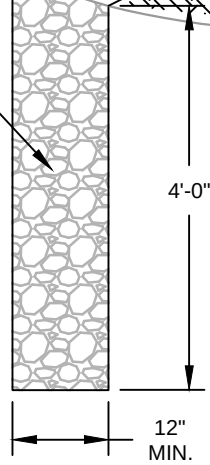


Date Revised: March, 2014	CITY OF OSAGE BEACH TYPICAL DETAIL SWALE	Design Guideline: SECTION 4
By: SH		STORM DRAINAGE
Checked By: JB		Drawing No: IV-3



Date Revised: March, 2014	CITY OF OSAGE BEACH TYPICAL DETAIL VEGETATION BARRIER & SWALE	Design Guideline: SECTION 4
By: SH		STORM DRAINAGE
Checked By: JB		Drawing No: IV-4

CLEAN ¾" MINUS
AGGREGATE



NOTES:

1. FIELD TEST TO DETERMINE INFILTRATION RATE $\pm$ 1 GAL/SF/MIN
2. DO NOT USE ABOVE RETAINING WALLS, BASEMENTS OR OTHER GROUND WATER SENSITIVE LOCATIONS

Date Revised:
March, 2014

By:
SH

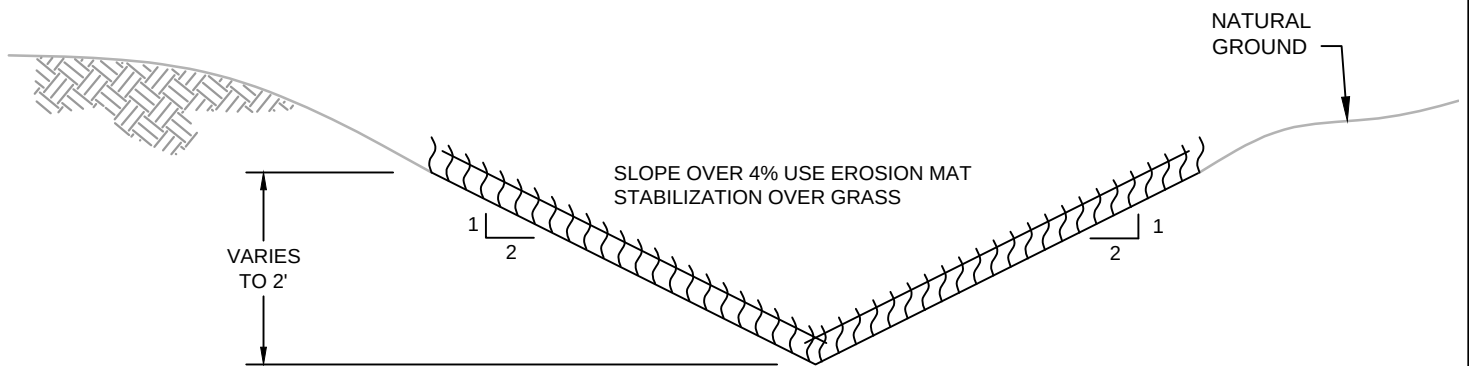
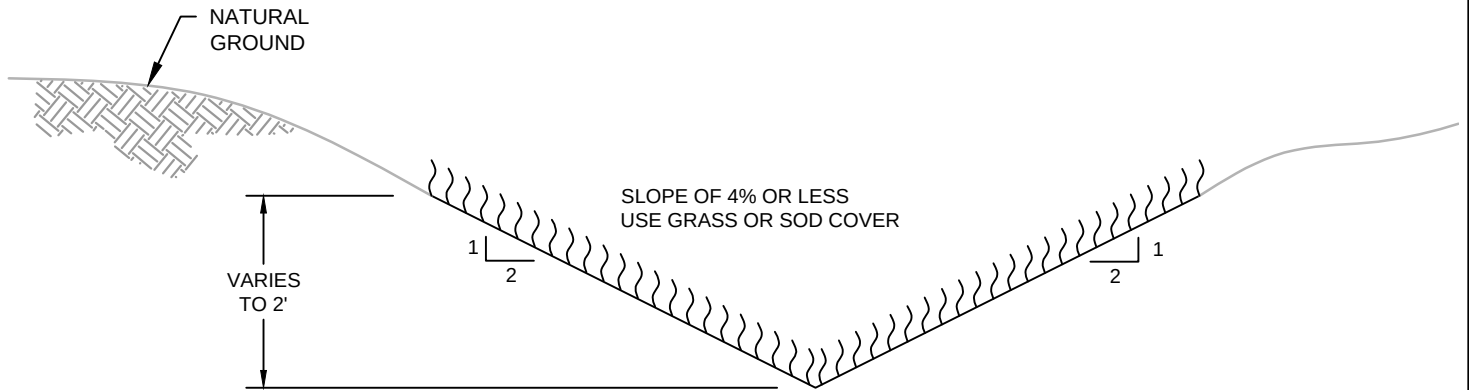
Checked By:
JB

CITY OF OSAGE BEACH
TYPICAL DETAIL
INFILTRATION TRENCH

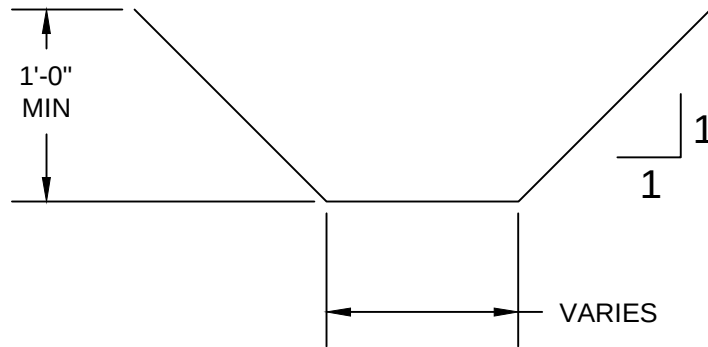
Design Guideline:
SECTION 4

STORM DRAINAGE

Drawing No:
IV-5



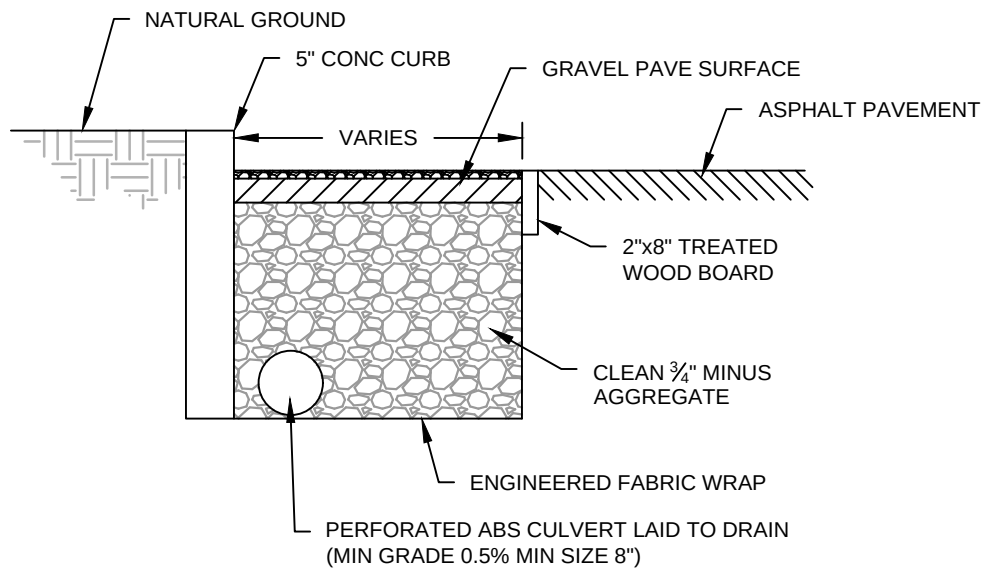
Date Revised: March, 2014	CITY OF OSAGE BEACH TYPICAL DETAIL DRAINAGE SWALE-GRASS OR TURF	Design Guideline: SECTION 4
By: SH		STORM DRAINAGE
Checked By: JB		Drawing No: IV-6



NOTES:

1. VELOCITY LESS THAN 2 FPS - GRASS OR TURF
2. VELOCITY 2-5 FPS - TURF AND EROSION MAT
3. VELOCITY OVER 5 FPS - RIP-RAP MIN SIZE 3" SMALLEST DIMENSION

Date Revised: March, 2014	CITY OF OSAGE BEACH TYPICAL DETAIL OPEN DRAINAGE CHANNEL	Design Guideline: SECTION 4
By: SH		STORM DRAINAGE
Checked By: JB		Drawing No: IV-7



NOTES:

1. WIDTH VARIES DEPENDENT UPON DRAINAGE AREA (PER MANUFACTURES RECOMMENDATION - 0.25 GPM/SF TARGET VALUE)
2. DIAMETER OF DRAIN DEPENDS ON FLOW
3. DEPTH DEPENDS ON SIZE OF DRAIN - MIN 16"

Date Revised:
March, 2014

By:
SH

Checked By:
JB

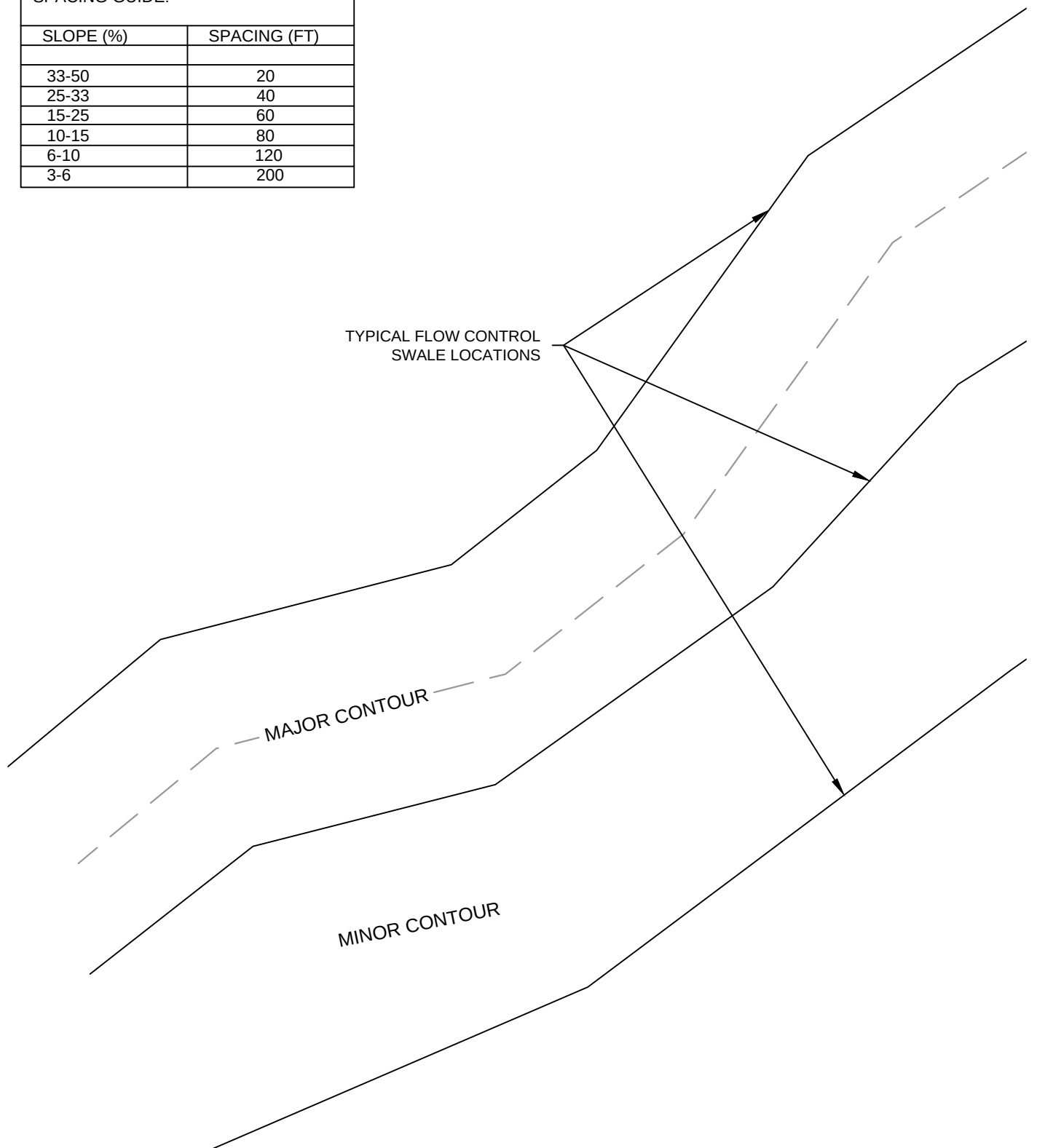
**CITY OF OSAGE BEACH
TYPICAL DETAIL
FILTER STRIP**

Design Guideline:
SECTION 4

STORM DRAINAGE

Drawing No:
IV-8

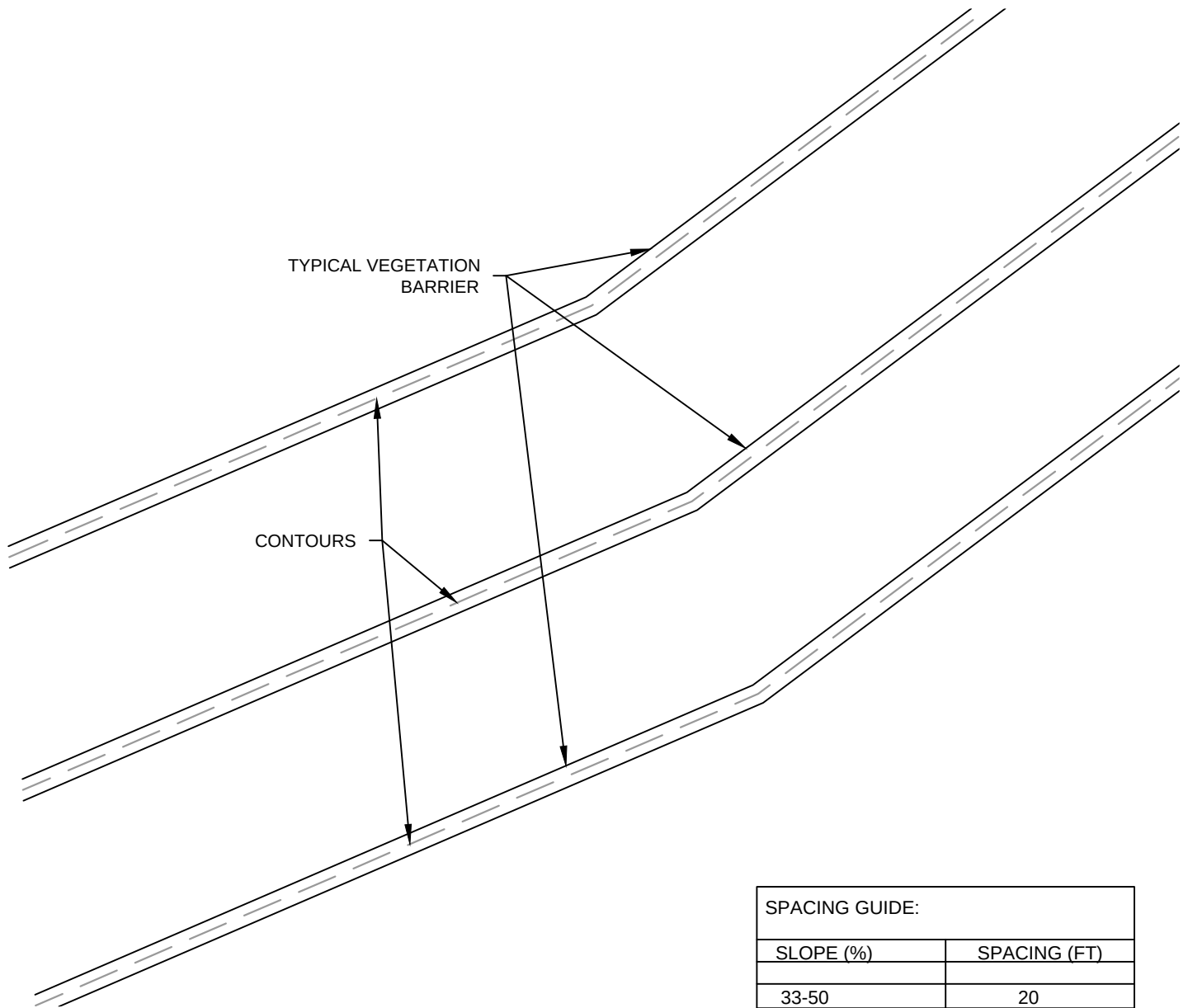
SPACING GUIDE:	
SLOPE (%)	SPACING (FT)
33-50	20
25-33	40
15-25	60
10-15	80
6-10	120
3-6	200



Date Revised:	March, 2014
By:	SH
Checked By:	JB

CITY OF OSAGE BEACH TYPICAL DETAIL SWALE LOCATION	

Design Guideline:	SECTION 4
	STORM DRAINAGE
Drawing No:	IV-9

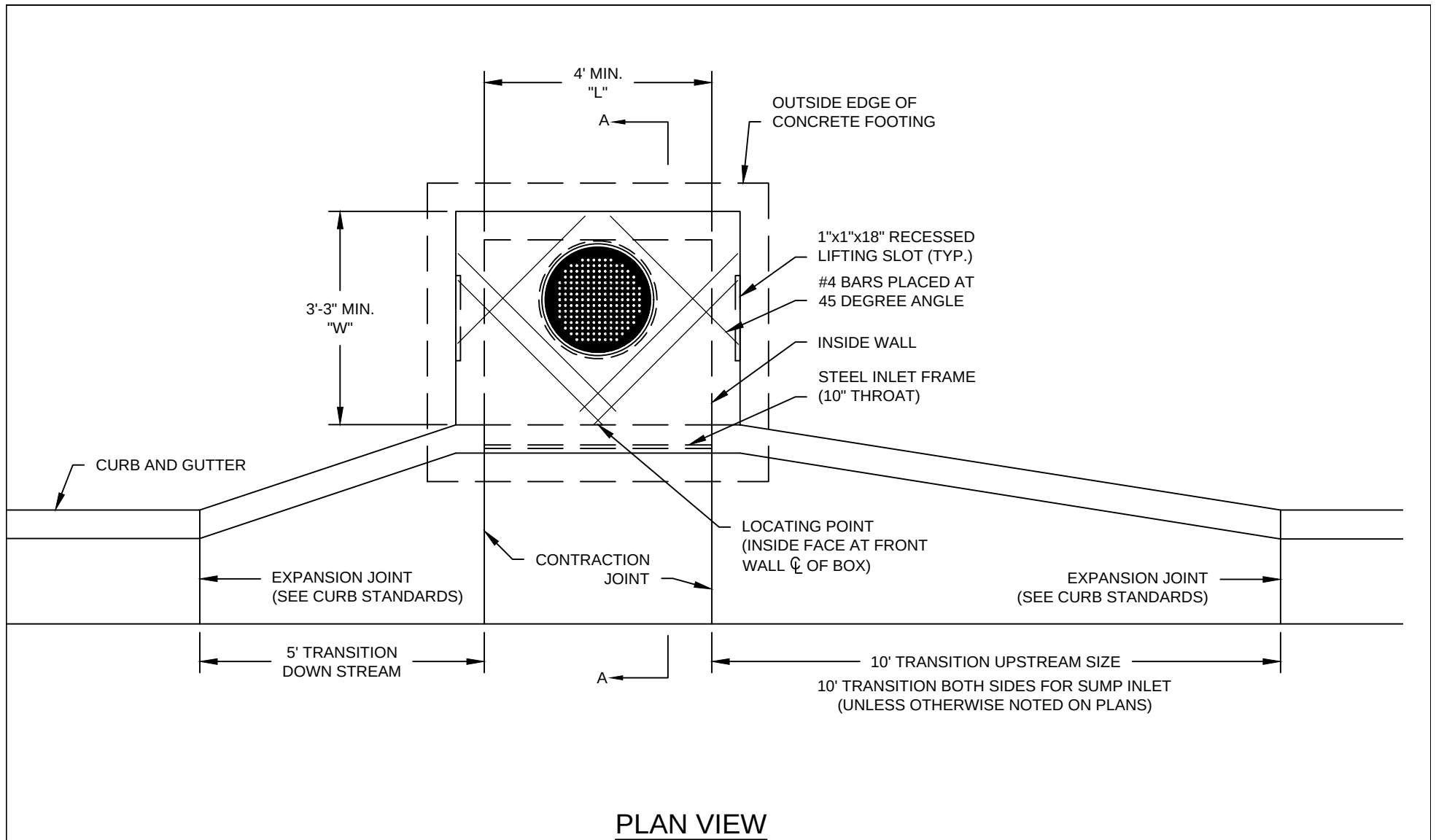


SPACING GUIDE:	
SLOPE (%)	SPACING (FT)
33-50	20
25-33	40
15-25	60
10-15	80
6-10	120
3-6	200

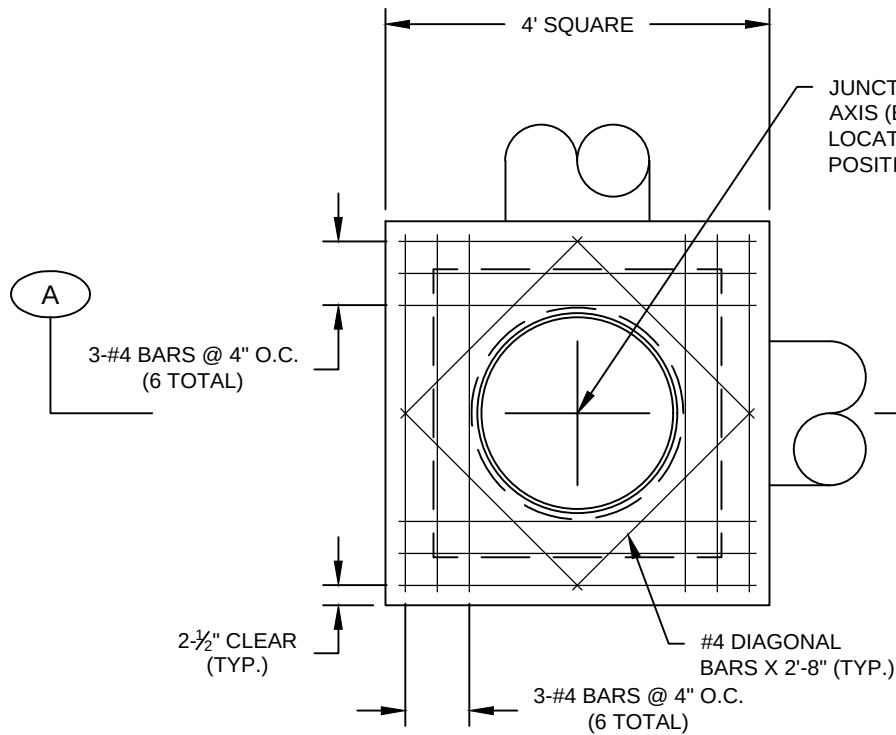
Date Revised:	March, 2014
By:	SH
Checked By:	JB

CITY OF OSAGE BEACH
TYPICAL DETAIL
VEGETATION BARRIER LOCATION

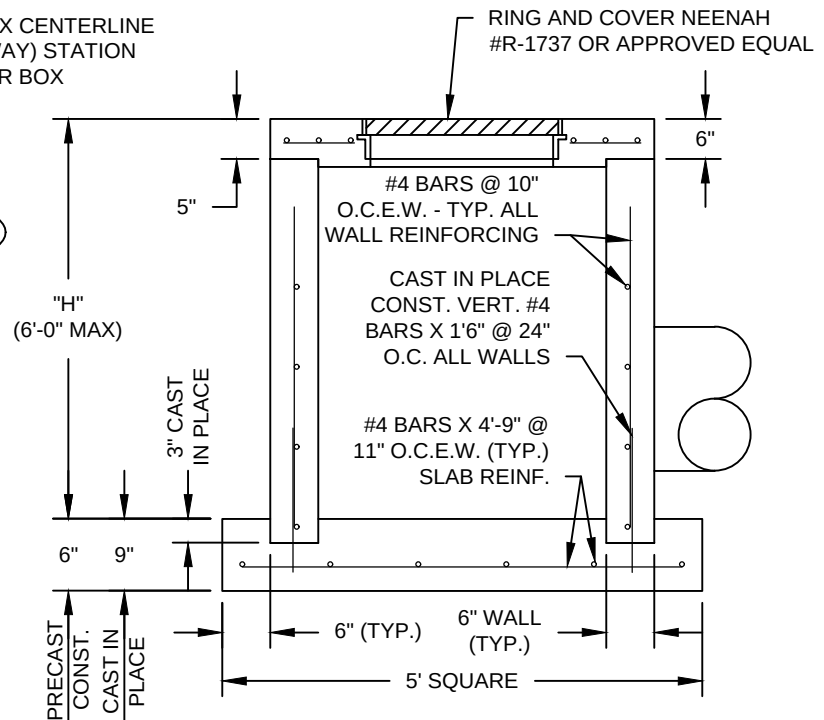
Design Guideline:	SECTION 4
	STORM DRAINAGE
Drawing No:	IV-10



Date Revised: March, 2014	CITY OF OSAGE BEACH TYPICAL DETAIL CURB INLET	Design Guideline: SECTION 4
By: SH		STORM DRAINAGE
Checked By: JB		Drawing No: IV-11

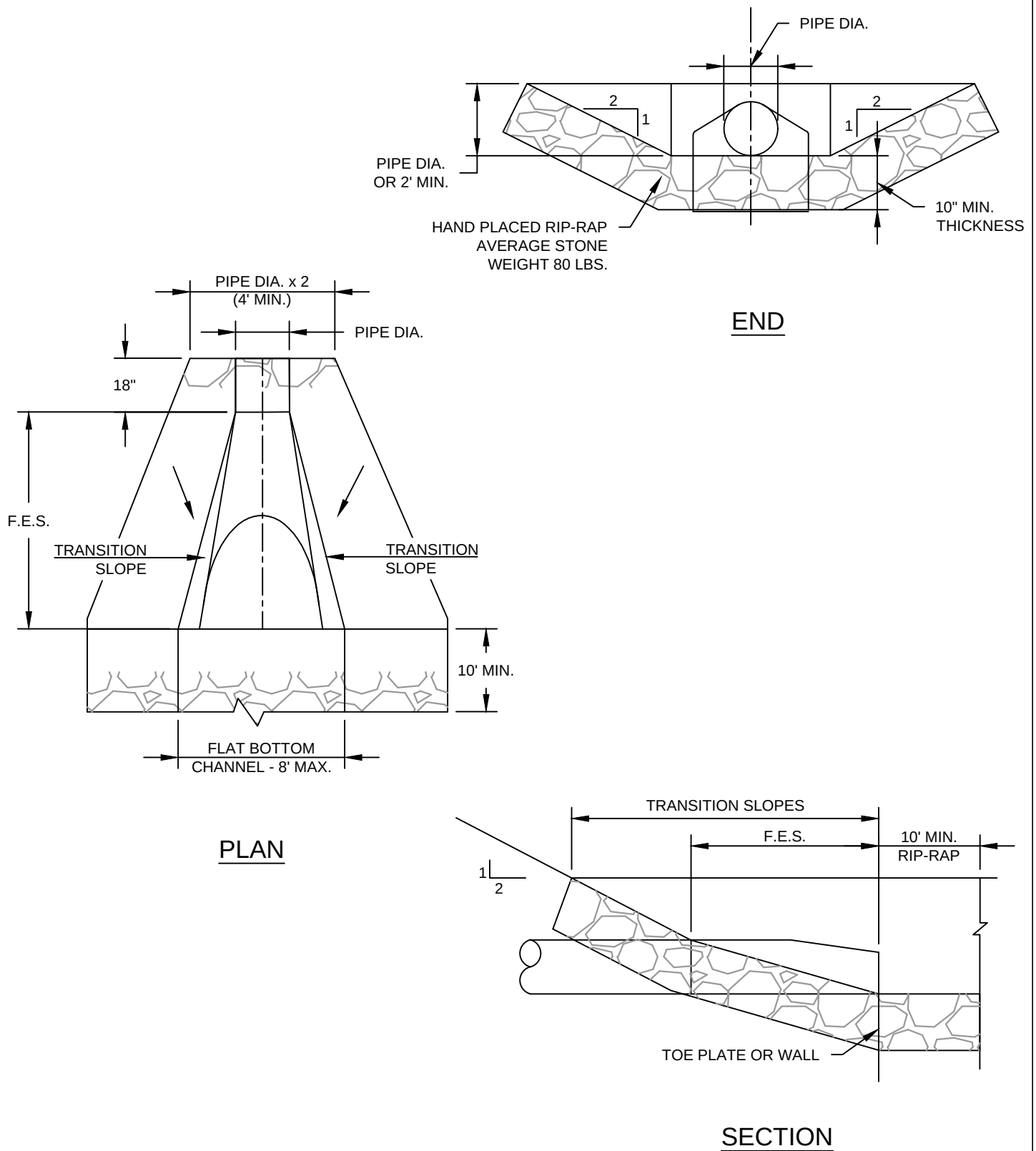


TOP - PLAN

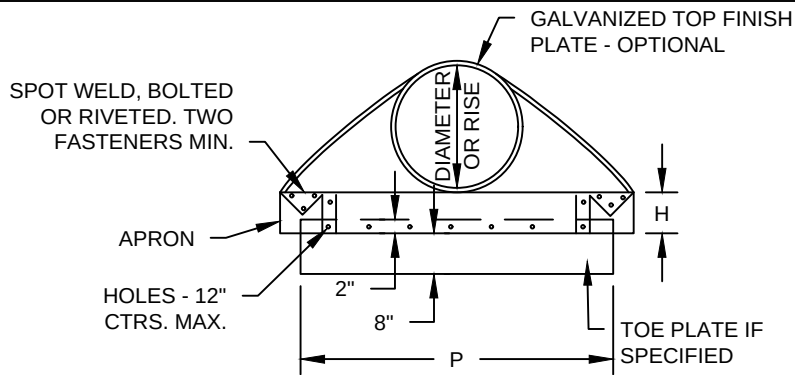


SECTION A-A

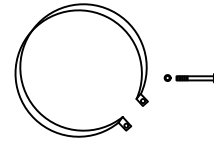
Date Revised: March, 2014	CITY OF OSAGE BEACH TYPICAL DETAIL JUNCTION BOX	Design Guideline: SECTION 4
By: SH		STORM DRAINAGE
Checked By: JB		Drawing No: IV-13



Date Revised: March, 2014	CITY OF OSAGE BEACH TYPICAL DETAIL FLARED END SECTION w/ RIP RAP	Design Guideline: SECTION 4
By: SH		STORM DRAINAGE
Checked By: JB		Drawing No: IV-14

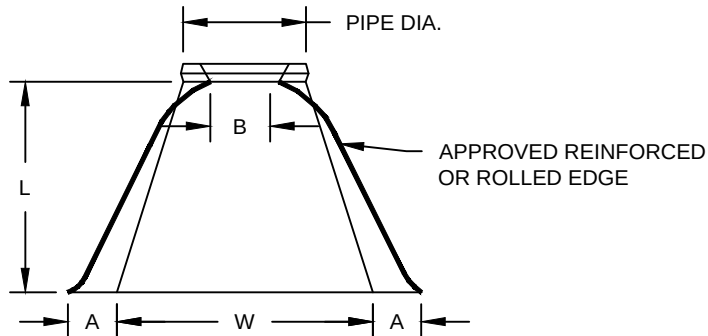


ELEVATION



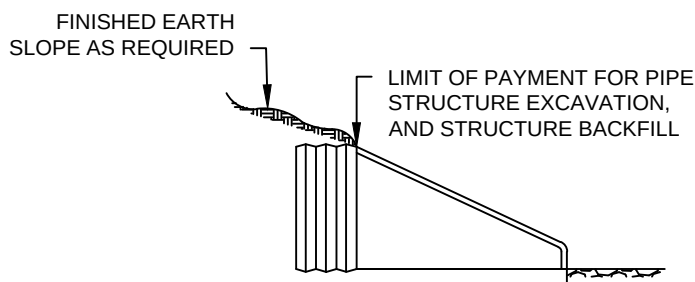
1 INCH WIDE 0.109" THICK CONNECTOR STRAP OF COMMERCIAL QUALITY STEEL. GALVANIZED WITH SAME WEIGHT COATING AS PIPE, AND 6" x 1/2" GALVANIZED BAND BOLT AND NUT. USE AS ALTERNATE ON CONNECTION.

CONNECTOR STRAP

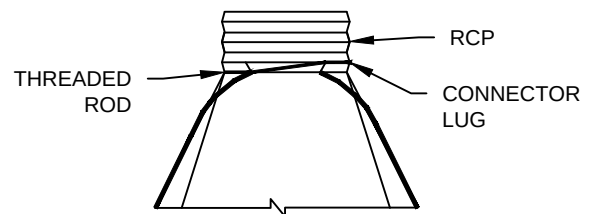


PLAN

END SECTION FOR ROUND PIPE								
PIPE DIA. (IN)	GALV. SHEET THICK (IN)	DIMENSIONS (IN)					APPROXIMATE SLOPE (V:H) (1:SLOPE)	TOE PLATE IF SPECIFIED P (IN)
		A 1" TOL.	B MAX.	H 1" TOL.	L 1-1/2" TOL.	W 2" TOL.		
18	0.064	8	10	6	31	36	2 - 1/2	46
21	0.064	9	12	6	36	42	2 - 1/2	52
24	0.064	10	13	6	41	48	2 - 1/2	58



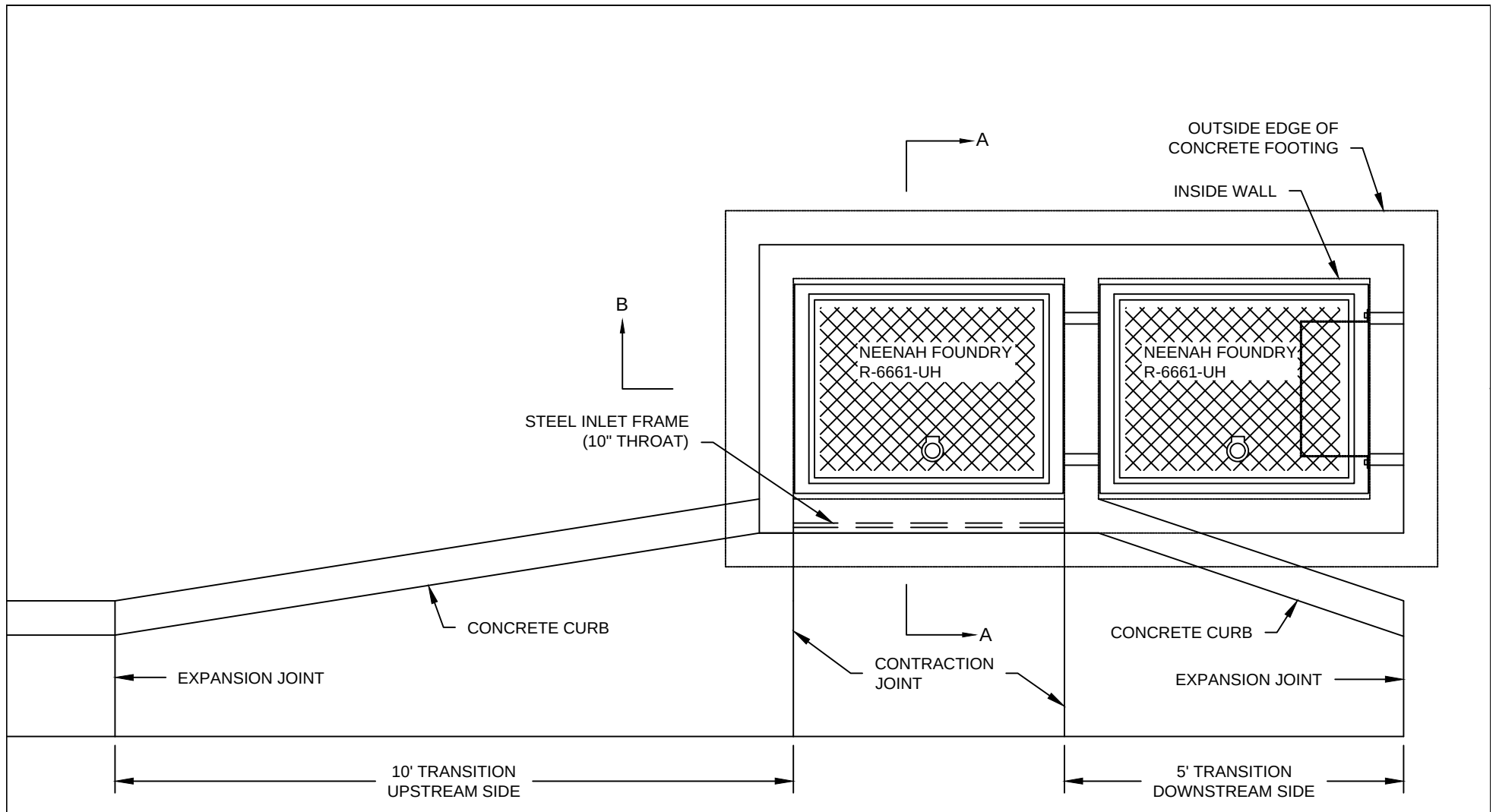
TYPICAL CROSS-SECTION



FOR 12" THRU 24" ROUND PIPE ONLY

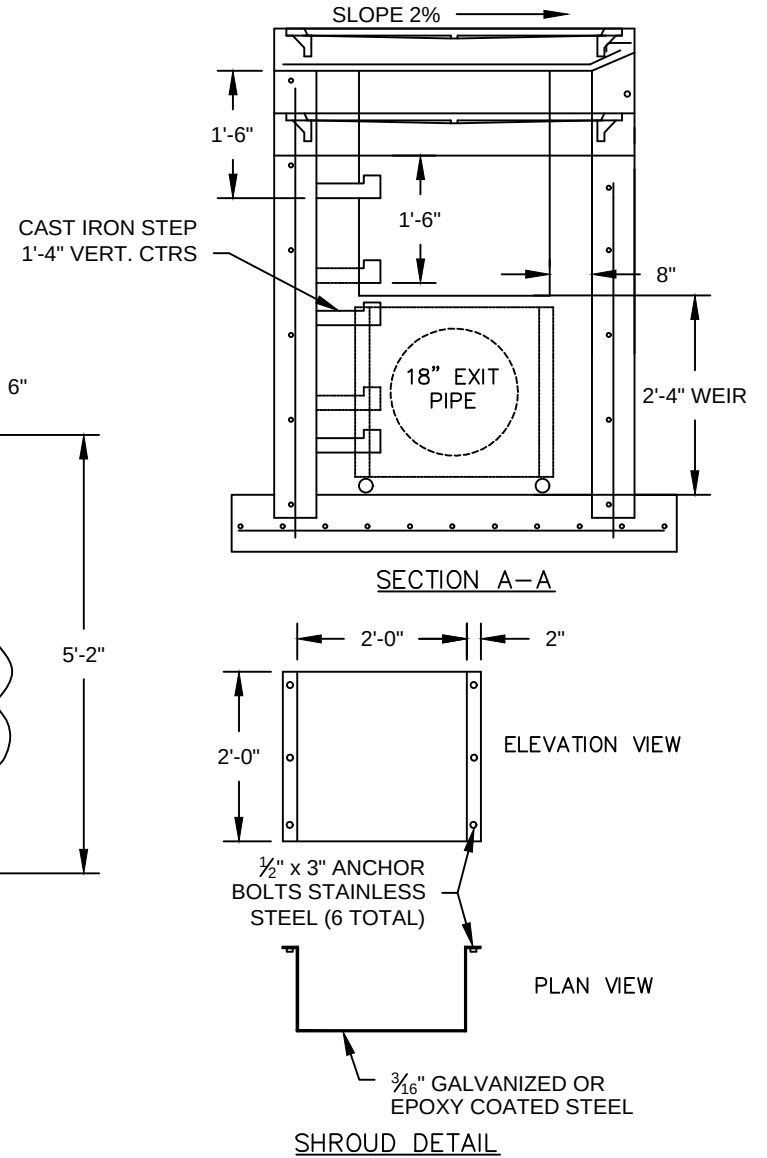
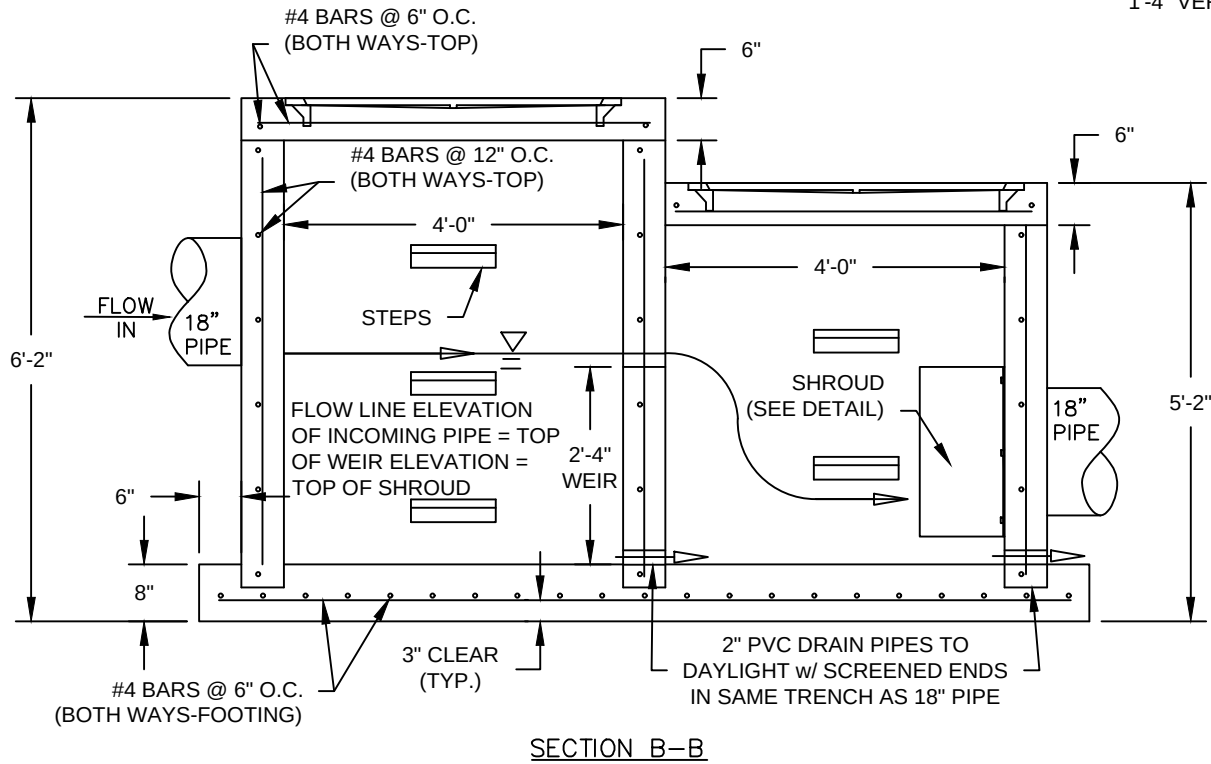
CONNECTION

Date Revised: March, 2014	CITY OF OSAGE BEACH TYPICAL DETAIL FLARED END SECTION	Design Guideline: SECTION 4
By: SH		STORM DRAINAGE
Checked By: JB		Drawing No: IV-15



Date Revised: March, 2014	CITY OF OSAGE BEACH TYPICAL DETAIL DISSIPATION BOX	Design Guideline: SECTION 4
By: SH		STORM DRAINAGE
Checked By: JB		Drawing No: IV-16

- NOTE:
1. BEVEL ALL EXPOSED EDGES WITH
 $\frac{3}{4}$ " CHAMFER OR $\frac{1}{2}$ " TOOLED EDGE.



Date Revised:
March, 2014

By:
SH

Checked By:
JB

CITY OF OSAGE BEACH TYPICAL DETAIL DISSIPATION BOX

Design Guideline:
SECTION 4

STORM DRAINAGE

Drawing No:
IV-17

Design Guidelines
City Of Osage Beach
SECTION 5 - ROADS, STREETS AND PARKING AREAS
(Revised 21 OCT 04SH)

OVERVIEW

This chapter establishes design guidelines for the construction of roads, streets, and parking areas within the jurisdictional boundaries of the City of Osage Beach. It also establishes the guidelines for reconstruction, improvement, and maintenance of existing streets within the city. Design standards are based upon the AASHTO Policy on the Geometric Design of Highways and Streets and the Supplement for Design of Very Low Volume Local Roads, ≤ 400 Average Daily Traffic (ADT).

CLASSIFICATION OF ROADS AND STREETS

A. Arterial Streets subdivided into three classifications:

1. Arterials over 50,000 Average Daily Traffic Count (ADT): Major through routes for high volume, moderate speed traffic, with limited access similar to the pending Rte. 54 Expressway.
2. Arterials with between 10,000 and 50,000 ADT: Major through route for high volume, restricted speed traffic, with restricted access, similar to the existing Rte 54.
3. Arterials with between 5,000 and 10,000 ADT: Major connecting through routes similar to Rte. 42, KK and D Roads.

The design criterion shall be as indicated in Table I - Design Criterion.

B. Collector Streets. Collector are those that streets that intersect with arterial streets and/or local streets and serve primarily local traffic from neighborhoods to through routes. Dependant upon traffic count and local conditions the access will be restricted. Collector Streets are subdivided into two classifications:

1. Collector Street with over 3,000 ADT: Major lake roads such as Nichols Road, Passover Road, and Bluff Road.
2. Collector Street with 1,000 to 3,000 ADT: Lake Roads such as Case, Jefferies, Malibu, and Lazy Days.

The design criterion shall be as indicated in Table I - Design Criterion

C. Local Streets. Local streets are relatively low traffic neighborhood streets that provide access to residences or business locations and connect to collector streets. Local Streets are subdivided into four classifications:

1. Local Street with over 1500 ADT: Relatively busy neighborhood streets that serve several residences and/or condo units and connect to collectors and lesser local streets such as Dogwood Lane, Airport Road, Sunset Drive, lesser traveled portions of Nichols Road and Dude Ranch Road, etc.

Design Guidelines
City Of Osage Beach
SECTION 5 - ROADS, STREETS AND PARKING AREAS

2. Local Street with between 400 and 1000 ADT: Neighborhood streets serving more than ten residences or condo units, and connecting to lesser local streets. May be dead end streets similar to: Wilson Drive, Broadwater Drive, Wyrick Road, etc.
3. Local Street with less than 400 ADT: Low use, usually dead end, streets serving less than ten residences similar to Cedar Village Lane, Sleepy Hollow Lane, End of Hawthorne Drive, etc.

The design criterion shall be as indicated in Table I - Design Criterion

DEAD END STREETS

- A. Cul-de-sacs shall be constructed on all dead-end streets and shall meet the following criterion:
 1. The minimum diameter shall be 50 feet (edge of pavement to edge of pavement).
 2. The minimum easement or right of way shall be 60 feet diameter, or back of cut or fill slope as determined by the City Engineer.
 3. In cases where terrain and other constraints prohibit the construction of a cul-de-sac a "turn-around tee" may be constructed with the approval of the City Engineer. The use of a cul-de-sac is preferred.

RESIDENTIAL PARKING AND COMMERCIAL PARKING AREAS

- A. Residential Parking
 1. Each residential property owner shall provide sufficient off street parking for his or her individual needs. Parking on the city street will not be permitted.
- B. Public Parking Areas
 1. All public and commercial facilities (except those in areas zoned as industrial) shall provide adequate parking to serve the public and employees as specified in the City of Osage Beach City Code Section 405.480, Off-Street Parking and Loading Requirements. In addition all commercial and public parking shall meet the following requirements:
 - a. All commercial, industrial, and/or public parking areas shall be asphalt or concrete paved.
 - b. The minimum structural section for asphalt paved parking areas shall be three inches of asphalt pavement on a minimum of eight inches of Type I-B Base.

Design Guidelines
City Of Osage Beach
SECTION 5 - ROADS, STREETS AND PARKING AREAS

- c. The minimum structural section for concrete paved parking areas shall be six inches of reinforced concrete pavement on six inches of Type I-B Base. Reinforcement shall be # 2 bars at 12" on centers both-ways or equivalent.
- d. ADA handicapped parking shall be in accordance with:
 - 1) City of Osage Beach Code Section 405.530.
 - 2) Handicapped access ramps shall be provided as necessary.
- e. The parking area shall be drained to suitably designed storm drainage systems. Refer to the Storm Drainage Guidelines.
- f. Minimum cross-slopes for drainage shall be 0.5% for one axis and 1.0% for the transverse axis.
- g. The minimum radius for edge of pavement at entrance and exit shall be 20 feet.
- h. The minimum width of entranceway for one-way entrances shall be 12 feet, and for two-way entrances shall be 24 feet.
- i. The maximum allowable entry width for commercial parking areas shall be 40 ft, edge of pavement to edge of pavement.

EXISTING CITY STREETS – RECONSTRUCTION AND UPGRADING

- A. Many of the existing city streets do not conform to the above standards. In many cases there is inadequate right-of-way and manmade or natural obstructions that preclude significant improvement of the street. In order to accommodate these problems the following shall apply to all existing city streets.
 - 1. Arterial, Collector, and Local Streets with an ADT of over 1000 will be upgraded to the new construction standards to the maximum extent practicable. Substandard streets shall be upgraded in order of priority as set by the City Engineer, and approved by the Board of Aldermen.
 - 2. Streets with an ADT of less than 1000 will be maintained to a driveable condition approximating their condition at the time of acceptance by the city until such time as increased traffic loading or safety consideration warrant upgrading them to new construction standards, providing the City has available funding. In many cases it will not be practicable to do so. In these cases the street will be upgraded by minor grading, overlay asphalt pavements, mitigation of safety issues, and construction of drainage facilities where required. Such upgrades and improvement will be prioritized. The priority shall be set by the City Engineer and approved by the Board of Aldermen.

Design Guidelines
City Of Osage Beach
SECTION 5 - ROADS, STREETS AND PARKING AREAS

EXISTING CITY STREETS – MAINTNENACE

- A. It is the intent of this guideline that existing city streets shall be maintained in a safe, drivable condition to the maximum extent practicable with consideration given to current available funding and staffing limitations.
- B. In general, the roadways will be maintained to the standard at which they were accepted into the city inventory. In cases where citizen complaints, staff investigations, or the Capital Infrastructure Advisory Committee deems appropriate the Board of Aldermen shall be requested to make improvements to the roadway. This request shall be in the form of a formal request from at least 50% of the persons or businesses located along the street in question. The request will be reviewed by the Capital Infrastructure Advisory Committee, the City Engineer, and Superintendent of Public Works and recommended to the Board of Aldermen. In general, improvements will be made only in accordance with the appropriate priority list and when funding is available.
- C. Snow and Ice Removal
 - 1. There are a few existing streets that are inaccessible to city snow plowing equipment. In cases where the street can not be safely plowed by existing city equipment or other safety concerns are prohibitive the street will be placed upon a no-plow list at the time the street is accepted into the city inventory. Streets to be placed on the no-plow list shall be recommended by the Department of Public Works, and be approved by the Board of Aldermen. They will remain on the no-plow list until they are upgraded to new construction standards.

ROADS, STREETS AND PARKING CONSTRUCTION DETAIL DRAWINGS

Construction details and sketches are attached.

END

Design Guidelines
City of Osage Beach
SECTION 5 - ROADS, STREETS, AND PARKING AREAS

TABLE I - STREET AND ROADWAY DESIGN CRITERION

DESIGN CRITERION	ARTERIAL			COLLECTOR		LOCAL STREET			ONE WAY less than 400 ADT
	Over 50,000 ADT	10,000 to 50,000 ADT	5,000 to 10,000 ADT	Over 3,000 ADT	1,500 to 3,000 ADT	Over 1,500 ADT	400 to 1,500 ADT	Less Than 400 ADT	
Design Speed (mph)	MoDOT	45	35	25	25	25	15	10	10
No. of Lanes	MoDOT	3 to 5	2	2	2	2	2	2	1
Width of Lane (ft)	MoDOT	12	12	12	12	12	10	9	14
Minimum Curve Radius (ft)	MoDOT	730	420	205	165	165	100	45*	45*
						*Minimum width of pavement is 23 ft. curb to curb.			
Maximum Super Elevation	MoDOT	4%	4%	4%	0	0	0	0	0
Minimum Curve Widening, (ft)	MoDOT	2	4.5	7	8	8	8	5**	5**
Vehicle Type WB-50						**Two-way streets only - see above			
Minimum Intersection Inside Curb Radius	MoDOT	70	50	50	30	30	30	30	30
Maximum Grade	MoDOT	8%	12%	12%	12%	15%	15%***	15%***	15%***
						***Steeper grades with approval of City Engineer			
Max. K Value	MoDOT	61	29	29	19	12	12	3	3
Minimum Sight Distance	MoDOT	360	250	155	155	155	100	80	80
Structural Cross Section	MoDOT	4" AC Pave 12" AB	4" AC Pave 12" AB	4" AC Pave 12" AB	4" AC Pave 12" AB	3" AC Pave 12" AB	3" AC Pave 8" AB	3" AC Pave 8" AB	3" AC Pave 8" AB
						AC Pave = Asphaltic Concrete Pavement AB = Aggregate Base Course			
Curb & Gutter	MoDOT	Optional	Required	Required	Required	Required	Required	Required	Required
Sidewalk	MoDOT	Both Sides	Both Sides	Both Sides	Both Sides	One Side	One Side	NO	NO

Design Guidelines
City of Osage Beach
SECTION 5 - ROADS, STREETS AND PARKING AREAS

TABLE I - STREET AND ROADWAY DESIGN CRITERION

DESIGN CRITERION	ARTERIAL			COLLECTOR		LOCAL STREET			ONE WAY
	Over 50,000 ADT	10,000 to 50,000 ADT	5000 to 10,000 ADT	Over 3000 ADT	1500 to 3000 ADT	Over 1500 ADT	400 to 1500 ADT	Less Than 400 ADT	Less Than 400 ADT
Design Speed (mph)	MoDOT	45	35	25	25	25	15	10	10
No. of Lanes	MoDOT	3 to 5	2	2	2	2	2	2	1
Width of Lane (ft)	MoDOT	12	12	12	12	12	10	9	14
Minimum Curve Radius (ft)	MoDOT	730	420	205	165	165	100	45*	45*
Maximum Super Elevation	MoDOT	4%	4%	4%	0	0	0	0	0
Minimum Curve Widening, (ft) Vehicle Type WB-50	MoDOT	2	4.5	7	8	8	8	5**	5**
Minimum Intersection Inside Curb Radius	MoDOT	70	50	50	30	30	30	30	30
Maximum Grade	MpDOT	8%	12%	12%	12%	15%	15%***	15%***	15%***
Max. K Value	MoDOT	61	29	29	19	12	12	3	3
Minimum Sight Distance	MoDOT	360	250	155	155	155	100	80	80
Structural Cross Section	MoDOT	4" AC Pave 12" AB	4" AC Pave 12" AB	4" AC Pave 12" AB	4" AC Pave 12" AB	3" AC Pave 12" AB	3" AC Pave 8" AB	3" AC Pave 8" AB	3" AC Pave 8" AB
Curb & Gutter	MoDOT	Optional	Required	Required	Required	Required	Required	Required	Required
Sidewalk	MoDOT	Both Sides	Both Sides	Both Sides	Both Sides	One Side	One Side	One Side****	One Side****

*Minimum width of pavement is 23 ft. curb to curb.

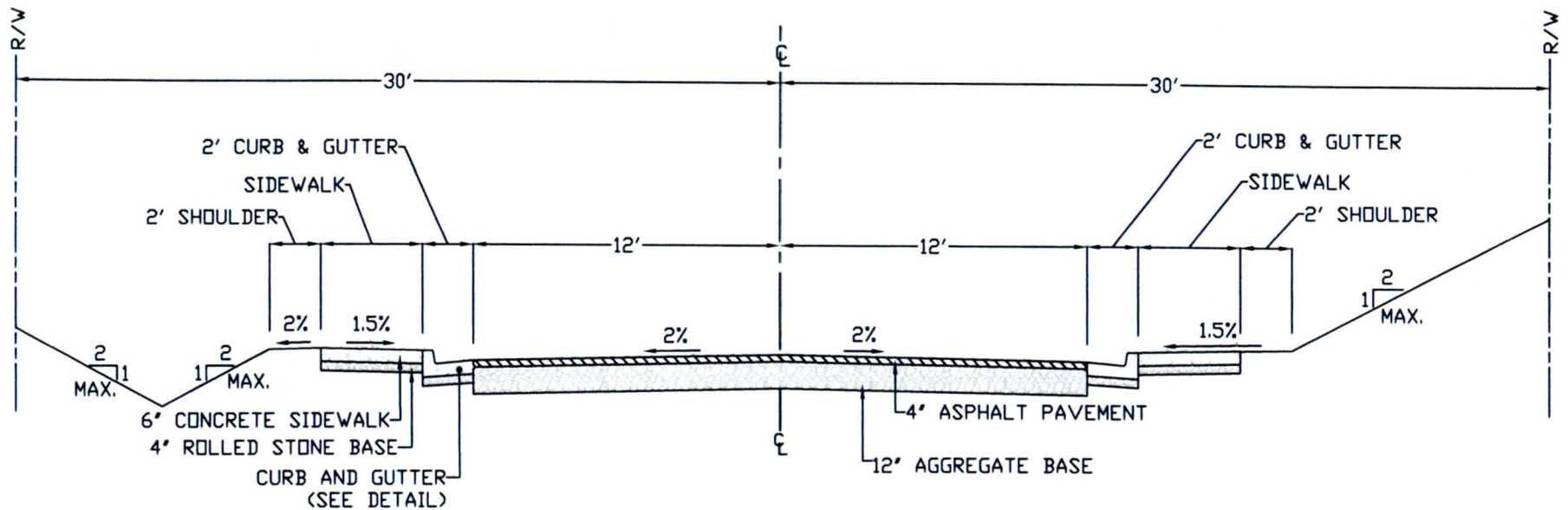
**Two-way streets only - see above

*** Steeper grades with approval of City Engineer

AC Pave = Asphaltic Concrete Pavement
AB = Aggregate Base Course

**** Dead end streets serving less than 10 homes-delete walk

Replaced w/ new page approved 3/22/18



Date Revised:
October 2004

By:
sh

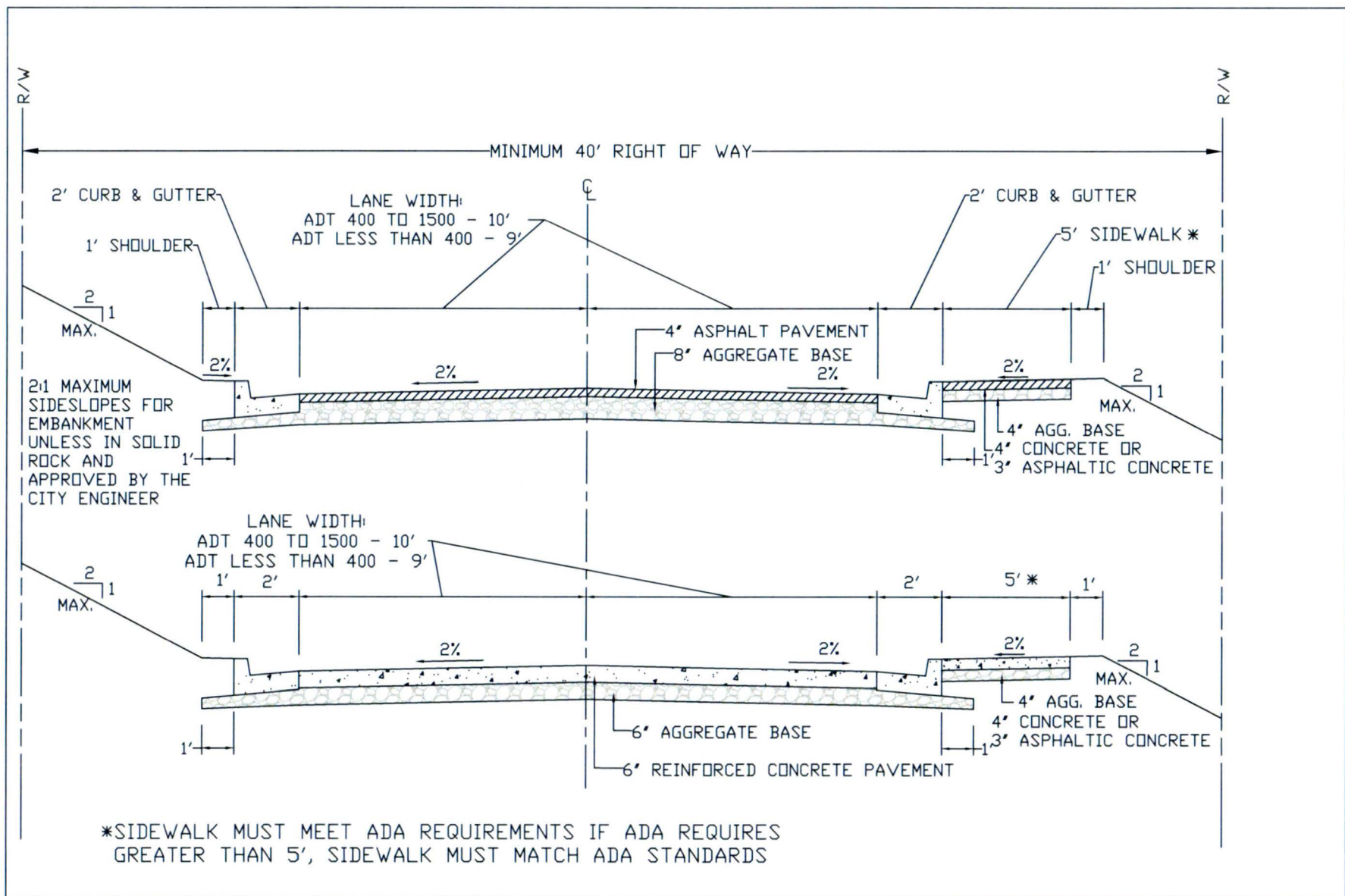
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CITY OF OSAGE BEACH TYPICAL DETAIL ARTERIAL STREET

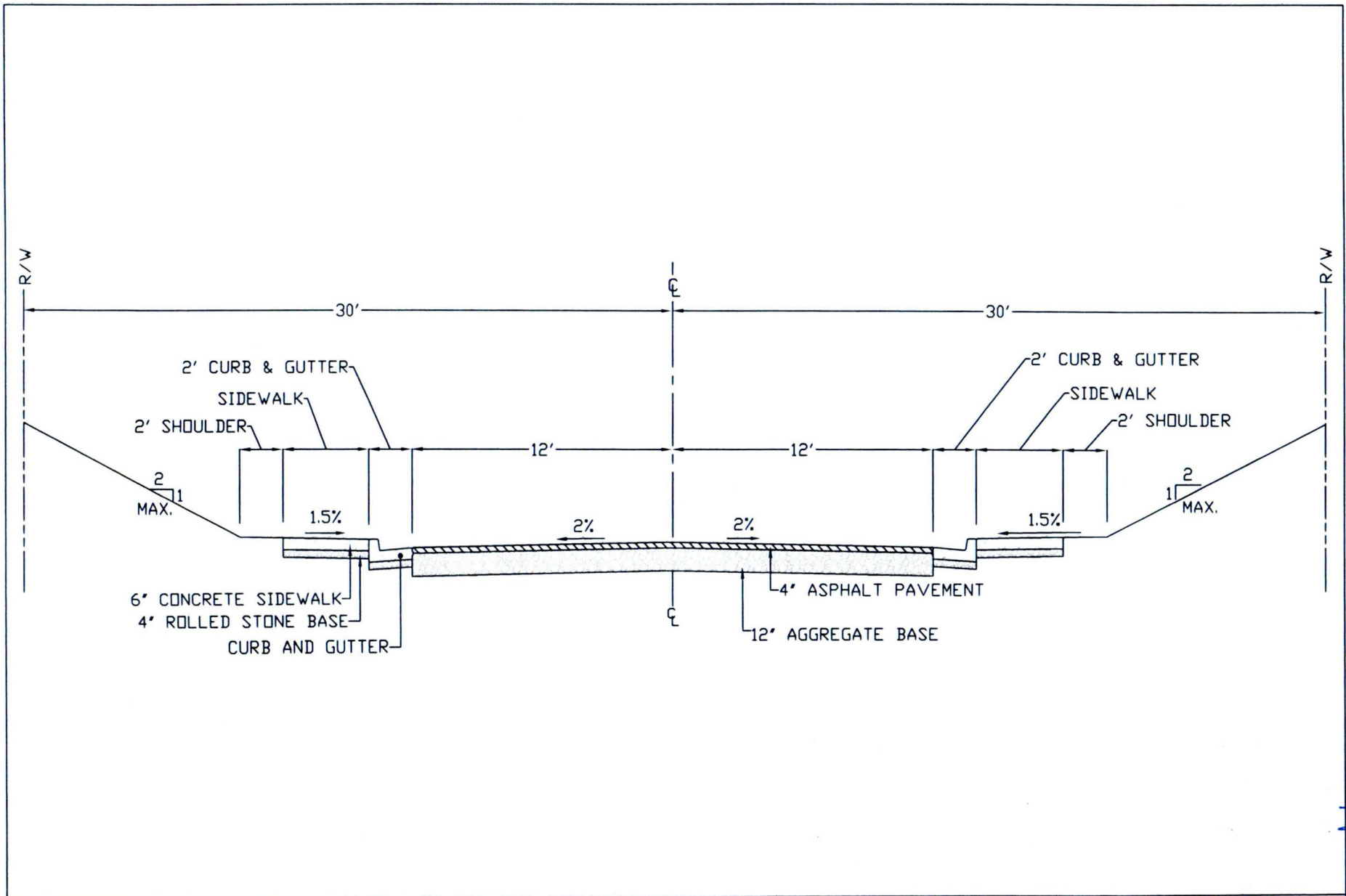
Design Guideline:
SECTION 5

ROADS, STREETS AND
PARKING AREAS

Drawing No:
V-1

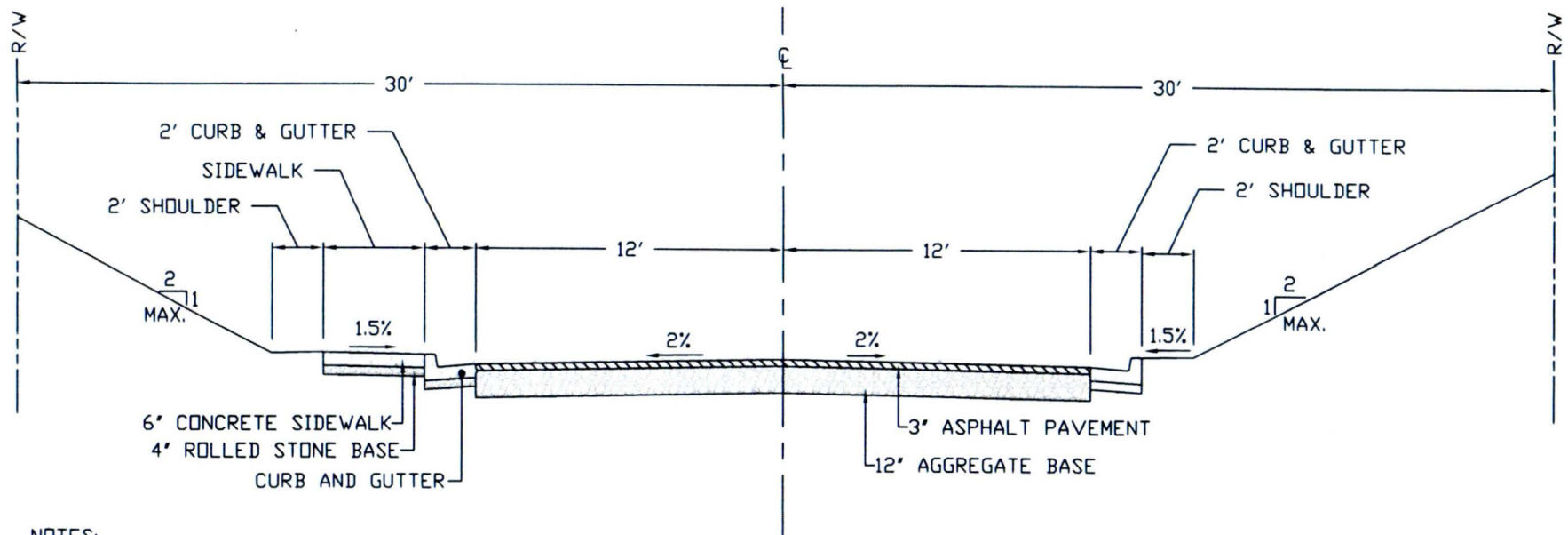


Date Revised: JUNE 2017	CITY OF OSAGE BEACH TYPICAL SECTION COLLECTOR	Design Guideline: SECTION 5
By: MLM		ROADS, STREETS AND PARKING AREAS
Checked By: NE		Drawing No. V-2



Date Revised: October 2004	CITY OF OSAGE BEACH TYPICAL DETAIL COLLECTOR STREET	Design Guideline: SECTION 5
By: sh		ROADS, STREETS AND PARKING AREAS
Checked By: jlb		Drawing No. V-2

Replace w/ page
 approved 3/22/18



NOTES:

1. IN COMMERCIAL DISTRICTS A CONCRETE SIDEWALK IS REQUIRED ON BOTH SIDES OF THE ROADWAY.
2. IN RESIDENTIAL AREAS CONCRETE SIDEWALK IS REQUIRED ON ONE SIDE ONLY.
3. HANDICAPPED ACCESS RAMPS SHALL BE PROVIDED AT ALL DRIVEWAYS, INTERSECTIONS AND OTHER INTERRUPTIONS TO THE SIDEWALK GRADE.

Date Revised:
October 2004

By:
sh

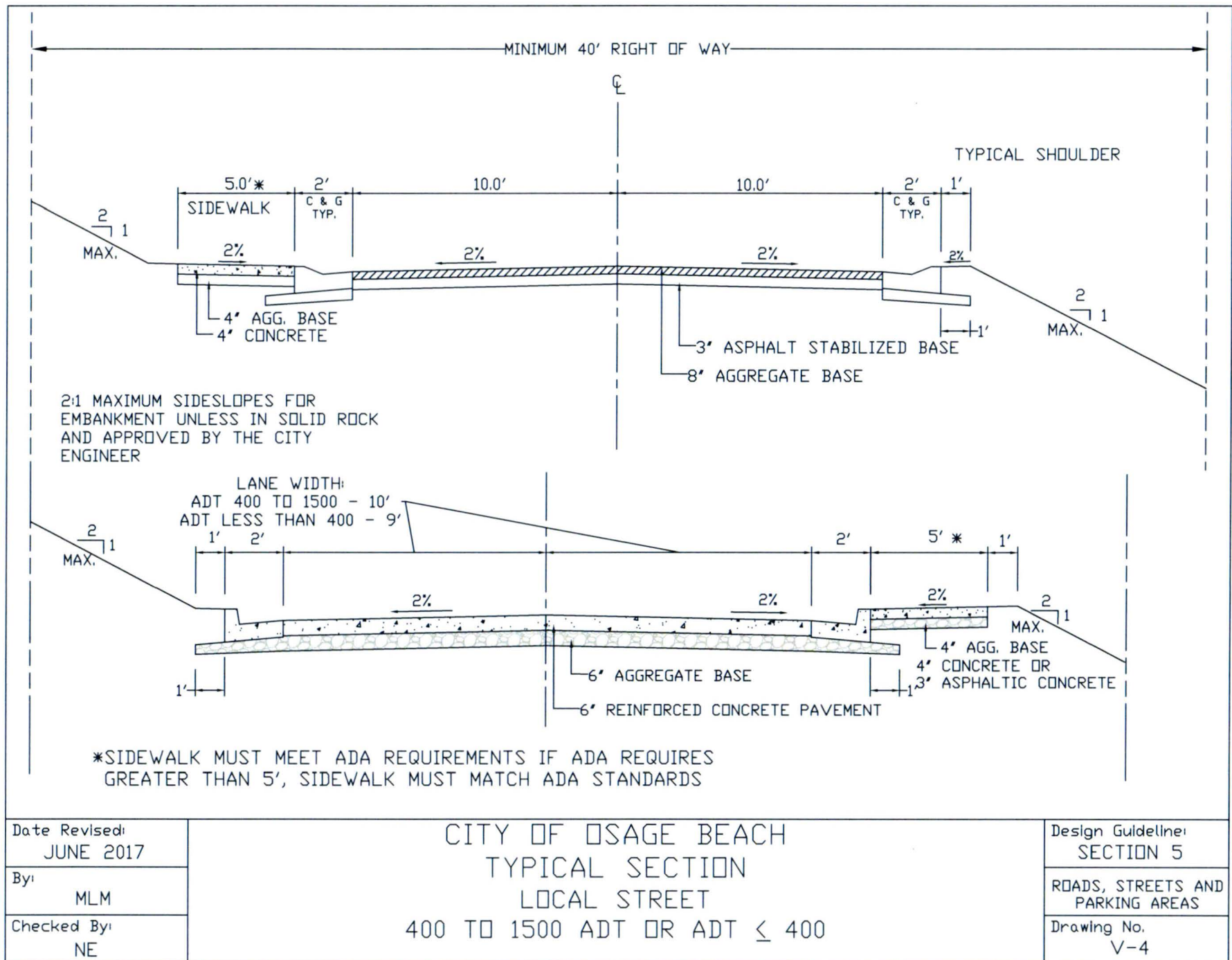
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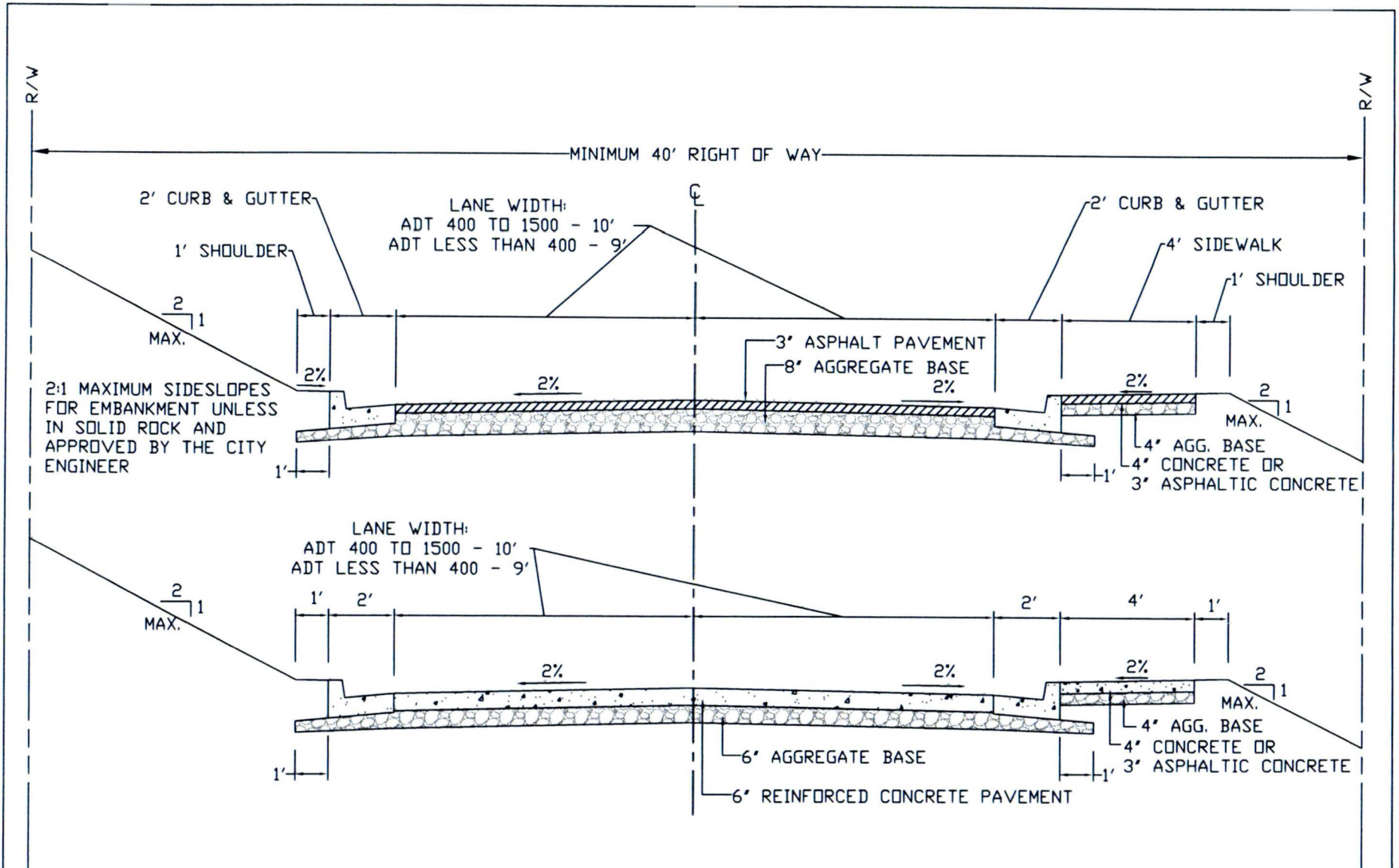
CITY OF OSAGE BEACH
TYPICAL DETAIL
LOCAL STREET ADT > 1500

Design Guideline:
SECTION 5

ROADS, STREETS AND
PARKING AREAS

Drawing No.
V-3





Date Revised:
October 2004

By:
sh

Checked By:
jb

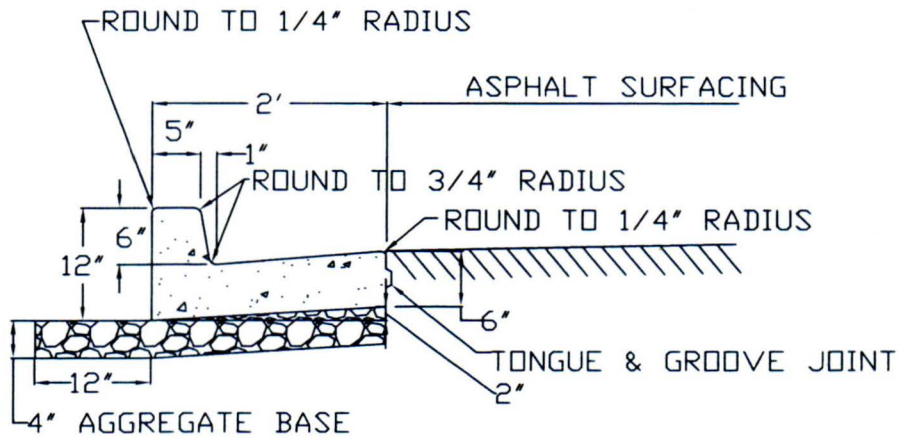
CITY OF OSAGE BEACH
TYPICAL SECTION
LOCAL STREET ADT ≤ 1500

Design Guideline:
SECTION 5

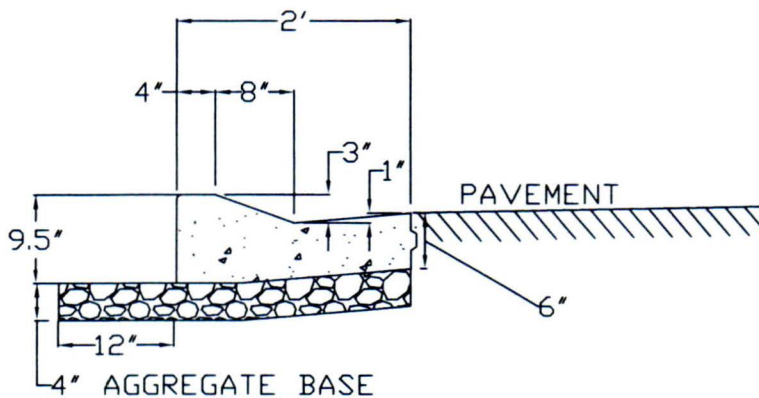
ROADS, STREETS AND
PARKING AREAS

Drawing No.
V-4

Replaced w/page
approved 3/22/18



BARRIER CURB



ROLL-BACK CURB

CURB & GUTTER NOTES

1. 3/4" EXPANSION JOINTS TO BE PLACED AT RADIUS POINT JUNCTURES AND AT 250' INTERVALS.
2. 1-1/2" DEEP CONTROL JOINTS SHALL BE INSTALLED AT APPROXIMATELY 15' INTERVALS. JOINTS SHALL PASS THROUGH THE ENTIRE CURB SECTION.
3. A MINIMUM OF 4" AGGREGATE BASE SHALL BE PLACED BENEATH ALL CURB AND GUTTER SECTIONS.

Date Revised:
October 2004

By:
sh

Checked By:
jb

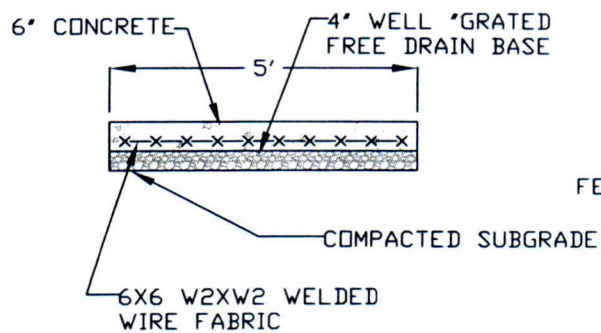
CITY OF OSAGE BEACH
TYPICAL DETAIL
CURB & GUTTER

Design Guideline:
SECTION 5

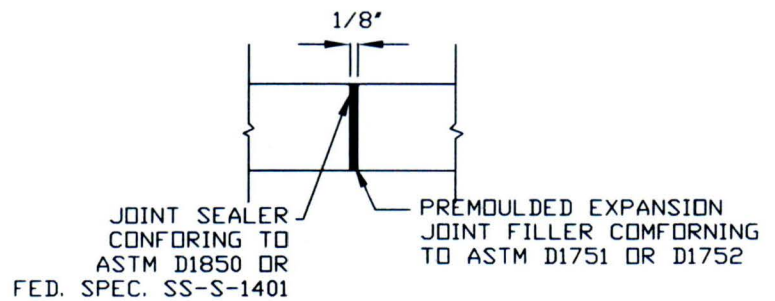
ROADS, STREETS AND
PARKING AREAS

Drawing No:
V-5

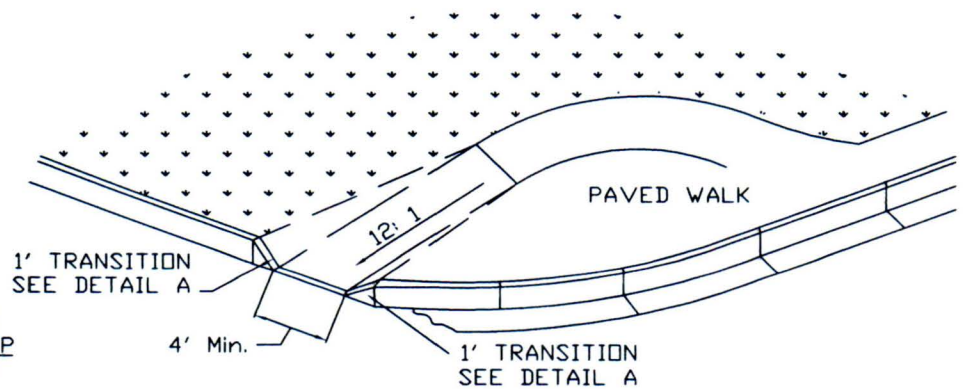
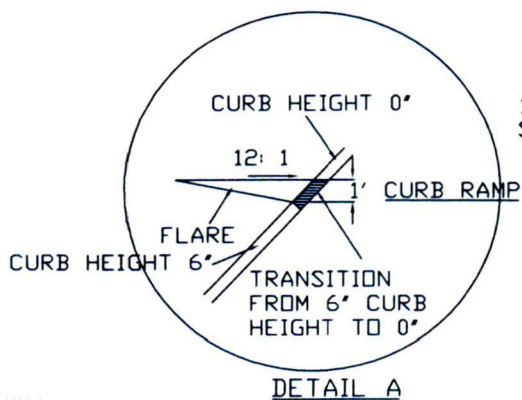
PLAN VIEW



CONCRETE WALK SECTION



EXPANSION JOINT



VIEW OF CURB OPENING AT STREET, SIDEROAD,
ALLEY OR COMMERCIAL APPROACHES.

Date Revised: October 2004

By: sh

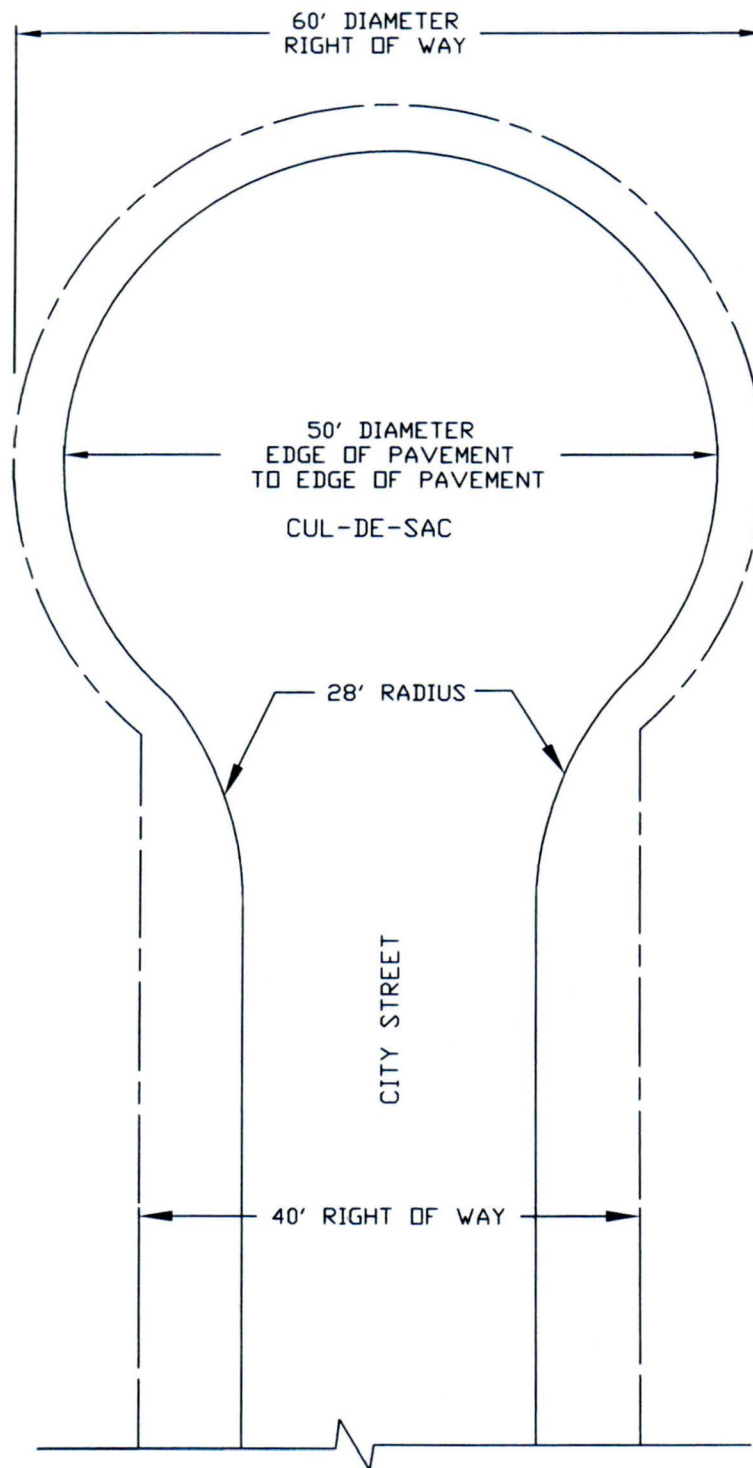
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CITY OF OSAGE BEACH
TYPICAL DETAIL
SIDEWALK

Design Guideline:
SECTION 5

ROADS, STREETS AND PARKING AREAS

Drawing No: V-6



Date Revised:
October 2004

By:
sh

Checked By:
jb

CITY OF OSAGE BEACH
TYPICAL DETAIL
CUL-DE-SAC

Design Guideline:
SECTION 5

ROADS, STREETS AND
PARKING AREAS

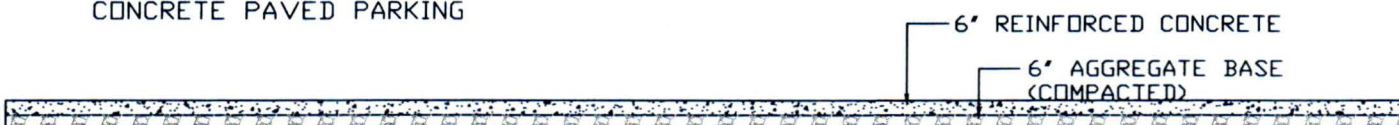
Drawing No:

V-7
Page 189 of 231

ASPHALT PAVED PARKING



CONCRETE PAVED PARKING

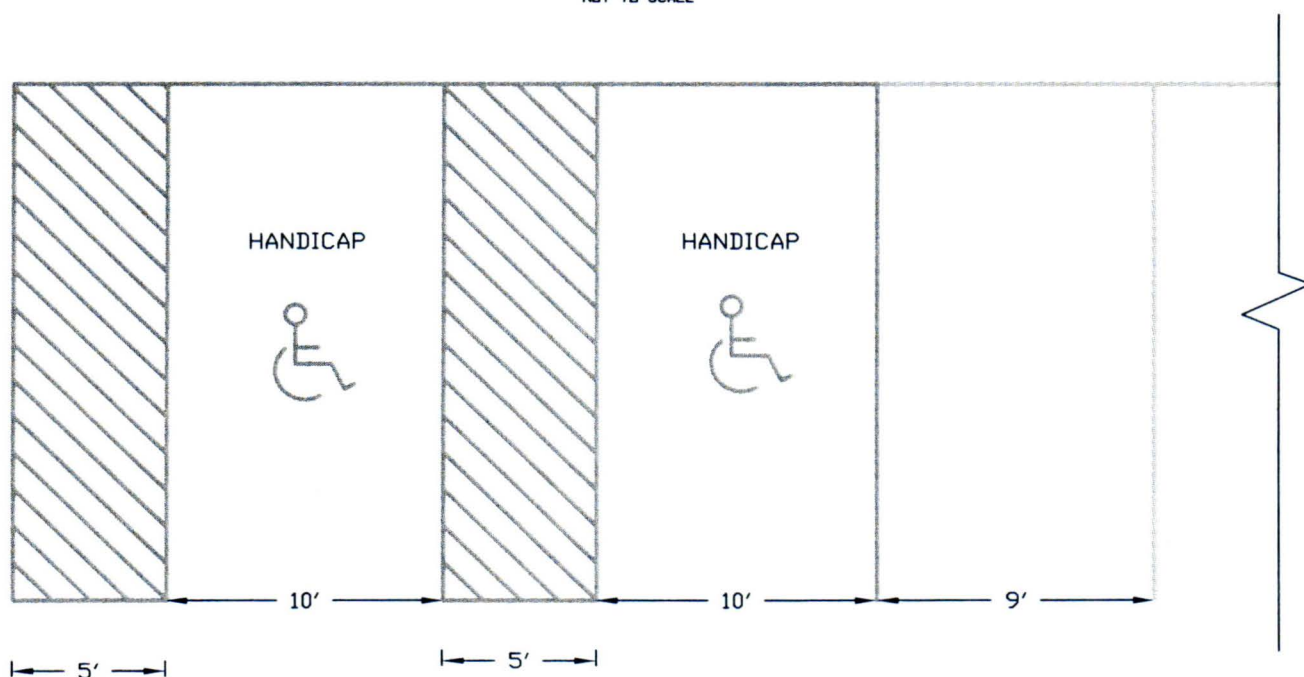


REINFORCEMENT SHALL BE #2 BAR @ 12" CTRS.

MINIMUM CROSS-SLOPES FOR DRAINAGE IS .5% ONE AXIS AND 1.0% TRANSVERSE AXIS.

TYPICAL STRUCTURAL SECTION PAVED PARKING

NOT TO SCALE



NOTE:
ALL PARKING LINES ARE 4"X 17 1/2"
HANDICAP EMBLEMS ARE AT LEAST 34" W
BY 39" H
ALL PAINT AND PAINT APPLICATIONS
SHALL CONFORM TO MoDOT SPECIFICATIONS.

TYPICAL MARKED PARKING AREA WITH HANDICAP PARKING

NOT TO SCALE

Date Revised:
October 2004

By:
sh

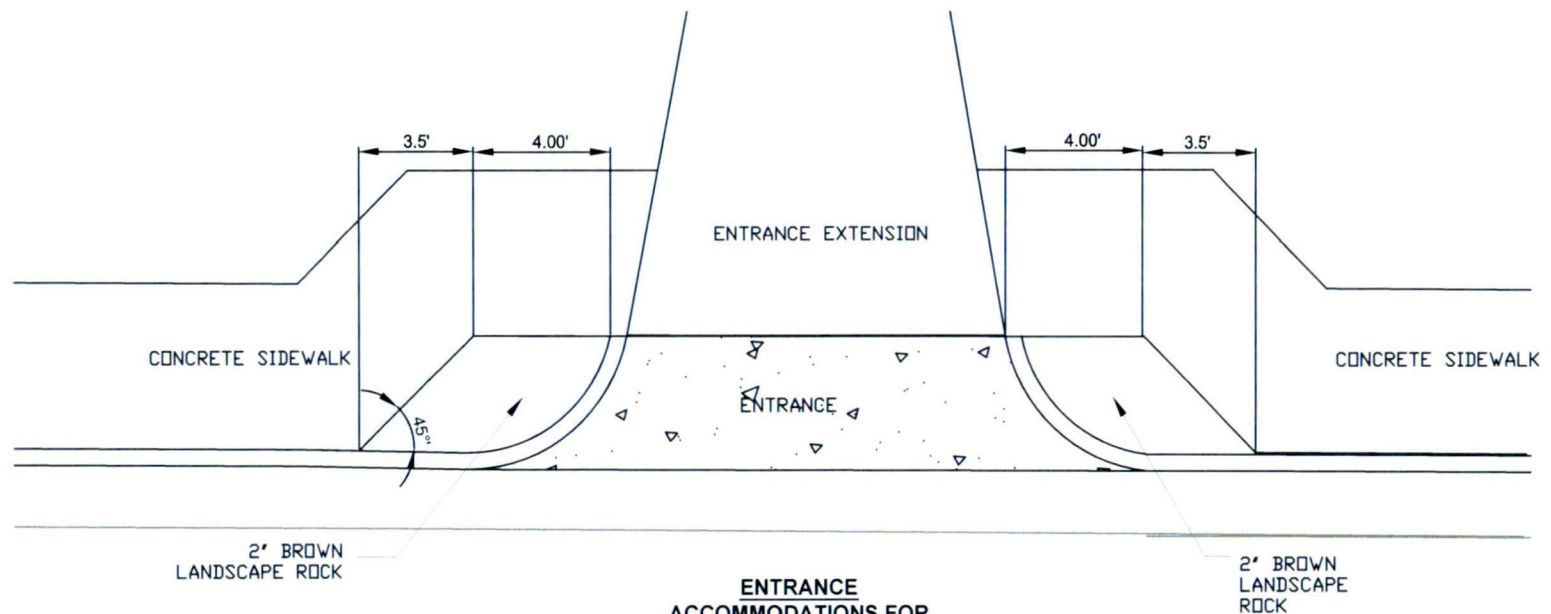
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jb

CITY OF OSAGE BEACH
TYPICAL DETAIL
PARKING AREA

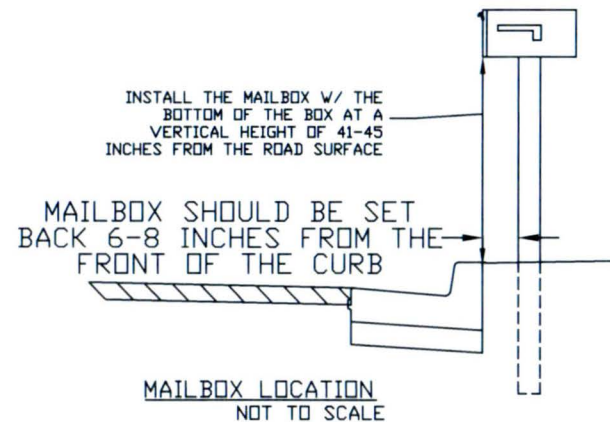
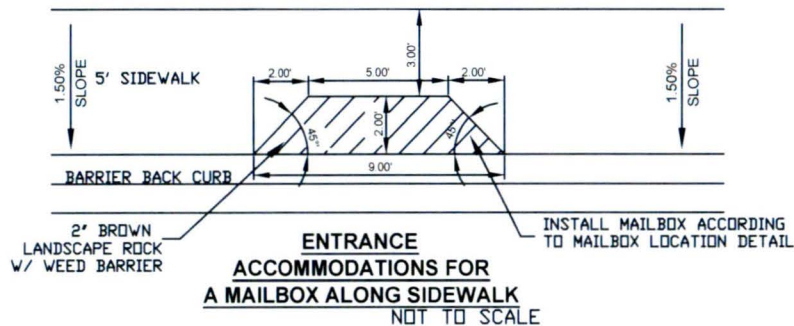
Design Guideline:
SECTION 5

ROADS, STREETS AND
PARKING AREAS

Drawing No:
V-8



**ENTRANCE
ACCOMMODATIONS FOR
A MAILBOX ALONG SIDEWALK**
NOT TO SCALE



Date Revised:
JUNE 2017

By:
MLM

Checked By:
NE

CITY OF OSAGE BEACH TYPICAL SIDEWALK SECTION MAILBOX ACCOMMODATIONS

Design Guideline:
SECTION 5

ROADS, STREETS AND
PARKING AREAS

Drawing No.
V-9

OVERVIEW

This chapter establishes design guidelines for the construction of roads, streets, and parking areas within the jurisdictional boundaries of the City of Osage Beach. It also establishes the guidelines for reconstruction, improvement, and maintenance of existing streets within the city. Design standards are based upon the AASHTO Policy on the Geometric Design of Highways and Streets and the Supplement for Design of Very Low Volume Local Roads, ≤ 400 Average Daily Traffic (ADT).

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1. Collector Street with over 3,000 ADT: Major lake roads such as Nichols Road, Passover Road, and Bluff Road.
2. Collector Street with 1,000 to 3,000 ADT: Lake Roads such as Case, Jefferies, Malibu, and Lazy Days.

The design criterion shall be as indicated in Table I - Design Criterion

C. Local Streets. Local streets are relatively low traffic neighborhood streets that provide access to residences or business locations and connect to collector streets. Local Streets are subdivided into four classifications:

1. Local Street with over 1500 ADT: Relatively busy neighborhood streets that serve several residences and/or condo units and connect to collectors and lesser local streets such as Dogwood Lane, Airport Road, Sunset Drive, lesser traveled portions of Nichols Road and Dude Ranch Road, etc.

Design Guidelines
City Of Osage Beach
SECTION 5 - ROADS, STREETS AND PARKING AREAS

2. Local Street with between 400 and 1500 ADT: Neighborhood streets serving more than ten residences or condo units, and connecting to lesser local streets. May be dead end streets similar to: Wilson Drive, Broadwater Drive, Wyrick Road, etc.
3. Local Street with less than 400 ADT: Low use, usually dead end, streets serving less than ten residences similar to Cedar Village Lane, Sleepy Hollow Lane, End of Hawthorne Drive, etc.

The design criterion shall be as indicated in Table I - Design Criterion

DEAD END STREETS

- A. Cul-de-sacs shall be constructed on all dead-end streets and shall meet the following criterion:
 1. The minimum diameter shall be 50 feet (edge of pavement to edge of pavement).
 2. The minimum easement or right of way shall be 60 feet diameter, or back of cut or fill slope as determined by the City Engineer.
 3. In cases where terrain and other constraints prohibit the construction of a cul-de-sac a “turn-around tee” may be constructed with the approval of the City Engineer. The use of a cul-de-sac is preferred.

RESIDENTIAL PARKING AND COMMERCIAL PARKING AREAS

- A. Residential Parking
 1. Each residential property owner shall provide sufficient off street parking for his or her individual needs. Parking on the city street will not be permitted.
- B. Public Parking Areas
 1. All public and commercial facilities (except those in areas zoned as industrial) shall provide adequate parking to serve the public and employees as specified in the City of Osage Beach City Code Section ~~405.480~~ **405.630 thru 405.670**, Off-Street Parking and Loading Requirements. In addition all commercial and public parking shall meet the following requirements:
 - a. All commercial, industrial, and/or public parking areas shall be asphalt or concrete paved.
 - b. The minimum structural section for asphalt paved parking areas shall be three inches of asphalt pavement on a minimum of eight inches of Type **V** ~~I-B~~ Base.

Design Guidelines
City Of Osage Beach
SECTION 5 - ROADS, STREETS AND PARKING AREAS

- e. The minimum structural section for concrete paved parking areas shall be six inches of reinforced concrete pavement on six inches of Type ~~V I-B~~ Base. ~~Reinforcement shall be # 2 bars at 12" on centers both ways or equivalent.~~
- d. ADA handicapped parking shall be in accordance with:
 - 1) City of Osage Beach Code Section ~~405.665~~ 405.530.
 - 2) Handicapped access ramps shall be provided as necessary.
- e. The parking area shall be drained to suitably designed storm drainage systems. Refer to the Storm Drainage Guidelines.
- f. Minimum cross-slopes for drainage shall be 0.5% for one axis and 1.0% for the transverse axis.
- g. The minimum radius for edge of pavement at entrance and exit shall be 20 feet.
- h. The minimum width of entranceway for one-way entrances shall be 12 feet, and for two-way entrances shall be 24 feet.
- i. The maximum allowable entry width for commercial parking areas shall be 40 ft, edge of pavement to edge of pavement.

EXISTING CITY STREETS – RECONSTRUCTION AND UPGRADING

- A. Many of the existing city streets do not conform to the above standards. In many cases there is inadequate right-of-way and manmade or natural obstructions that preclude significant improvement of the street. In order to accommodate these problems the following shall apply to all existing city streets.
 - 1. Arterial, Collector, and Local Streets with an ADT of over 1000 will be upgraded to the new construction standards to the maximum extent practicable. Substandard streets shall be upgraded in order of priority as set by the City Engineer, and approved by the Board of Aldermen.
 - 2. Streets with an ADT of less than 1000 will be maintained to a driveable condition approximating their condition at the time of acceptance by the city until such time as increased traffic loading or safety consideration warrant upgrading them to new construction standards, providing the City has available funding. In many cases it will not be practicable to do so. In these cases the street will be upgraded by minor grading, overlay asphalt pavements, mitigation of safety issues, and construction of drainage facilities where required. Such upgrades and improvement will be prioritized. The priority shall be set by the City Engineer and approved by the Board of Aldermen.

Design Guidelines
City Of Osage Beach
SECTION 5 - ROADS, STREETS AND PARKING AREAS

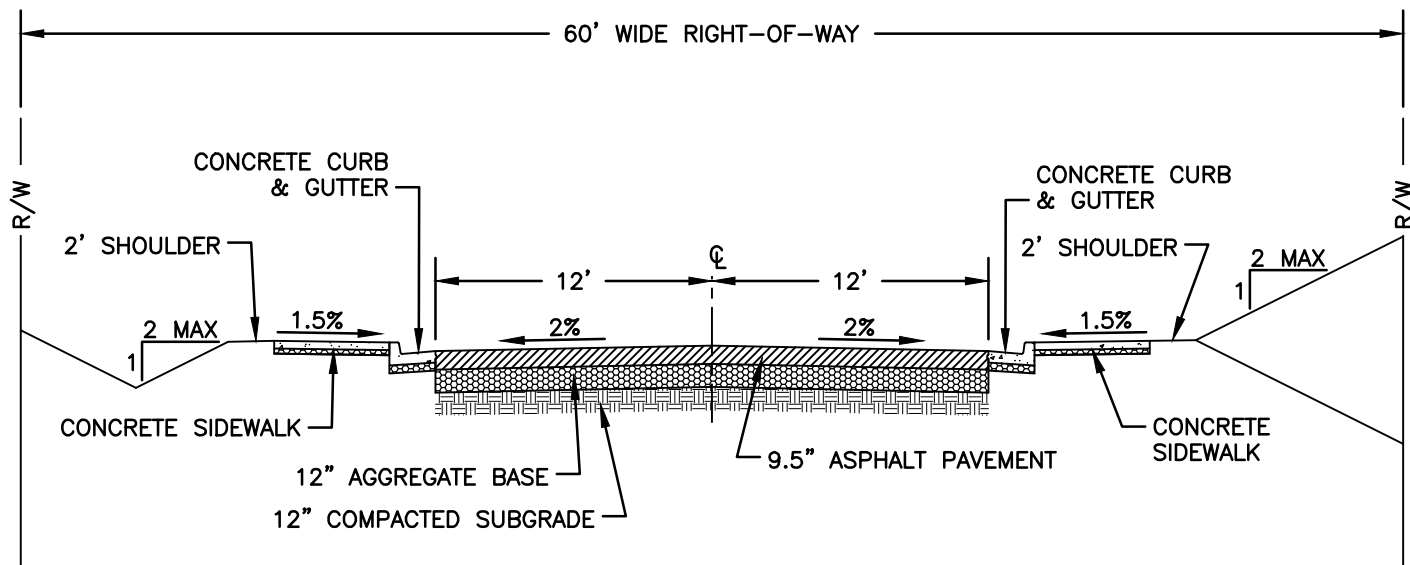
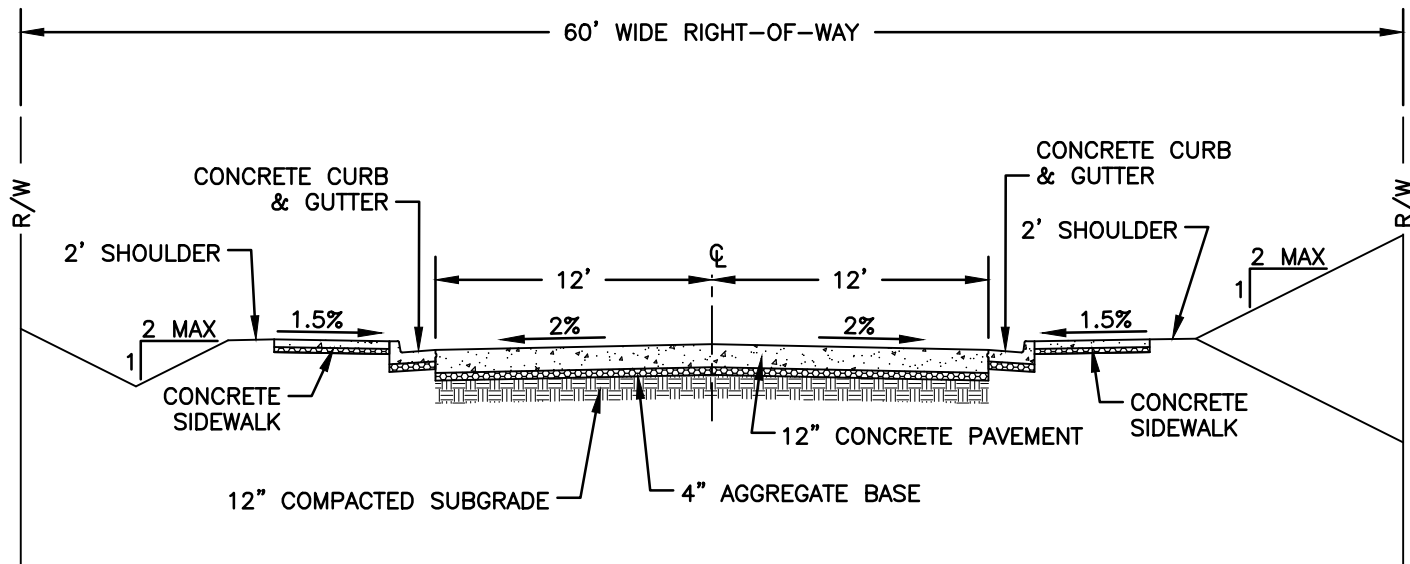
EXISTING CITY STREETS – MAINTNENACE

- A. It is the intent of this guideline that existing city streets shall be maintained in a safe, drivable condition to the maximum extent practicable with consideration given to current available funding and staffing limitations.
- B. In general, the roadways will be maintained to the standard at which they were accepted into the city inventory. In cases where citizen complaints, staff investigations, or the Capital Infrastructure Advisory Committee deems appropriate the Board of Aldermen shall be requested to make improvements to the roadway. This request shall be in the form of a formal request from at least 50% of the persons or businesses located along the street in question. The request will be reviewed by the Capital Infrastructure Advisory Committee, the City Engineer, and Superintendent of Public Works and recommended to the Board of Aldermen. In general, improvements will be made only in accordance with the appropriate priority list and when funding is available.
- C. Snow and Ice Removal
 - 1. There are a few existing streets that are inaccessible to city snow plowing equipment. In cases where the street can not be safely plowed by existing city equipment or other safety concerns are prohibitive the street will be placed upon a no-plow list at the time the street is accepted into the city inventory. Streets to be placed on the no-plow list shall be recommended by the Department of Public Works, and be approved by the Board of Aldermen. They will remain on the no-plow list until they are upgraded to new construction standards.

ROADS, STREETS AND PARKING CONSTRUCTION DETAIL DRAWINGS

Construction details and sketches are attached.

END



Date Revised:
APRIL 2021

By:
EAH

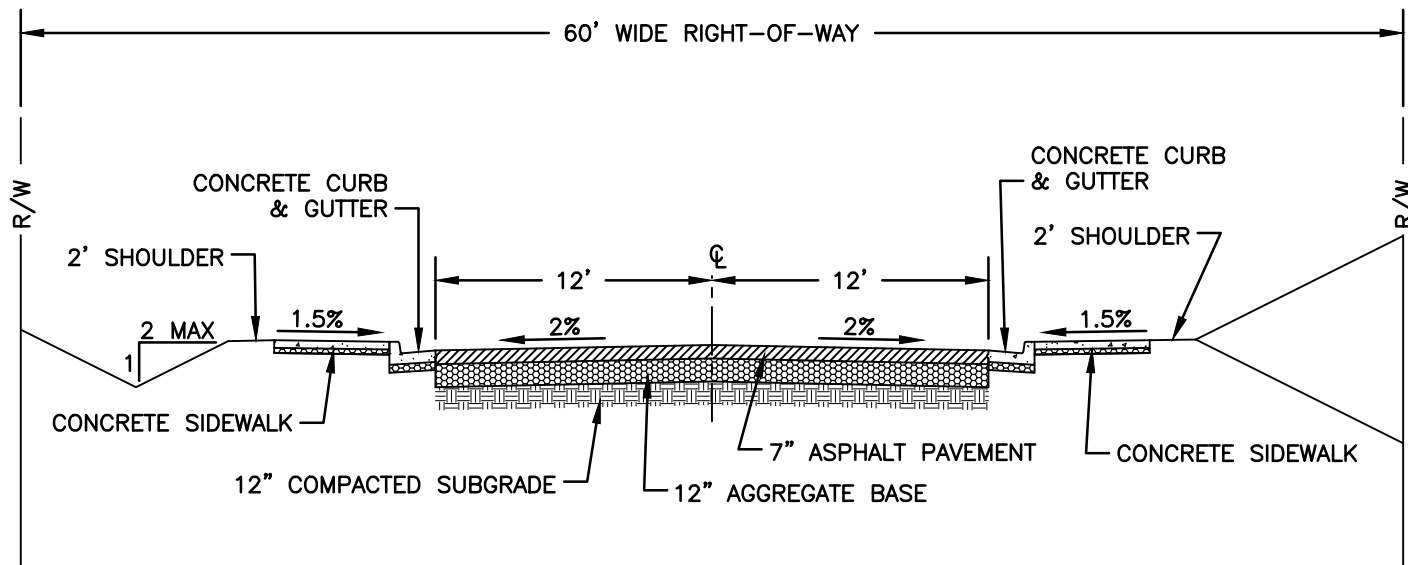
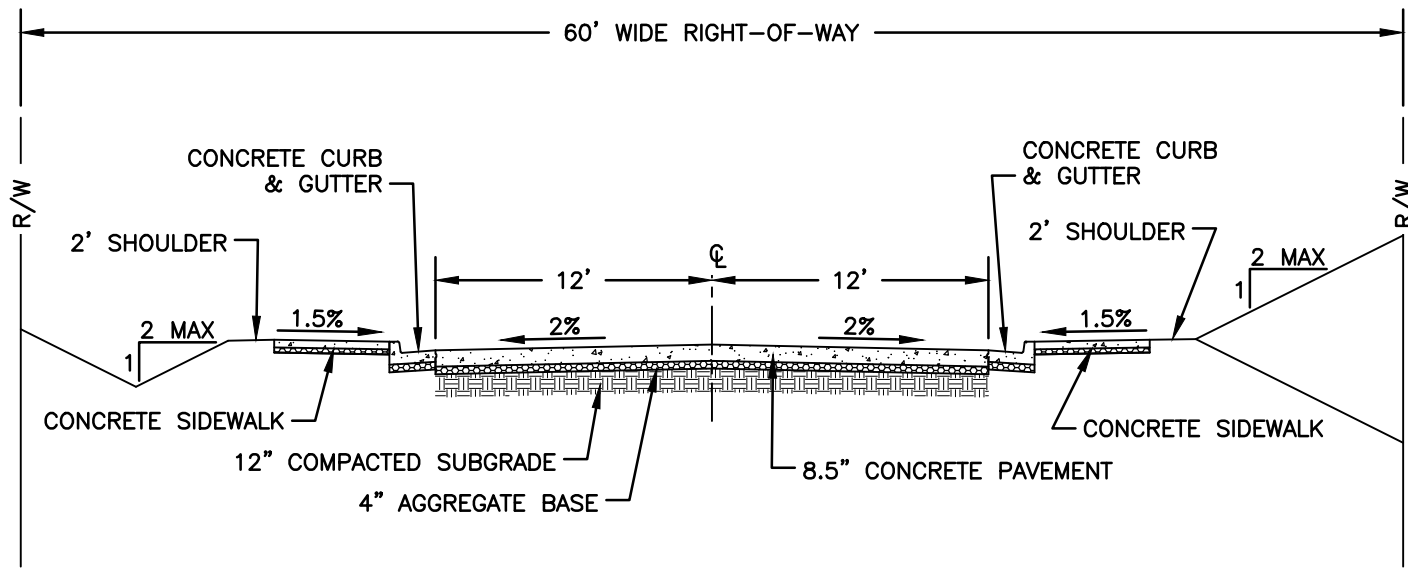
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CITY OF OSAGE BEACH
TYPICAL DETAIL
ARTERIAL STREET 10,000 TO 50,000 ADT

Design Guideline:
SECTION 5

ROADS, STREETS AND
PARKING AREAS

Drawing No:
V-1



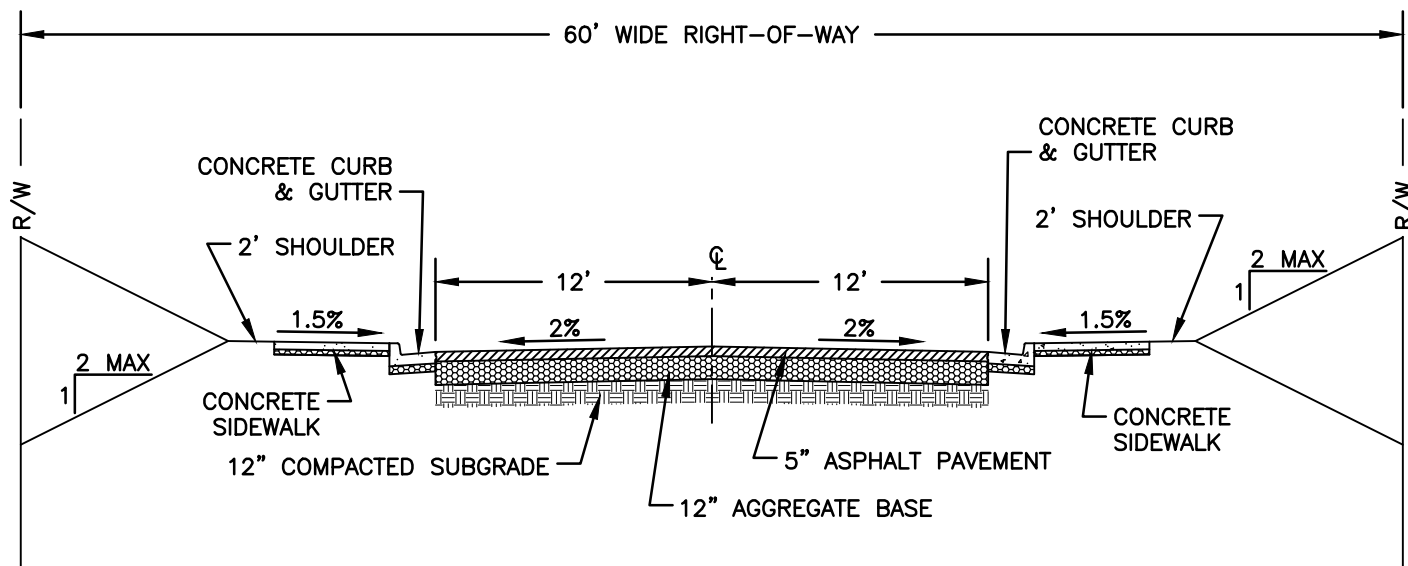
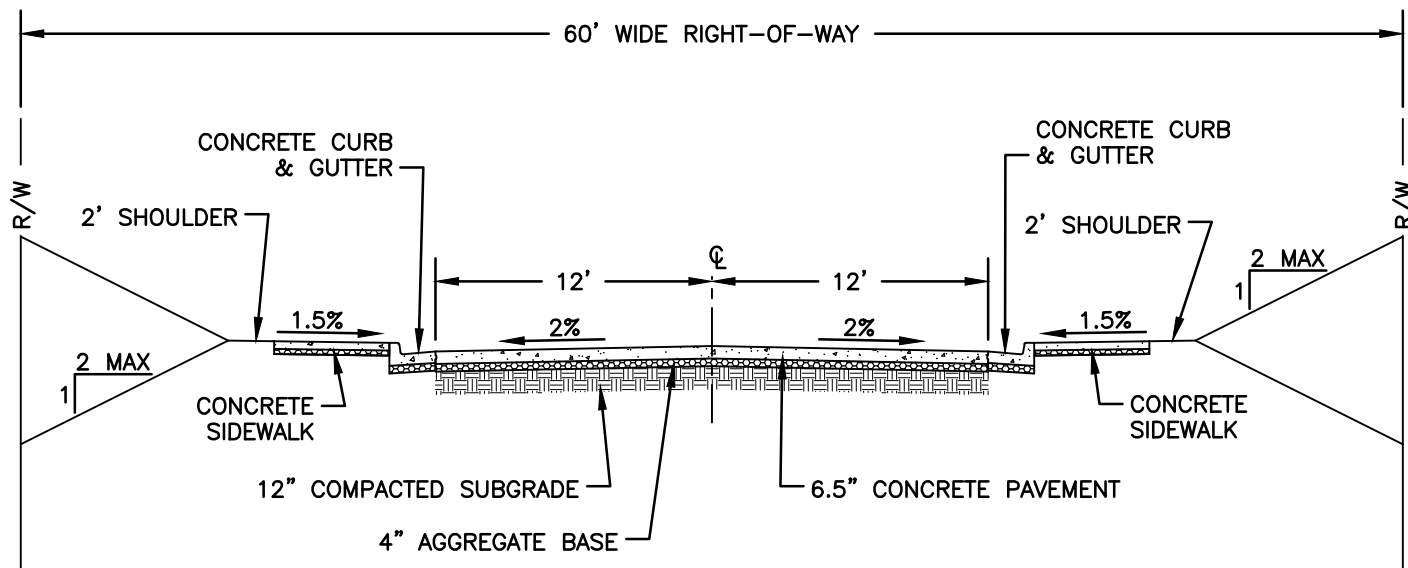
Date Revised:
APRIL 2021

By:
EAH

Checked By:

CITY OF OSAGE BEACH
TYPICAL DETAIL
ARTERIAL STREET 5,000 TO 10,000 ADT

Design Guideline:
SECTION 5
ROADS, STREETS AND
PARKING AREAS
Drawing No:
V-2



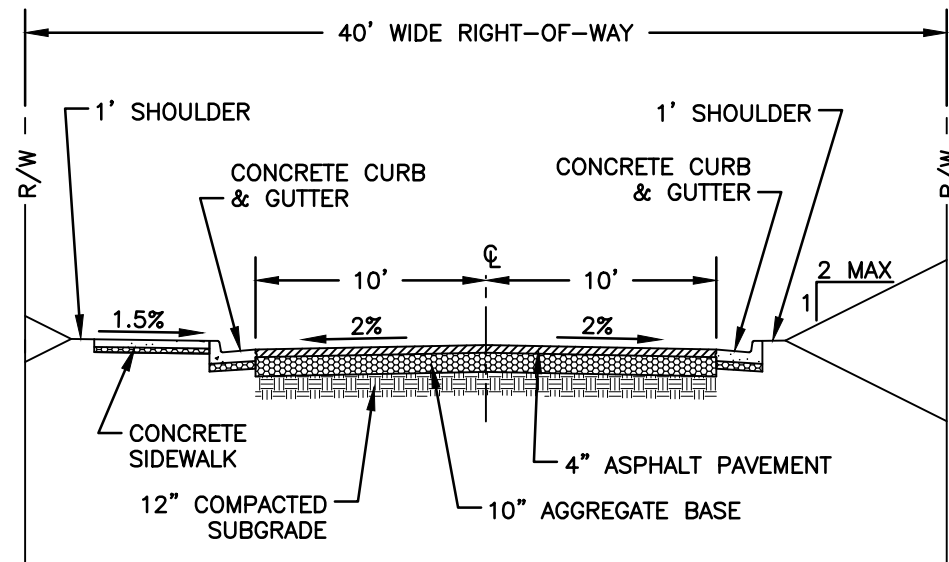
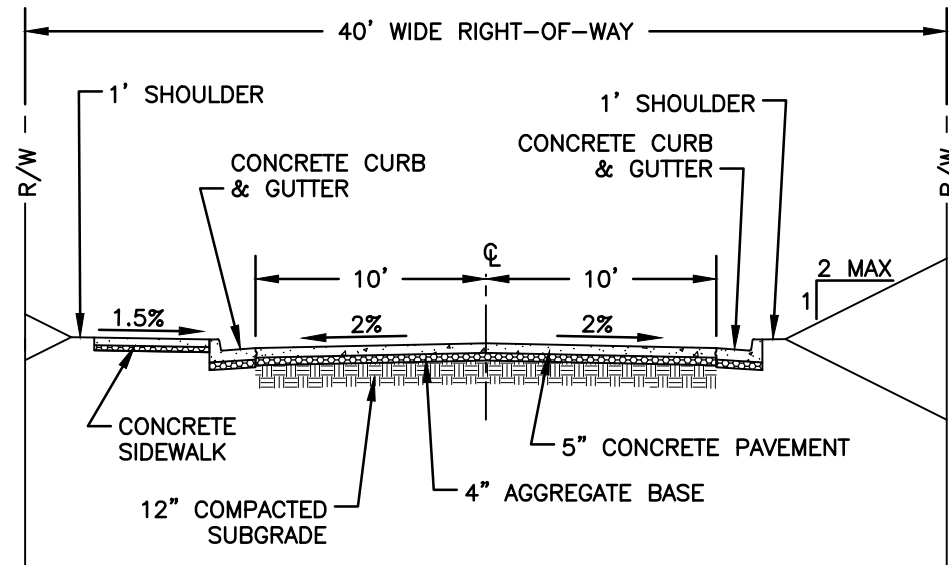
Date Revised:
APRIL 2021

By:
EAH

Checked By:

CITY OF OSAGE BEACH
TYPICAL DETAIL
COLLECTOR STREET

Design Guideline:
SECTION 5
ROADS, STREETS AND
PARKING AREAS
Drawing No:
V-3



Date Revised:
APRIL 2021

By:
EAH

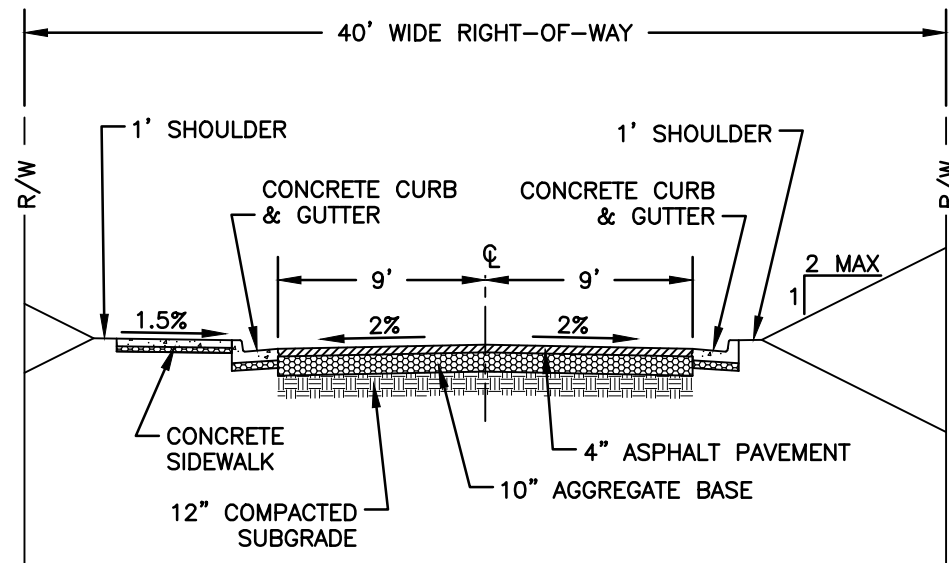
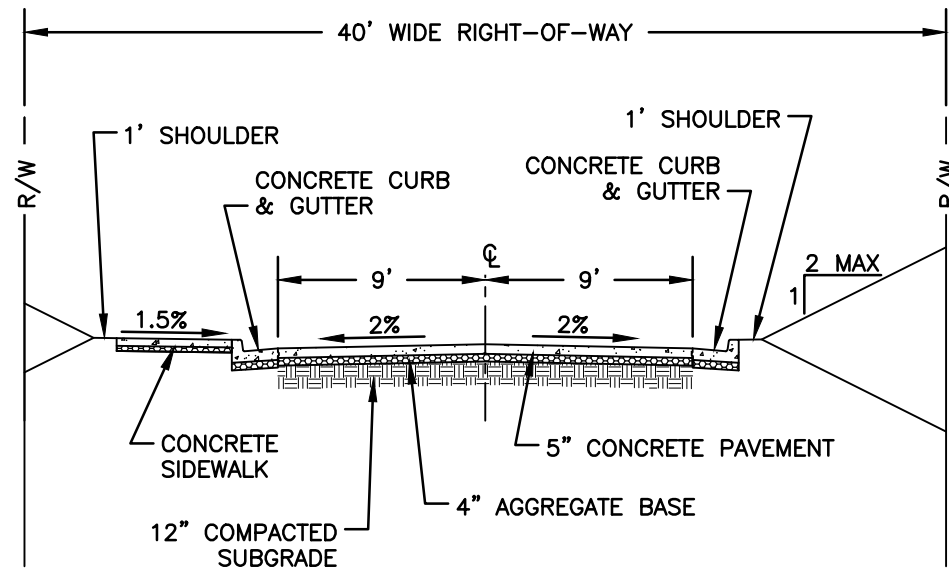
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CITY OF OSAGE BEACH
TYPICAL DETAIL
LOCAL STREET 400 TO 1,500 ADT

Design Guideline:
SECTION 5

ROADS, STREETS AND
PARKING AREAS

Drawing No:
V-5



Date Revised:
APRIL 2021

By:
EAH

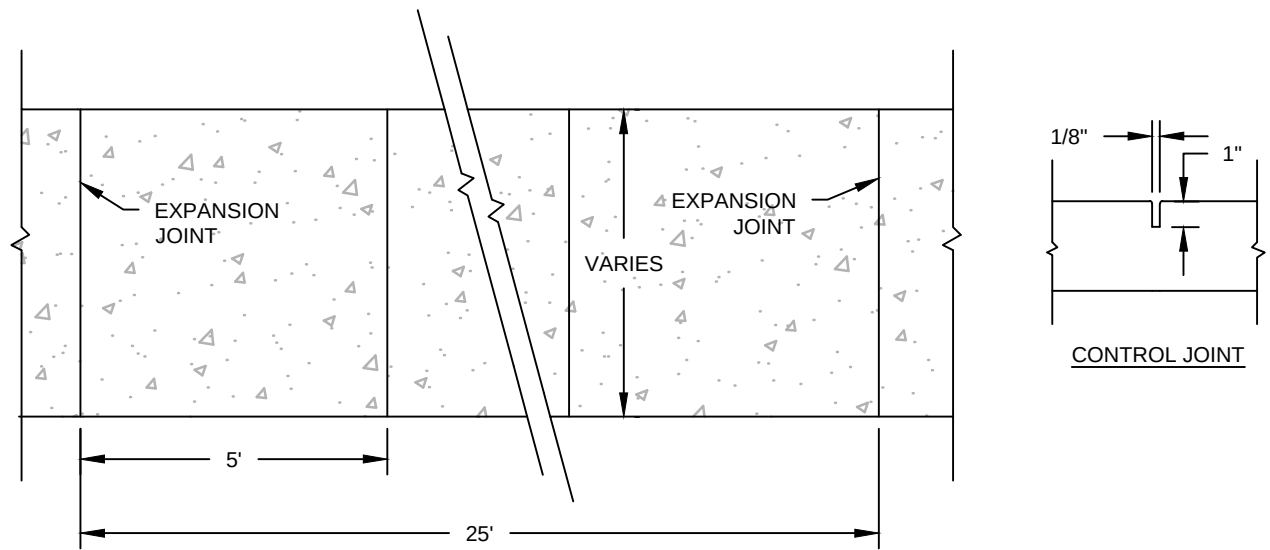
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CITY OF OSAGE BEACH
TYPICAL DETAIL
LOCAL STREET LESS THAN 400

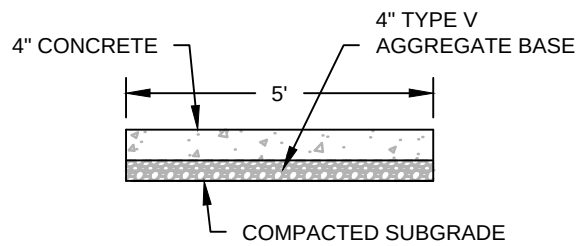
Design Guideline:
SECTION 5

ROADS, STREETS AND
PARKING AREAS

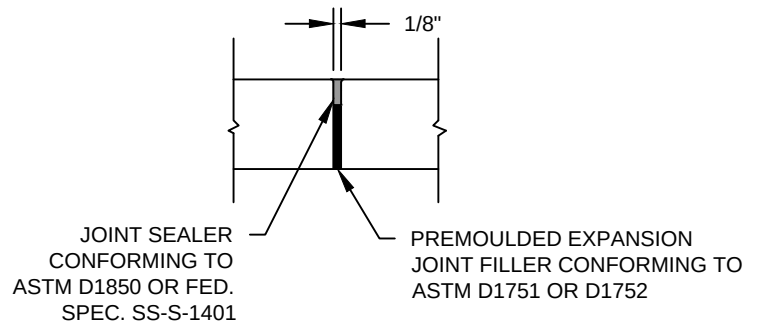
Drawing No:
V-6



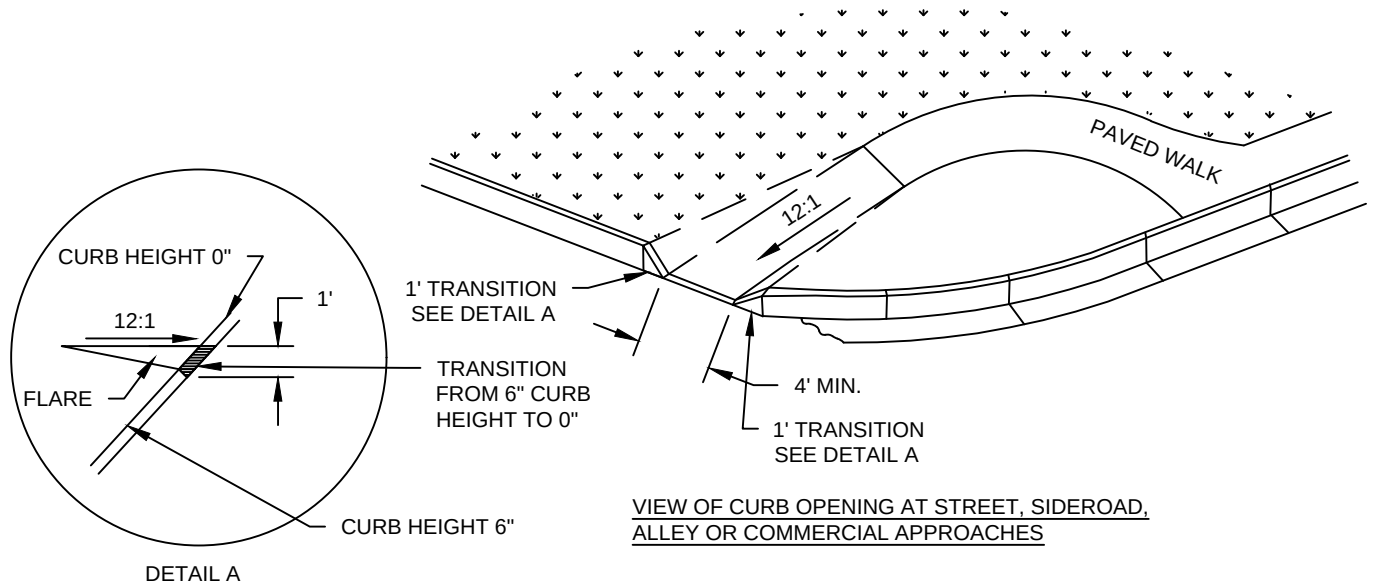
PLAN VIEW



CONCRETE WALK SECTION



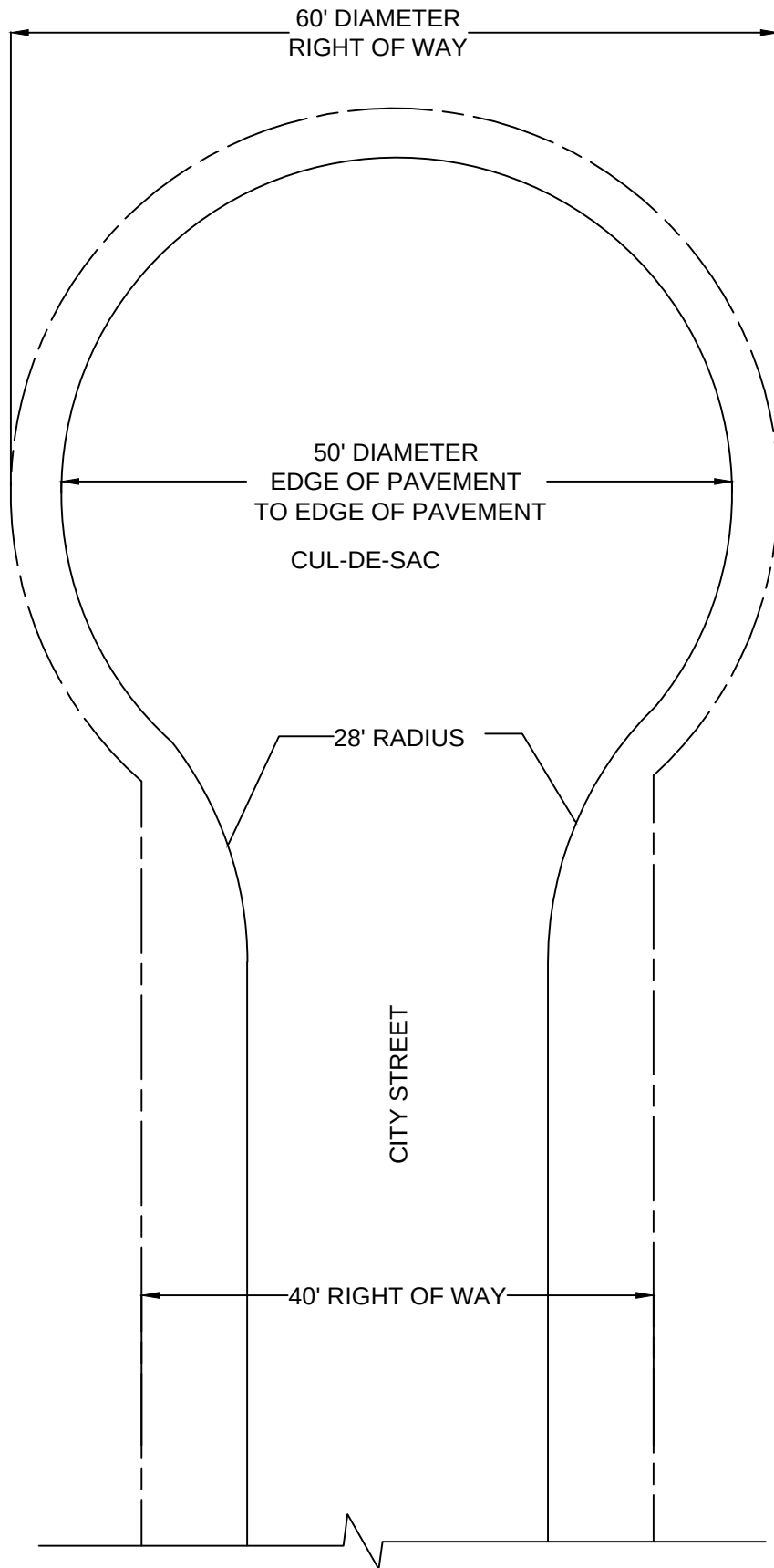
EXPANSION JOINT



DETAIL A

VIEW OF CURB OPENING AT STREET, SIDEWALK,
ALLEY OR COMMERCIAL APPROACHES

Date Revised: APRIL 2014	CITY OF OSAGE BEACH TYPICAL DETAIL SIDEWALK	Design Guideline: SECTION 5
By: JMY		ROADWAY, STREETS, AND PARKING
Checked By: SLB		Drawing No.: V - 8

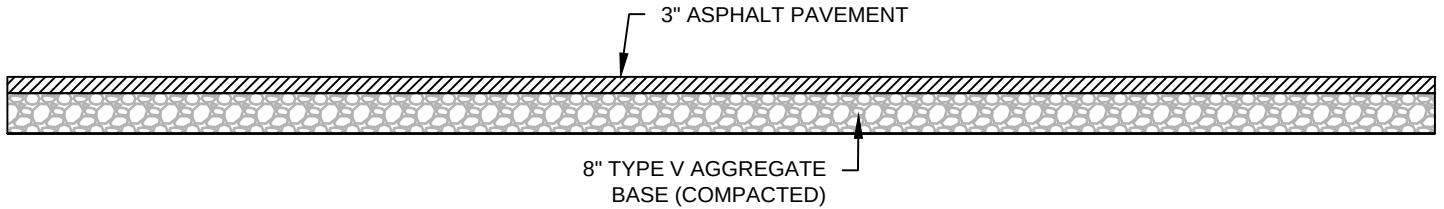


Date Revised:	APRIL 2014
By:	JMY
Checked By:	SLB

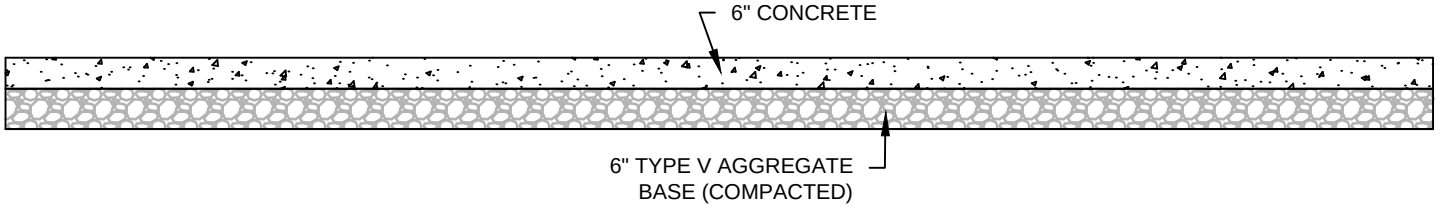
**CITY OF OSAGE BEACH
TYPICAL DETAIL
CUL-DE-SAC**

Design Guideline:	SECTION 5
	ROADWAY, STREETS, AND PARKING
Drawing No.:	V - 9

ASPHALT PAVEMENT PARKING

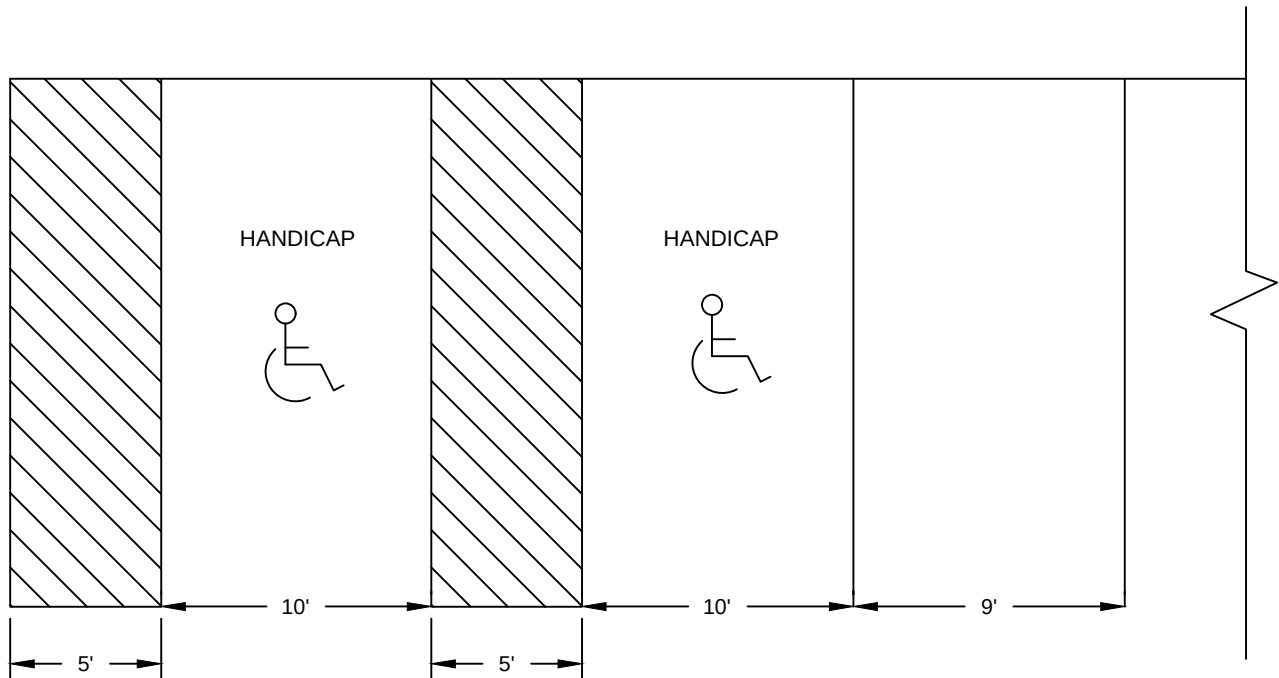


CONCRETE PAVEMENT PARKING



MINIMUM CROSS-SLOPES FOR DRAINAGE IS 0.5% ONE AXIS AND 1.0% TRANSVERSE AXIS.

TYPICAL STRUCTURAL SECTION PAVED PARKING
NOT TO SCALE



NOTE:

ALL PARKING LINES ARE 4"x 17- $\frac{1}{2}$ "
HANDICAP EMBLEMS ARE AT LEAST 34" WIDE
BY 39" HEIGHT
ALL PAINT AND PAINT APPLICATIONS SHALL
CONFORM TO MoDOT SPECIFICATIONS

TYPICAL MARKED PARKING AREA WITH HANDICAP PARKING
NOT TO SCALE

Date Revised:

APRIL 2014

By:

JMY

Checked By:

SLB

CITY OF OSAGE BEACH TYPICAL DETAIL PARKING AREA

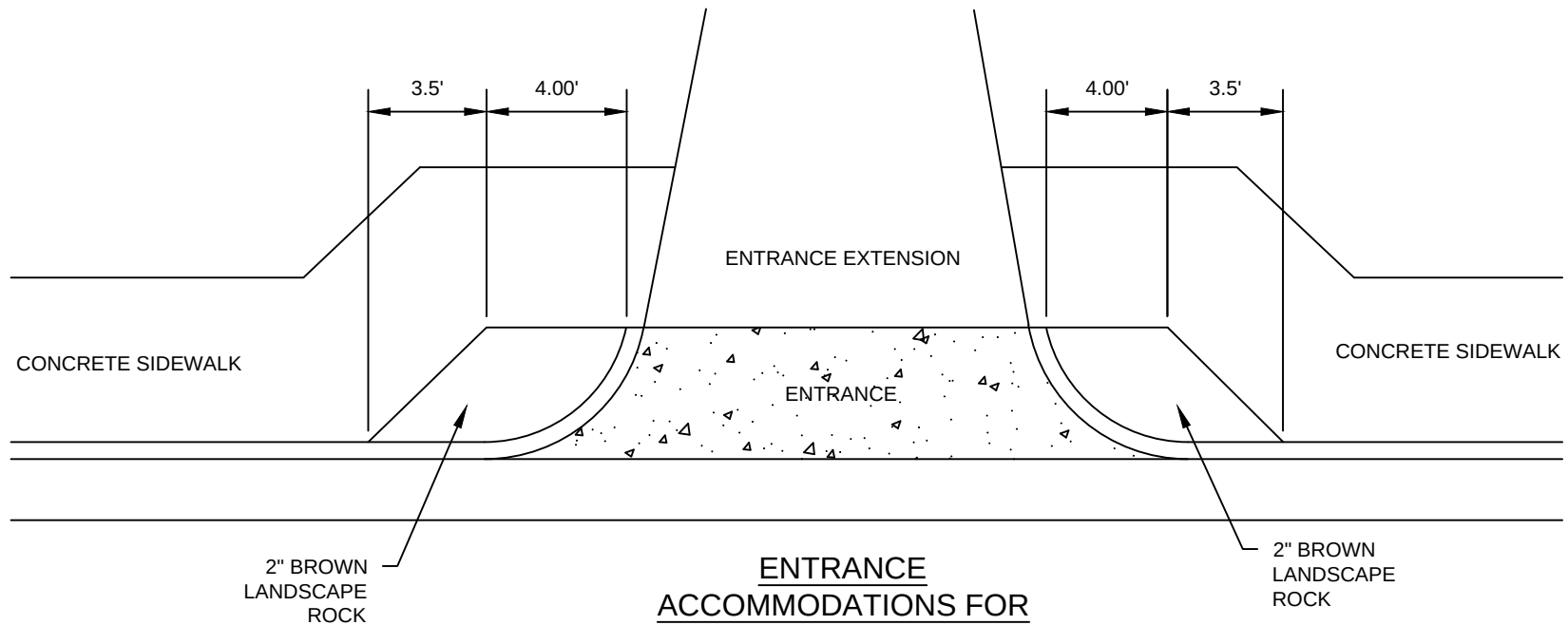
Design Guideline:

SECTION 5

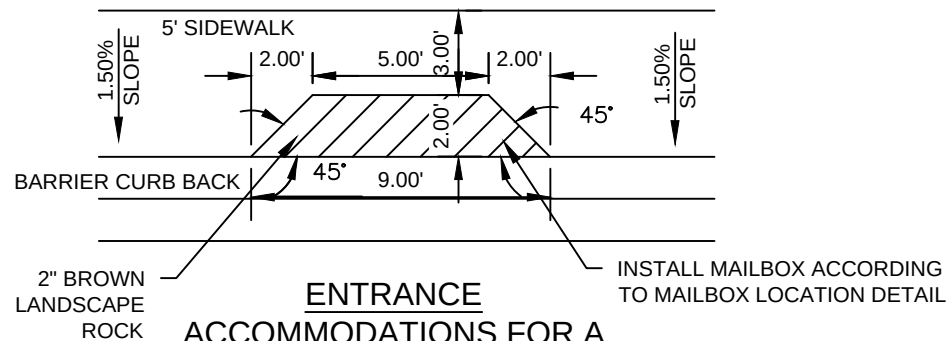
ROADWAY, STREETS,
AND PARKING

Drawing No.:

V - 10



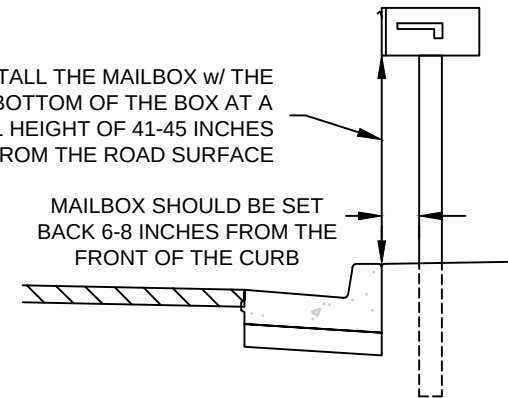
**ENTRANCE
ACCOMMODATIONS FOR
A MAILBOX ALONG SIDEWALK**
NOT TO SCALE



**ENTRANCE
ACCOMMODATIONS FOR A
MAILBOX ALONG SIDEWALK**
NOT TO SCALE

INSTALL THE MAILBOX w/ THE
BOTTOM OF THE BOX AT A
VERTICAL HEIGHT OF 41-45 INCHES
FROM THE ROAD SURFACE

MAILBOX SHOULD BE SET
BACK 6-8 INCHES FROM THE
FRONT OF THE CURB



MAILBOX LOCATION
NOT TO SCALE

Date Revised:
JUNE 2017

By:
MLM

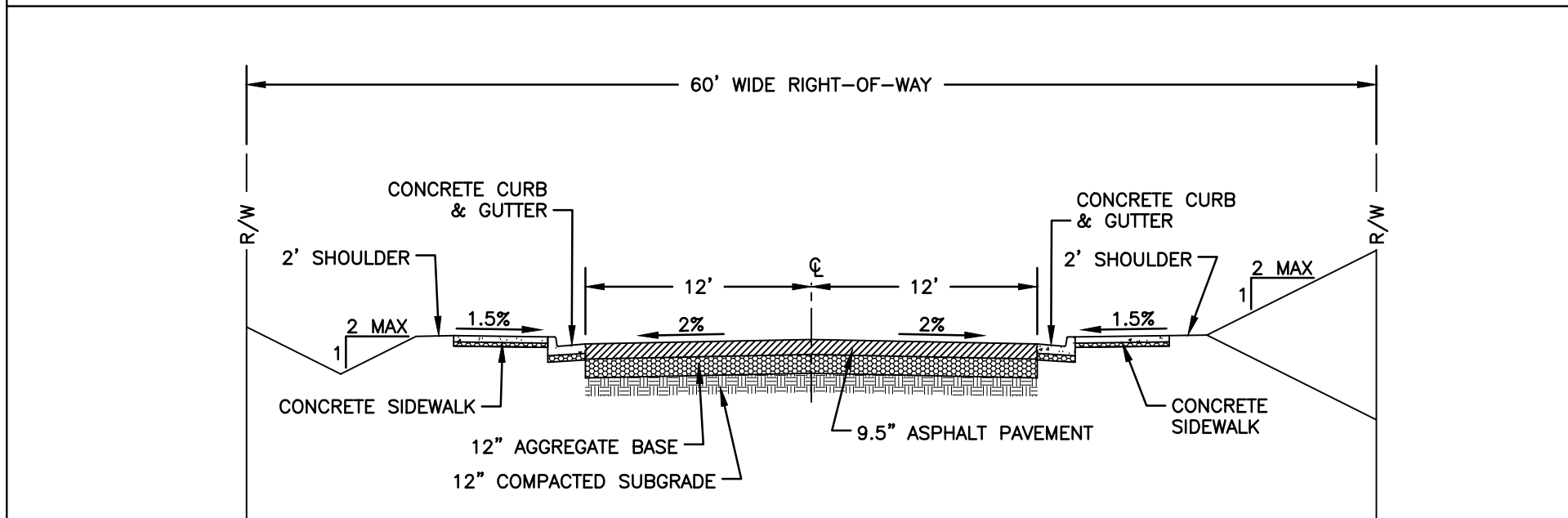
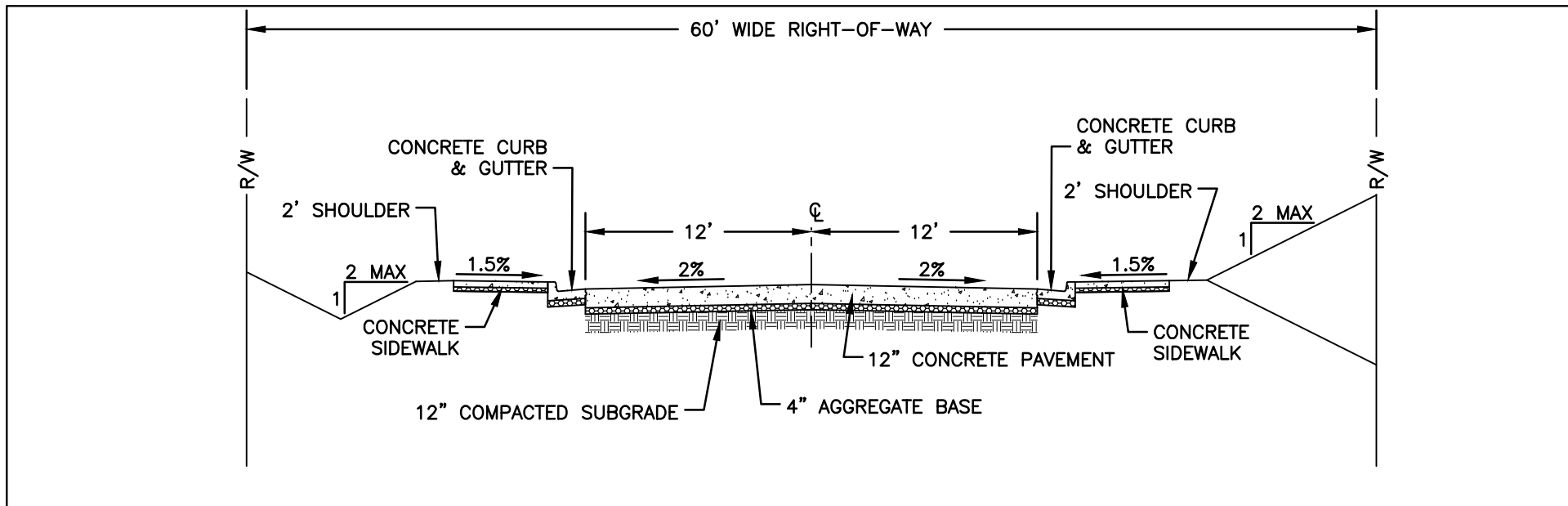
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**CITY OF OSAGE BEACH
TYPICAL DETAIL
MAILBOX ACCOMMODATIONS**

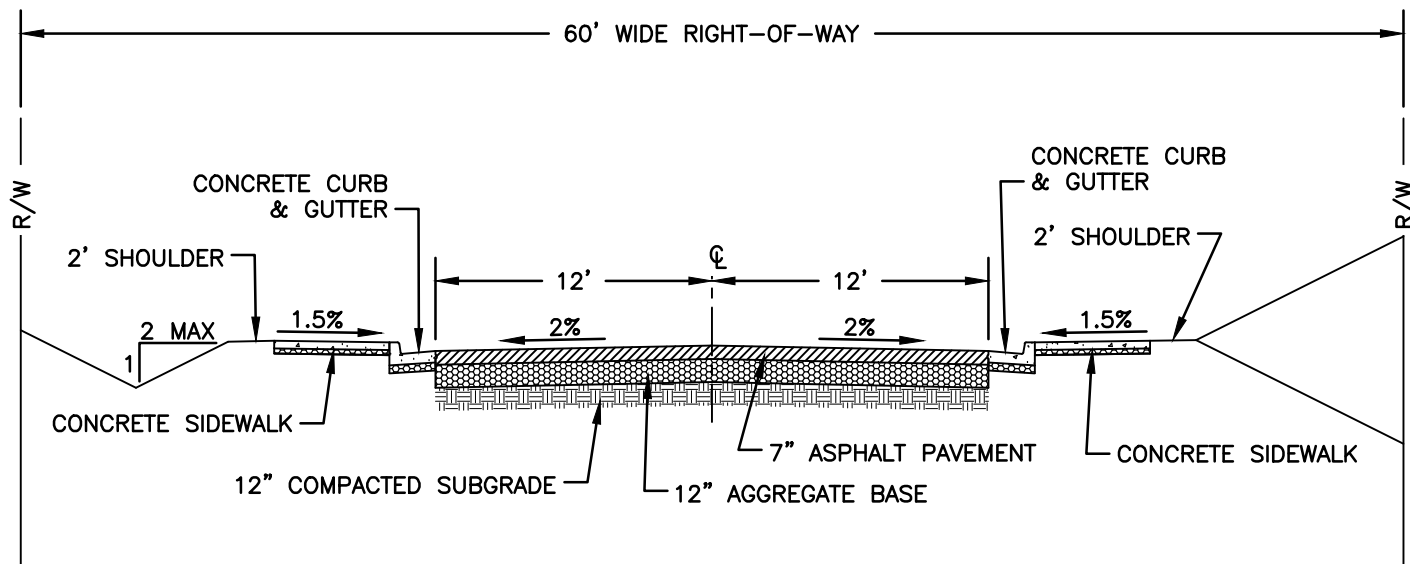
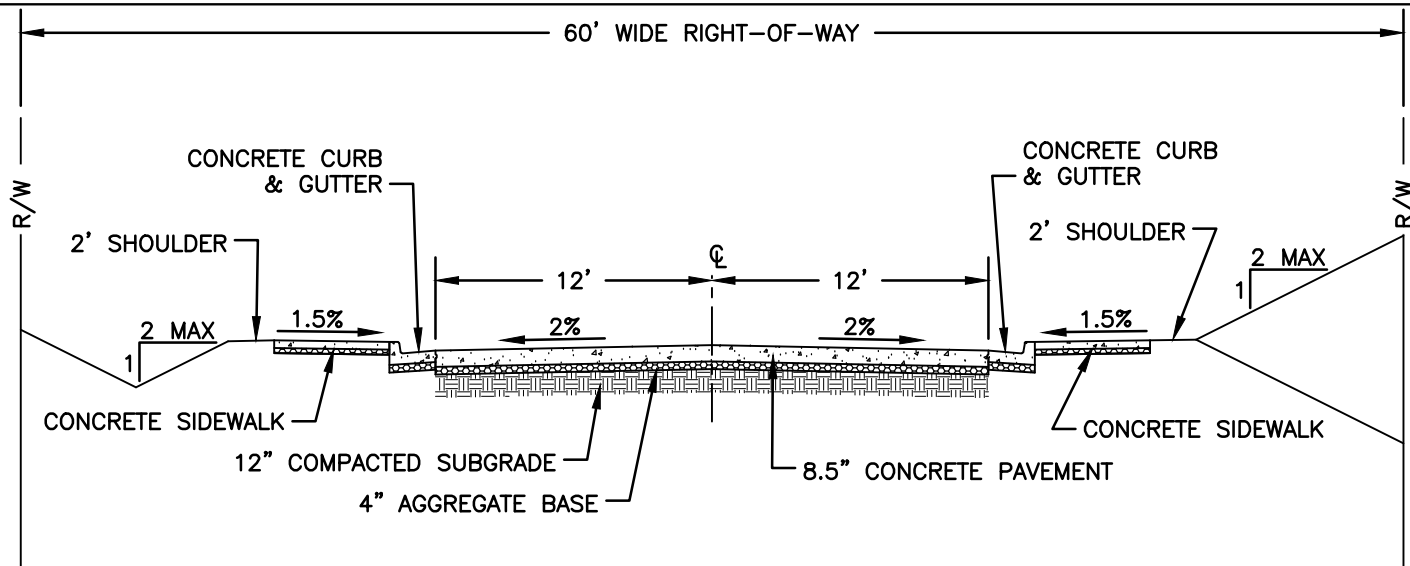
Design Guideline:
SECTION 5
ROADS, STREETS AND
PARKING AREAS
Drawing No:
V-11

Design Guidelines
City of Osage Beach
SECTION 5 - ROADS, STREETS AND PARKING AREAS

TABLE I - STREET AND ROADWAY DESIGN CRITERION									
DESIGN CRITERION	ARTERIAL			COLLECTOR		LOCAL STREET			ONE WAY
	Over 50,000 ADT	10,000 to 50,000 ADT	5,000 to 10,000 ADT	Over 3,000 ADT	1,500 to 3,000 ADT	Over 1,500 ADT	400 to 1,500 ADT	Less Than 400 ADT	Less Than 400 ADT
Design Speed (mph)	MoDOT	45	35	25	25	25	15	10	10
No. of Lanes	MoDOT	3 to 5	2	2	2	2	2	2	1
Width of Lane (ft)	MoDOT	12	12	12	12	12	10	9	14
Minimum Curve Radius (ft)	MoDOT	730	420	205	165	165	100	45*	45*
						* Minimum width of pavement is 23 ft. curb to curb			
Maximum Super Elevation	MoDOT	4%	4%	4%	0	0	0	0	0
Minimum Curve Widening, (ft) Vehicle Type WB-50	MoDOT	2	4.5	7	8	8	8	5**	5**
						** Two-way streets only - see above			
Minimum Intersection Inside Curb Radius	MoDOT	70	50	50	30	30	30	30	30
Maximum Grade	MoDOT	8%	12%	12%	12%	15%	15%***	15%***	15%***
						***Steeper grades with approval of City Engineer			
Max. K Value	MoDOT	61	29	29	19	12	12	3	3
Minimum Sight Distance	MoDOT	360	250	155	155	155	100	80	80
Structural Cross Section									
Asphaltic Concrete									
Pavement	MoDOT	9.5"	7"	5"	5"	4"	4"	4"	4"
Aggregate Base	MoDOT	12"	12"	12"	12"	10"	10"	10"	10"
Portland-Cement Concrete									
Pavement	MoDOT	12"	8.5"	6.5"	6.5"	5"	5"	5"	5"
Aggregate Base	MoDOT	4"	4"	4"	4"	4"	4"	4"	4"
Curb & Gutter	MoDOT	Option	Required	Required	Required	Required	Required	Required	Required
Sidewalk	MoDOT	Both Sides	Both Sides	Both Sides	Both Sides	One Side	One Side	One Side****	One Side****
						**** Dead end streets serving less than 10 homes - delete walk			



Date Revised: APRIL 2021	CITY OF OSAGE BEACH TYPICAL DETAIL ARTERIAL STREET 10,000 TO 50,000 ADT	Design Guideline: SECTION 5
By: EAH		ROADS, STREETS AND PARKING AREAS
Checked By: ---		Drawing No.: V-1



Date Revised:
APRIL 2021

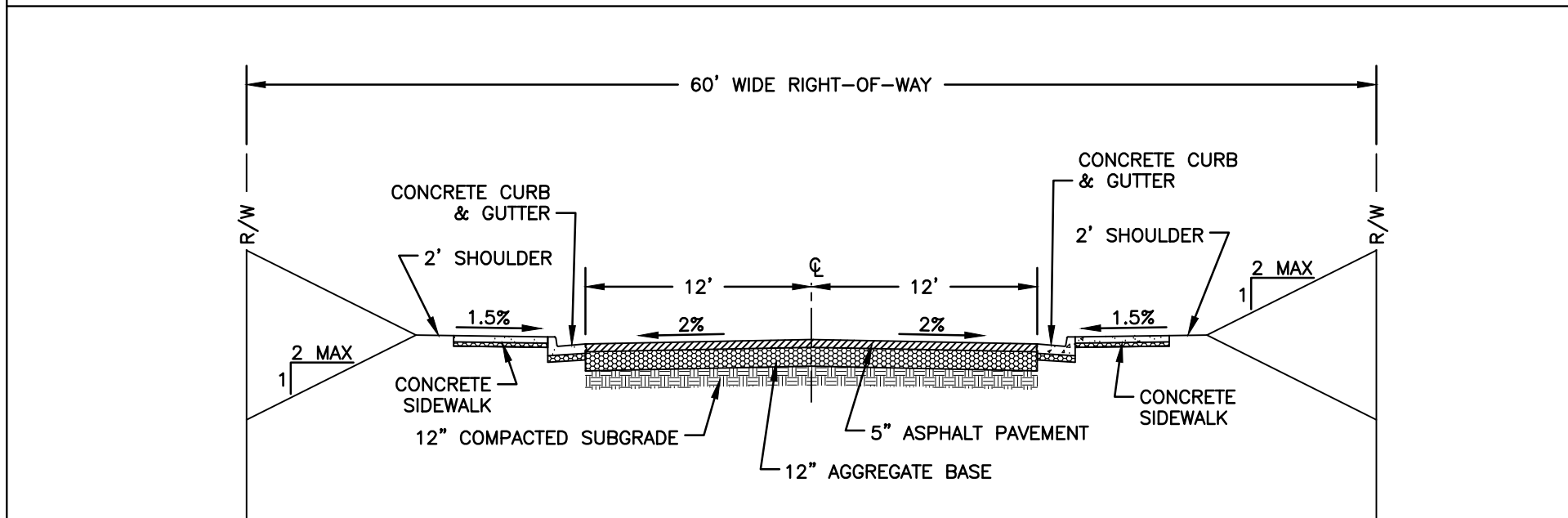
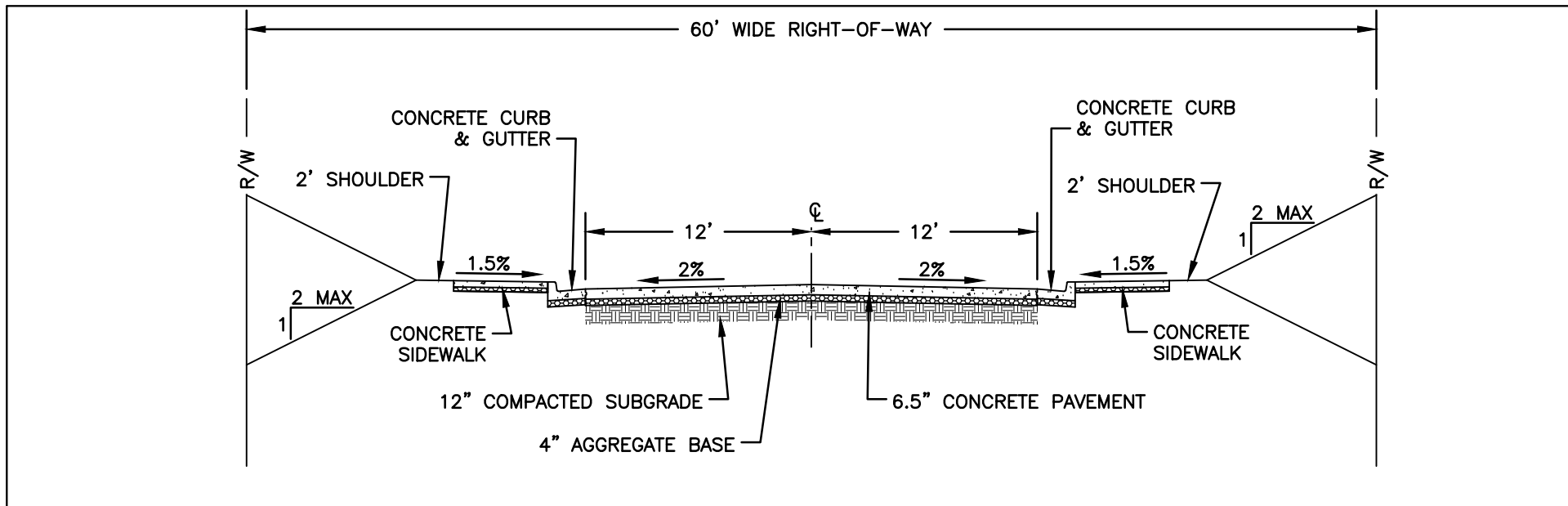
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EAH

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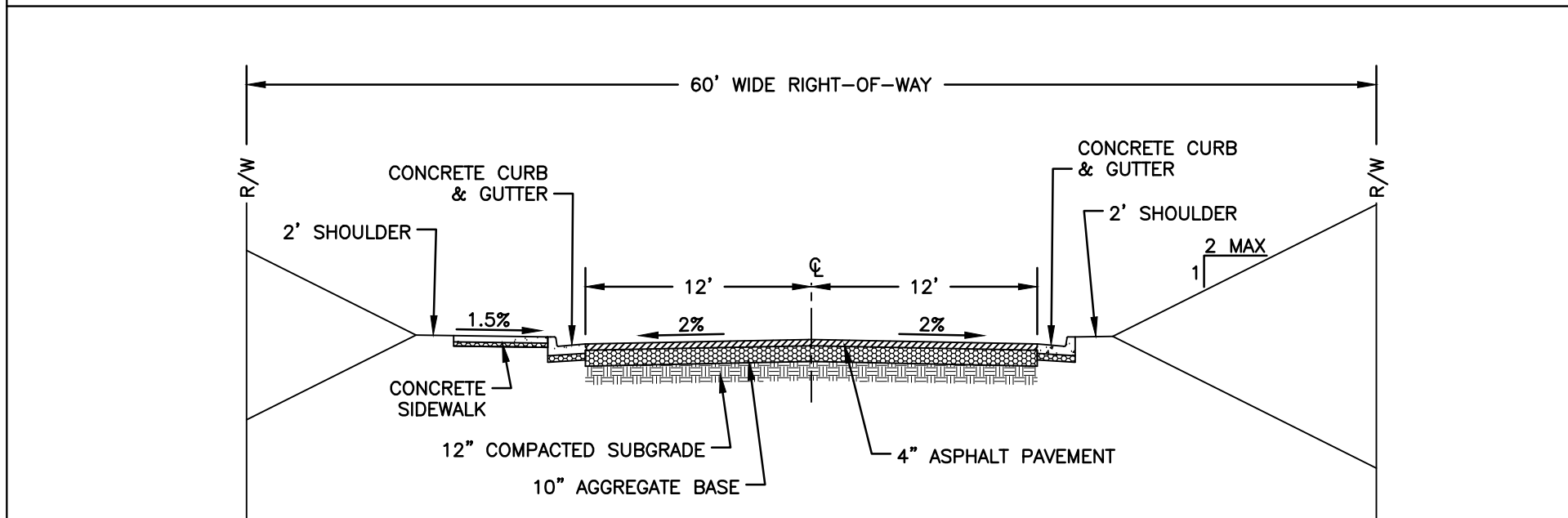
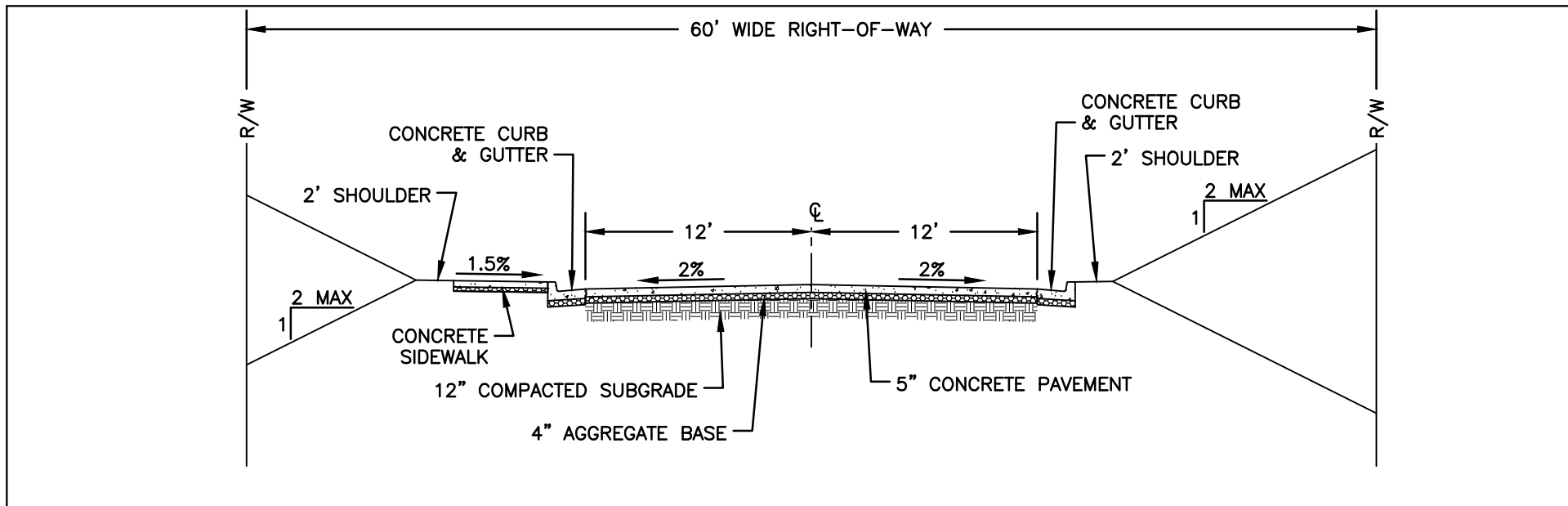
CITY OF OSAGE BEACH
TYPICAL DETAIL
ARTERIAL STREET 5,000 TO 10,000 ADT

Design Guideline:
SECTION 5
ROADS, STREETS AND
PARKING AREAS

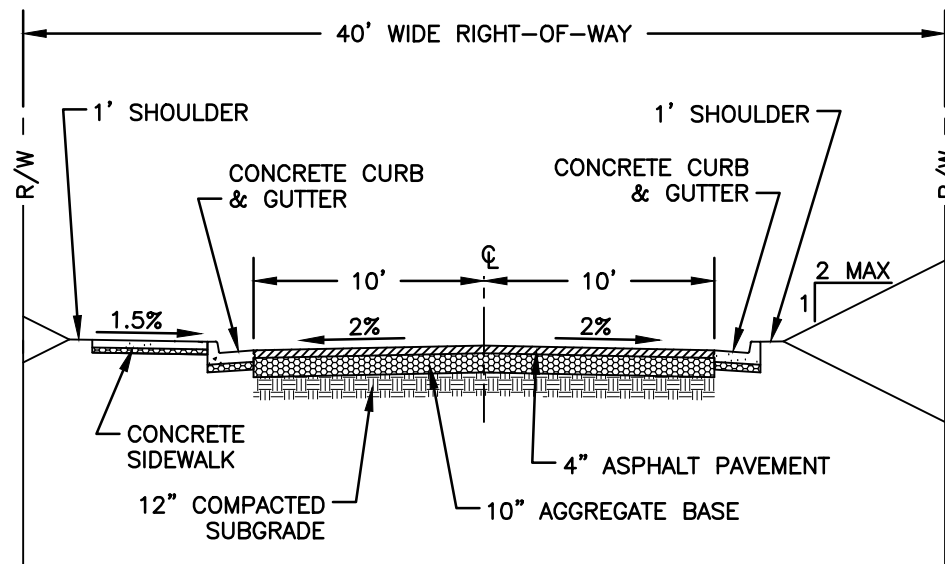
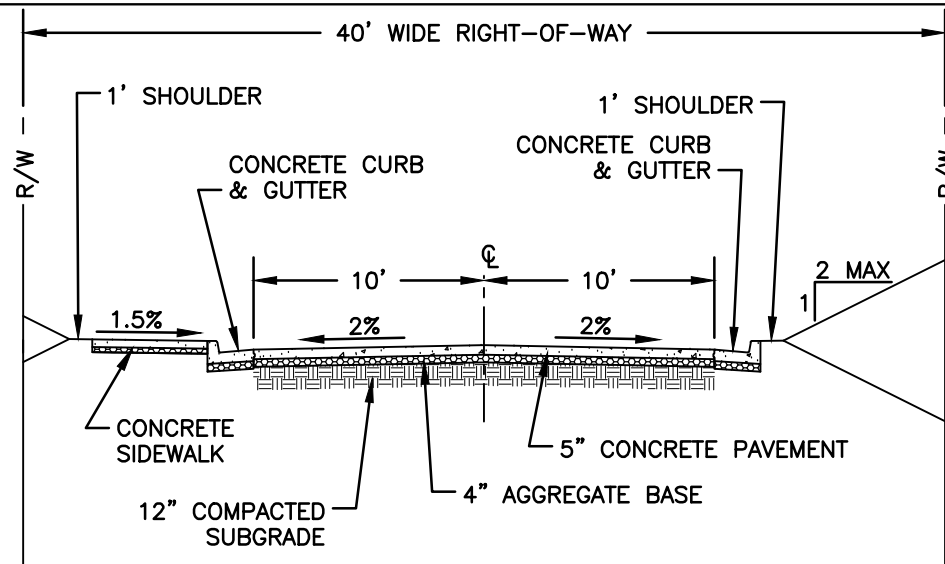
Drawing No.:
V-2



Date Revised: APRIL 2021	CITY OF OSAGE BEACH TYPICAL DETAIL COLLECTOR STREET	Design Guideline: SECTION 5
By: EAH		ROADS, STREETS AND PARKING AREAS
Checked By: ---		Drawing No.: V-3



Date Revised: APRIL 2021	CITY OF OSAGE BEACH TYPICAL DETAIL LOCAL STREET OVER 1,500 ADT	Design Guideline: SECTION 5
By: EAH		ROADS, STREETS AND PARKING AREAS
Checked By: ---		Drawing No.: V-4



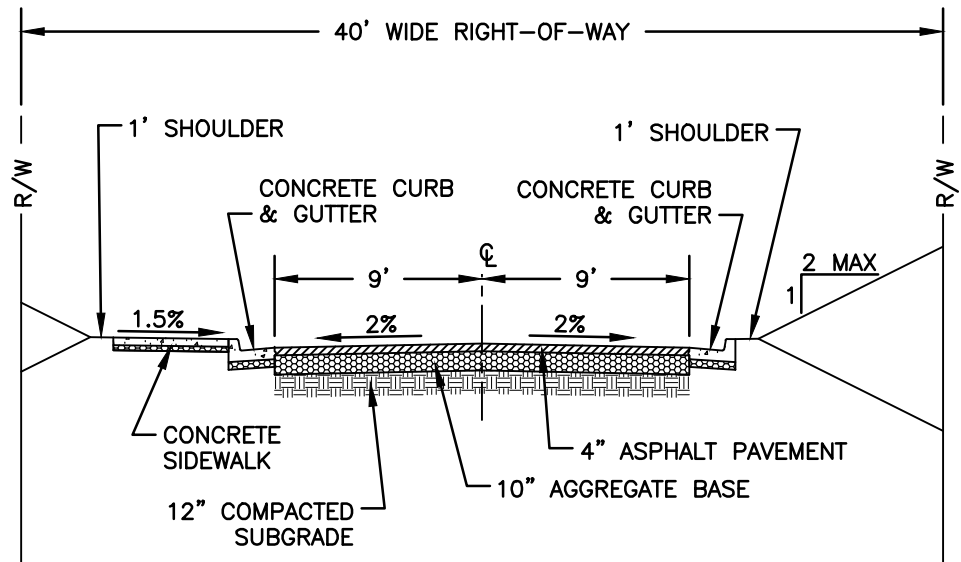
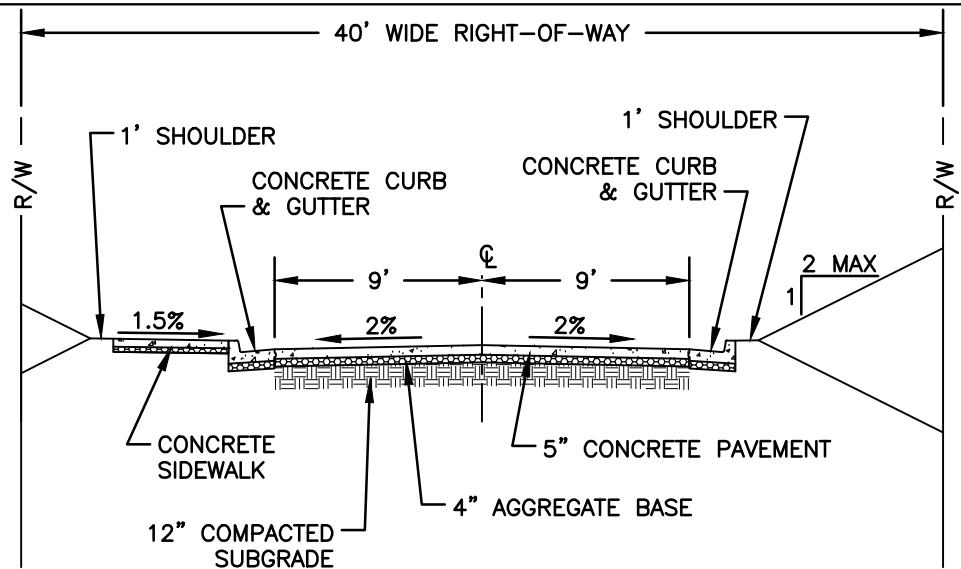
Date Revised:
APRIL 2021

By:
EAH

Checked By:

CITY OF OSAGE BEACH
TYPICAL DETAIL
LOCAL STREET 400 TO 1,500 ADT

Design Guideline:
SECTION 5
ROADS, STREETS AND
PARKING AREAS
Drawing No.:
V-5



Date Revised:
APRIL 2021

By:
EAH

Checked By:

CITY OF OSAGE BEACH
TYPICAL DETAIL
LOCAL STREET LESS THAN 400 ADT

Design Guideline:
SECTION 5
ROADS, STREETS AND
PARKING AREAS
Drawing No.:
V-6

Design Guidelines
City of Osage Beach
SECTION 6 – ROAD CUT, UTILITY TRENCH AND EXCAVATION PERMIT
(Revised October 2023)

OVERVIEW

This guideline pertains to all encroachments into the City of Osage Beach street right-of-ways, street easements and utility easements including: intersections with new roadways to be dedicated to the city, private roadways or parking areas, driveways, trenches for underground utilities such as water or sewer lines and any other underground utility, aerial utility lines, and roadway appurtenances.

PERMITS

- A. A City of Osage Beach Road Cut and Utility Trench Permit is required prior to any encroachments into or over city right-of-ways or easements.
- B. A City of Osage Beach Excavation Permit is required for any excavation of more than 50 cubic yards and/or cut or fill which change existing elevations by more than two feet.

GENERAL

- A. Timely notice of work is required:
 - 1. The applicant shall notify the city Building Official not less than twenty-four (24) hours in advance of any work in the city right-of-way or easements.
 - 2. Additional notice shall be given to the City Building Official by telephone (573-302-2030) four (4) hours prior to actual excavation so that a City Inspector can be dispatched to carry out the required inspection.
 - 3. As a general rule inspections will not be made on weekends or official city holidays. In the case of an emergency good judgment shall rule.
- B. Timely completion of the work is required:
 - 1. Disruption of public access or use shall be minimized to the maximum extent practicable.
 - 2. Work within the city right-of-way or easement shall be done on a continuous basis, i.e.: once work is started it shall be continuous during normal work hours on a continual basis until completed.
 - 3. Leaving open trenches or other excavations for more than forty-eight (48) hours is prohibited.
- C. Traffic control, signs, and barricades:
 - 1. All open trenches or excavations within street right-of-ways or easements shall be provided with appropriate warning signs and barricades.

SECTION 6 – ROAD CUT, UTILITY TRENCH AND EXCAVATION PERMIT

2. If street traffic is interfered with appropriate flagman shall be provided.
3. All traffic control activities and devices shall conform to the U. S. Department of Transportation Manual of Uniform Control Devices.
4. If the excavated trench is to remain open or surface repairs to the street not completed prior to darkness appropriate warning lights shall be provided.
5. The applicant shall maintain all traffic control devices for the duration of the work.
6. At least one traffic lane shall be maintained in usable condition at all times.
7. All trenches within the traveled way shall be closed during nighttime hours.
8. No work will be permitted within the city right-of-way or easements over weekends or holiday periods.

INTERSECTIONS, PARKING AREAS, AND DRIVEWAYS

- A. Prior to construction for all proposed intersections with new streets, parking areas and driveways the applicant shall:
 1. Obtain an encroachment permit.
 2. Submit a drawing showing horizontal and vertical alignment of the intersecting facility and all storm drainage facilities.
- B. Intersecting streets and parking areas shall conform to the City of Osage Beach Design Standards for width, alignment, and grade.
 1. Intersecting streets and parking areas shall have curb and gutters.
 2. Streets, parking areas and driveways shall intersect perpendicular to the city street to the maximum extent practicable.
- C. Minimum width for driveway entrances to commercial properties shall be twelve (12) feet for a one-way entrance and twenty-four (24) feet for two-way entrances. Minimum radius for flares shall be fifteen (15) feet.
- D. Driveways for private residences shall be a minimum of ten (10) feet of driving surface exclusive of flares. Minimum radius for flares shall be ten (10) feet.
- E. All entrances into city streets shall be designed and constructed to accommodate storm drainage run-off.
 1. Appropriate catch drains shall be provided to accommodate run-off from or into driveways.
 2. Where roadway ditches exist on the city street appropriate culverts, swales, or slotted drains shall be provided.

Design Guidelines
City of Osage Beach
SECTION 6 – ROAD CUT, UTILITY TRENCH AND EXCAVATION PERMIT

UTILITY TRENCHES

A. Utility trenches traversing under a city roadway.

1. Saw cut all pavement surfaces.
2. All utility lines, except storm sewer, across city right-of-ways shall be incased in Schedule 40 or SDR 21 PVC sleeve.
3. The sleeve shall be not less two inches in inside diameter larger than the maximum outside diameter of the widest dimension of the utility duct or pipe to be run through the sleeve.
4. The minimum depth of cover of the sleeve shall be:
 - a. In accordance with Section 2 - Water Systems for waterlines
 - b. In accordance with Section 3 - Sewerage Design for sanitary sewer
 - c. In accordance with Section 4 - Storm Drainage for storm sewer
 - d. 36 inches below finished pavement grade for all others or as described in this Section.
- ~~5. The maximum depth of cover shall be in accordance with the appropriate section for the utility. The maximum depth of cover for all water and sewer lines shall be eight (8) feet unless specifically authorized in writing by the City Engineer.~~
 - ~~a. In accordance with Section 2 - Water Systems for waterlines~~
 - ~~b. In accordance with Section 3 - Sewerage Design for sanitary sewer~~
6. Select Backfill shall be installed:
 - a. From six inches below the utility to eighteen inches below the finished pavement grade for water, pressure sewer and primary power lines.
 - b. From four inches below the utility to 9 inches below the finished pavement grade for storm sewer and secondary power lines.

Select backfill shall be 95% of maximum density ~~nominal ½ inch minus~~ crushed rock conforming to MoDOT ~~Type V aggregate, Section 1007. 1004, Grade D, Chat, pea gravel or Osage River Sand. Any material used shall have a PI of six or less.~~ Trench backfill material shall not contain any material with a nominal particle size greater than six (6) inches.

7. Concrete Backfill:
 - a. Shall be installed from three inches below finished pavement grade to the top of the Select Backfill.
 - b. The top six inches of the concrete backfill shall be extended not less than twelve inches on each side of the utility trench.
 - c. Shall conform to MDOT Section 501, Concrete.

Design Guidelines
City of Osage Beach
SECTION 6 – ROAD CUT, UTILITY TRENCH AND EXCAVATION PERMIT

- 1) Concrete shall be Class A-1
- 2) Course aggregate shall be Gradation B
- 3) Fine aggregate shall be Class A
- 4) Cement shall be either Type I or III.
- 5) An accelerator may be used in conformance with MoDOT Section 1054.5.

8. Asphalt Pavement

- a. Shall be installed from the surface to three (3) inches below finished grade.
- b. Asphalt pavement shall conform to MoDOT Section 403; Type 1B
- c. Asphalt cement shall be AC-30
- d. Concrete backfill as specified above maybe utilized in lieu of asphalt pavement with prior permission of the City Engineer.
- e. Finish Tolerance the surface of the finished roadcut shall not exceed ¼ inch below a ten (10) foot straight edge as measured below the straight edge.

B. Utility trenches paralleling under a city roadway or parking area.

1. Saw cut all pavement surfaces.
2. The minimum depth of cover shall be:
 - a. In accordance with Section 2 - Water Systems for waterlines
 - b. In accordance with Section 3 - Sewerage Design for sanitary sewer
 - c. In accordance with Section 4 - Storm Drainage for storm sewer
 - d. 24 inches below finished pavement grade for all others or as described in this Section.
3. Select Backfill shall be installed:
 - a. From six inches below the utility to three (3) inches below the finished pavement grade.
 - b. Select backfill shall be 95% of maximum density ~~nominal ½ inch minus~~ crushed rock conforming to MoDOT Type V aggregate, Section ~~1007. 1004, Grade D, Chat, pea gravel or Osage River Sand. Any material used shall have a PI of six or less.~~ Trench backfill material shall not contain any material with a nominal particle size greater than six (6) inches.
 - c. Select backfill shall be placed in maximum 8-inch lifts and mechanically compacted to a compaction of 95% SPT.
4. Asphalt Pavement
 - a. Shall be installed from the surface to three (3) inches below finished grade.

SECTION 6 – ROAD CUT, UTILITY TRENCH AND EXCAVATION PERMIT

- b. Asphalt pavement shall conform to MoDOT Section 403; Type 1B
 - c. Asphalt cement shall be AC-30
 - d. Concrete backfill as specified above maybe utilized in lieu of asphalt pavement with prior permission of the City Engineer.
 - e. Finish Tolerance the surface of the finished roadcut shall not exceed ¼ inch below a ten (10) foot straight edge as measured below the straight edge.
- C. Utility trenches out of traffic area
 - 1. The minimum depth of cover shall be:
 - a. In accordance with Section 2 - Water Systems for waterlines
 - b. In accordance with Section 3 - Sewerage Design for sanitary sewer
 - c. In accordance with Section 4 - Storm Drainage for storm sewer
 - d. 24 inches below finished pavement grade for all others or as described in this Section.
 - 3. Select Backfill shall be installed:
 - a. In accordance with Section 2 - Water Systems for waterlines
 - b. In accordance with Section 3 - Sewerage Design for sanitary sewer
 - c. In accordance with Section 4 - Storm Drainage for storm sewer
 - d. 6 inches below the utility line to 12 inches above the utility line for all others.
 - 4. Backfill shall be granular material or select soil excavated from the trench, free of rocks over ~~1/2~~ 6 inch in least dimension, foreign material or frozen earth.
 - a. Backfill shall be compacted to 95% of optimum density at optimum moisture content.
 - b. The surface shall be graded to smooth flowing lines blending into surrounding slopes.
 - 5. Restore disturbed surface area to pre-construction condition (seed & mulch, decorative rock, etc.).
- ~~D. Utility trenches more than 150 feet in length shall have an impervious clay or bentonite plug constructed at each terminus or intersection with other trenches to prevent water from following the trench line and creating drainage problems.~~
- E. Underground Primary Power Trenches. All electrical power of 480 volts AC or more is considered “primary power”.
 - 1. See Ameren Missouri Specifications for requirements.
 - 2. Where underground primary power crosses city utilities, the primary power shall be a minimum of one-foot below.

SECTION 6 – ROAD CUT, UTILITY TRENCH AND EXCAVATION PERMIT

3. Where primary power line parallels a city utility line it shall be separated by a minimum of four feet.
- F. Underground Secondary Power Trenches, all electrical power less than 480 volts.
1. See Ameren Missouri Specifications for requirements. Where secondary power will be owned by the City, the following shall apply:
 - a. Secondary power trenches shall be a minimum of twenty-four (24) inches of cover in depth.
 - b. An approved warning tape shall be installed twelve inches above the duct.
 - c. Underground secondary power ducts can be co-located with water or sewer lines if they are placed not less than one foot to the side and at or below the elevation of the water or sewer line.
 - d. Where secondary power crosses water or sewer lines, the power shall be in conduit and shall be a minimum of one-foot below water or sewer lines.

ROAD BORES

In all location where the utility is to be installed under a paved area that has been constructed within the previous five (5) years, as determined by the city engineer, a road bore shall be constructed. The minimum depth of the bore shall be thirty-six (36) inches. All bores shall be sleeved as specified above.

AERIAL UTILITIES

- A. Minimum vertical clearance for aerial utilities shall be a minimum of eighteen feet (18 ft. 0 in.) at the lowest point of crossing above the finished pavement grade of any city street.
- B. Utility poles shall not be located less than three (3) feet from the edge of pavement on city streets or parking areas.

ROADWAY APPURTENANCES

- A. Traffic control signs shall be installed in accordance with US Department of Transportation and Federal Highway Administrations Uniform Manual of Traffic Control Devices.
- B. Other signs.
 1. A City of Osage Beach Sign Permit is required for all signs within city right-of-ways or easements except traffic control signs.
- C. No sign shall be installed within three (3) feet of the edge of pavement.

Design Guidelines
City of Osage Beach
SECTION 6 – ROAD CUT, UTILITY TRENCH AND EXCAVATION PERMIT

D. Mailbox.

1. Mailboxes and/or newspaper boxes shall not be located within twelve (12) inches of the edge of pavement on city streets.
2. If the street has concrete curb and gutter the face of the mailbox shall not protrude into the roadway past the back of the curb.
3. Mail and newspaper boxes shall be removed within thirty days of cessation of delivery service. If the box is unused and not removed the city will remove it at the owner's expense.

E. Guard Rail or Crash Barrier

1. Shall only be installed at locations where a severe traffic safety hazard exists and only with the approval of the City Engineer.
2. Installation shall conform to MoDOT Specifications.

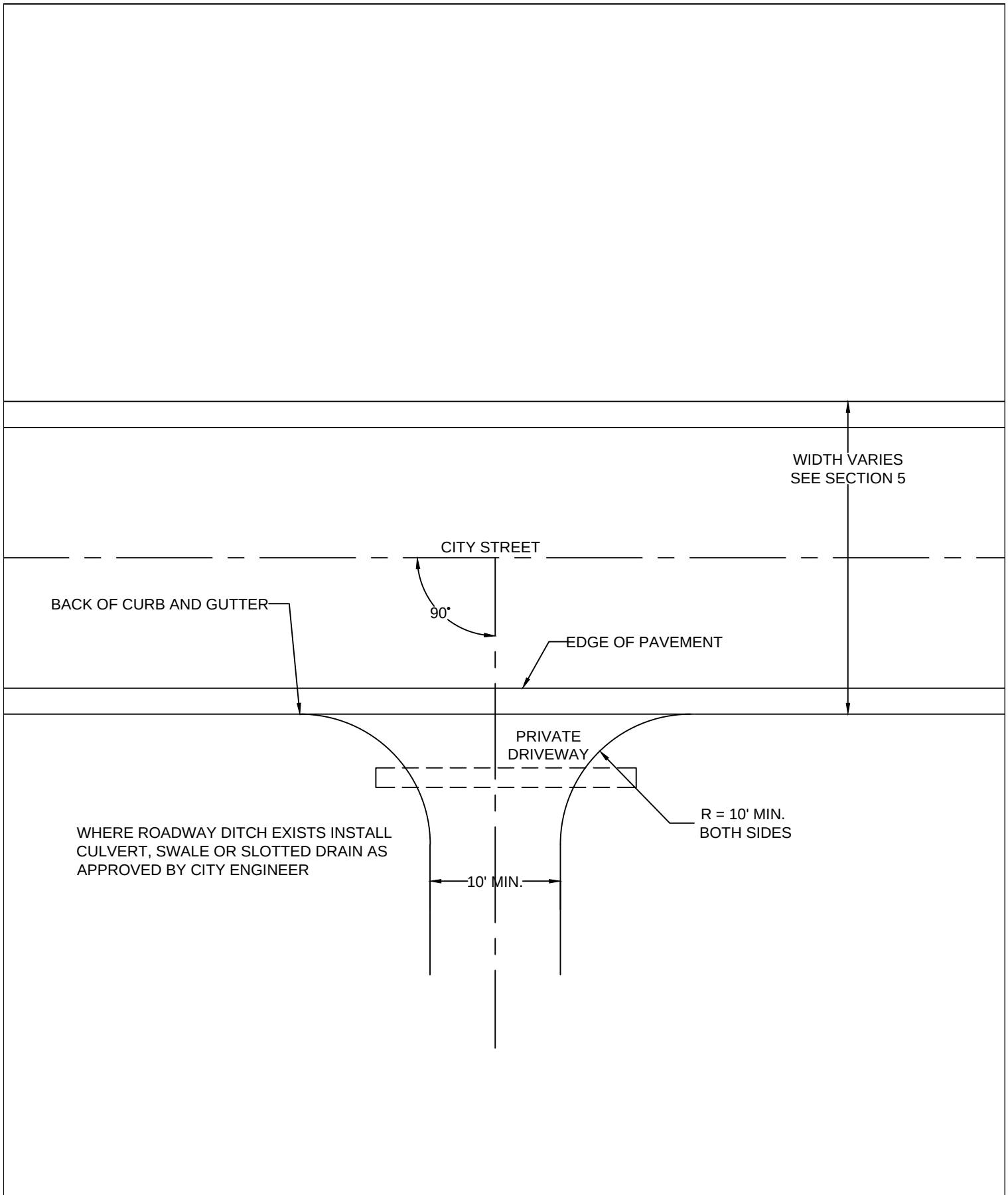
INSPECTIONS

During the progress of the work each utility line shall be inspected by the Engineering Department prior to trench backfill.

ROADCUT AND UTILITY TRENCH CONSTRUCTION DETAIL DRAWINGS

Construction details and sketches are attached.

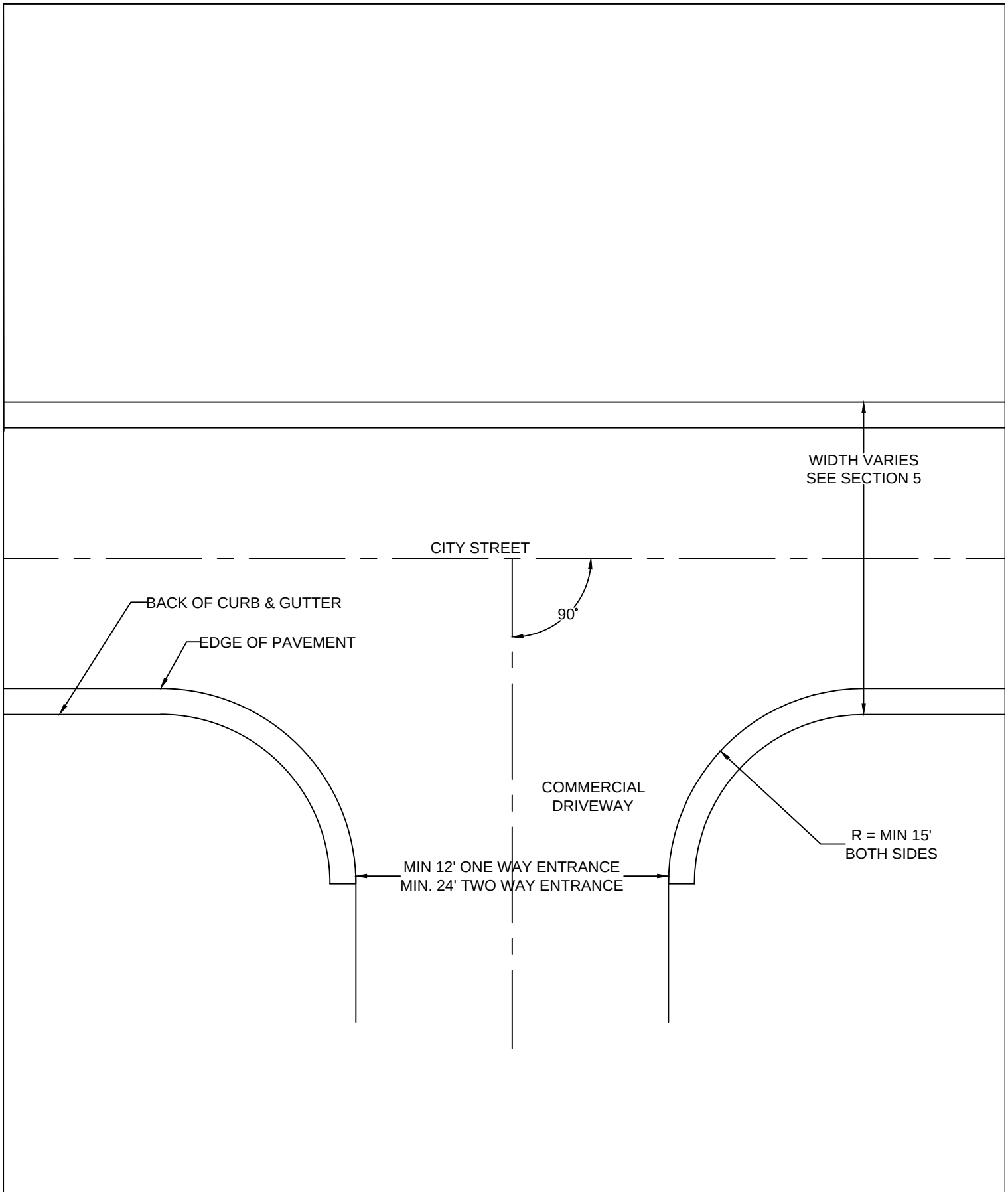
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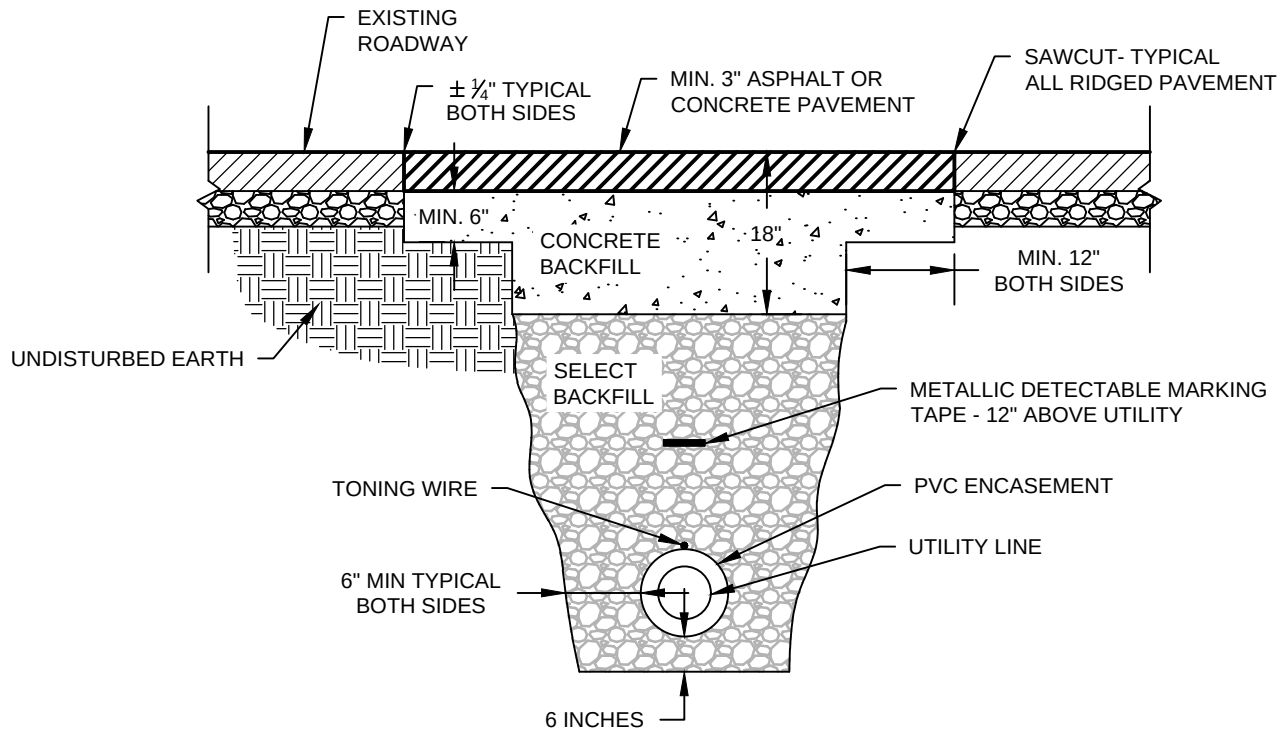
Date Revised:	APRIL 2014
By:	JMY
Checked By:	SLB

CITY OF OSAGE BEACH
TYPICAL DETAIL
PRIVATE RESIDENCE ENTRANCE
INTERSECTING CITY STREET

Design Guideline:	SECTION 6
	ROAD CUTS, UTILITY TRENCHES, AND EXCAVATION
Drawing No.:	VI-1



Date Revised: APRIL 2014	CITY OF OSAGE BEACH TYPICAL DETAIL COMMERCIAL ENTRANCE INTERSECTING CITY STREET	Design Guideline: SECTION 6
By: JMY		ROAD CUTS, UTILITY TRENCHES, AND EXCAVATION
Checked By: SLB		Drawing No.: VI-2



NOTE: SAWCUT SHALL BE CONTINUOUS WITH SMOOTH, TAPERED TRANSITIONS IN WIDTH IN ORDER TO MAINTAIN A CONSISTENT PAVEMENT RESTORATION WIDTH.

Date Revised:
APRIL 2014

By:
JMY

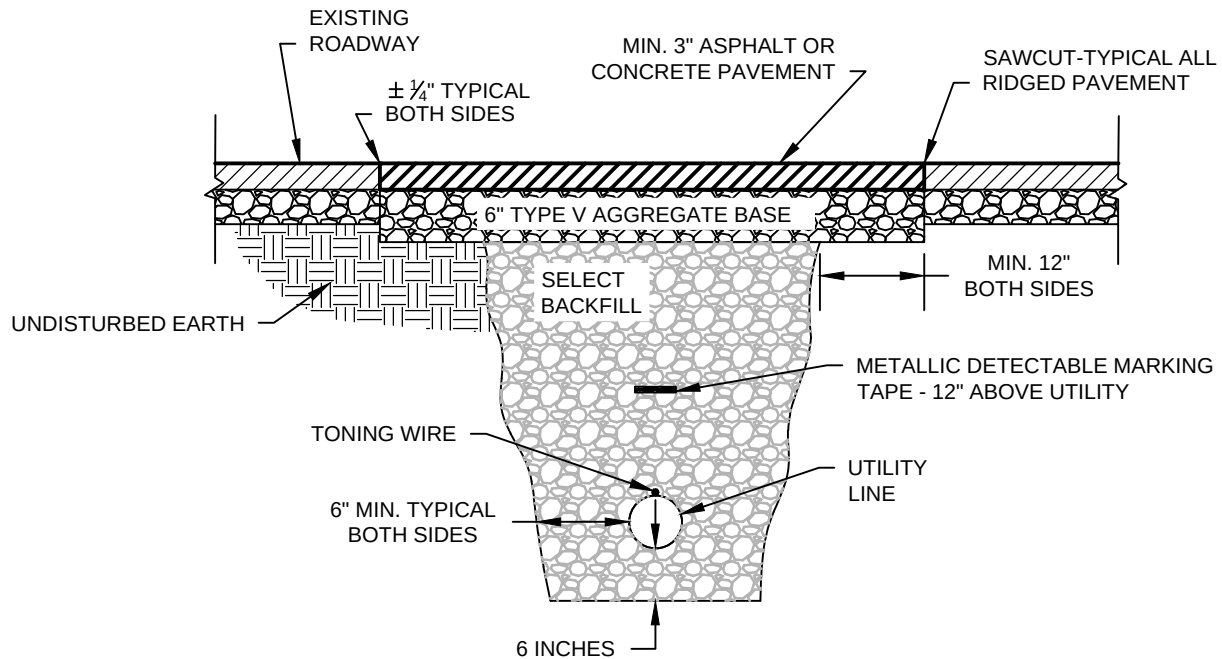
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SLB

CITY OF OSAGE BEACH
TYPICAL DETAIL
UTILITY TRENCH TRAVERSING A
CITY ROADWAY

Design Guideline:
SECTION 6

ROAD CUTS, UTILITY
TRENCHES, AND EXCAVATION

Drawing No.:
VI-3



NOTE: SAWCUT SHALL BE CONTINUOUS WITH SMOOTH, TAPERED TRANSITIONS IN WIDTH IN ORDER TO MAINTAIN A CONSISTENT PAVEMENT RESTORATION WIDTH.

Date Revised:
APRIL 2014

By:
JMY

Checked By:
SLB

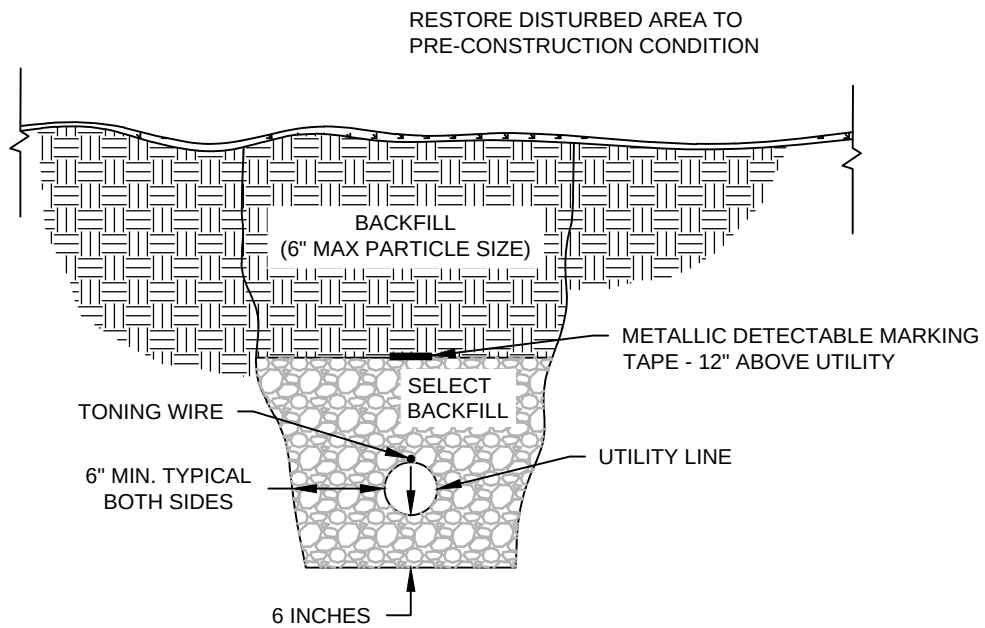
CITY OF OSAGE BEACH
TYPICAL DETAIL
UTILITY TRENCH PARALLELING
CITY ROADWAY

Design Guideline:
SECTION 6

ROAD CUTS, UTILITY
TRENCHES, AND EXCAVATION

Drawing No.:
VI-4

NOTE: THE MINIMUM DEPTH OF COVER VARIES
PER UTILITY. REFER TO INDIVIDUAL
SECTION FOR COVER REQUIREMENTS.



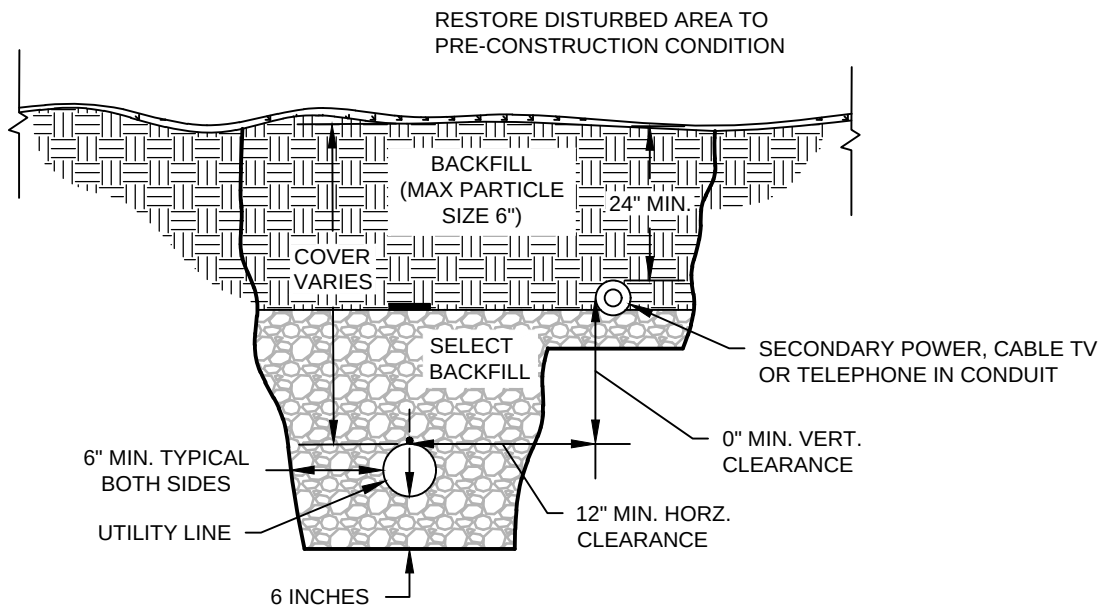
Date Revised:
APRIL 2014

By:
JMY

Checked By:
SLB

CITY OF OSAGE BEACH
TYPICAL DETAIL
UTILITY TRENCH OUT OF TRAFFIC AREA

Design Guideline:
SECTION 6
ROAD CUTS, UTILITY
TRENCHES, AND EXCAVATION
Drawing No.:
VI-5



- NOTES:
1. WARNING TAPE TO BE PLACED 12" ABOVE BOTH UTILITIES.
 2. TONING WIRE TO BE PLACED TAPED TO THE TOP OF THE WATER/SEWER UTILITY.
 3. DETAIL IS FOR OUT OF TRAFFIC AREAS. IF UTILITIES ARE LOCATED WITHIN THE CITY STREET BACKFILL SHALL BE AS DETAILED IN TRAVERSING OR PARALLELING CITY ROADWAY WHICH EVER MAY APPLY.

Date Revised:
APRIL 2014

By:
JMY

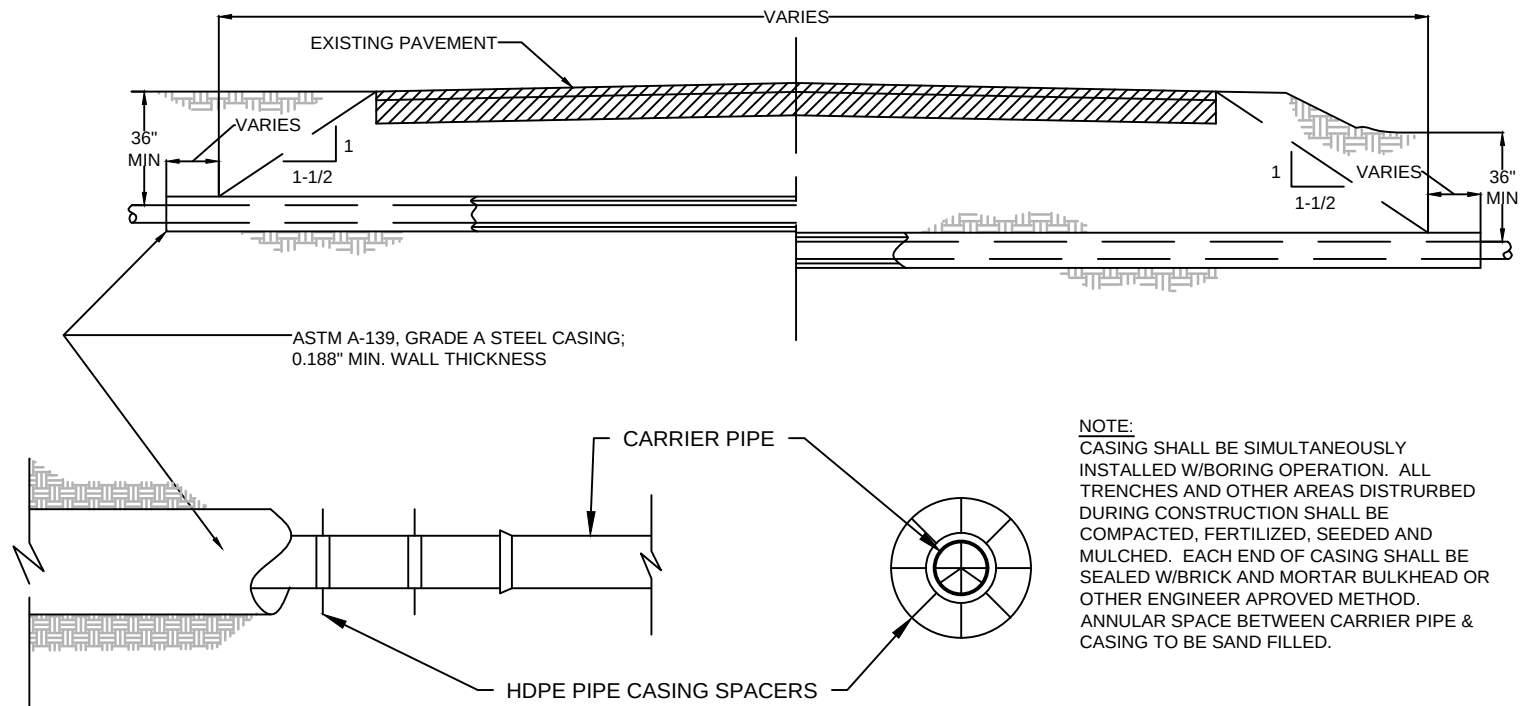
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SLB

CITY OF OSAGE BEACH
TYPICAL DETAIL
WATER & SEWER IN SAME TRENCH AS
SECONDARY POWER

Design Guideline:
SECTION 6

ROAD CUTS, UTILITY
TRENCHES, AND EXCAVATION

Drawing No.:
VI-6



NOTE:
CASING SHALL BE SIMULTANEOUSLY
INSTALLED W/BORING OPERATION. ALL
TRENCHES AND OTHER AREAS DISTURBED
DURING CONSTRUCTION SHALL BE
COMPACTED, FERTILIZED, SEEDED AND
MULCHED. EACH END OF CASING SHALL BE
SEALED W/BRICK AND MORTAR BULKHEAD OR
OTHER ENGINEER APPROVED METHOD.
ANNULAR SPACE BETWEEN CARRIER PIPE &
CASING TO BE SAND FILLED.

CITY OF OSAGE BEACH
TYPICAL DETAIL
HIGHWAY CROSSING BORE/ENCASEMENT

Date Revised:
APRIL 2014

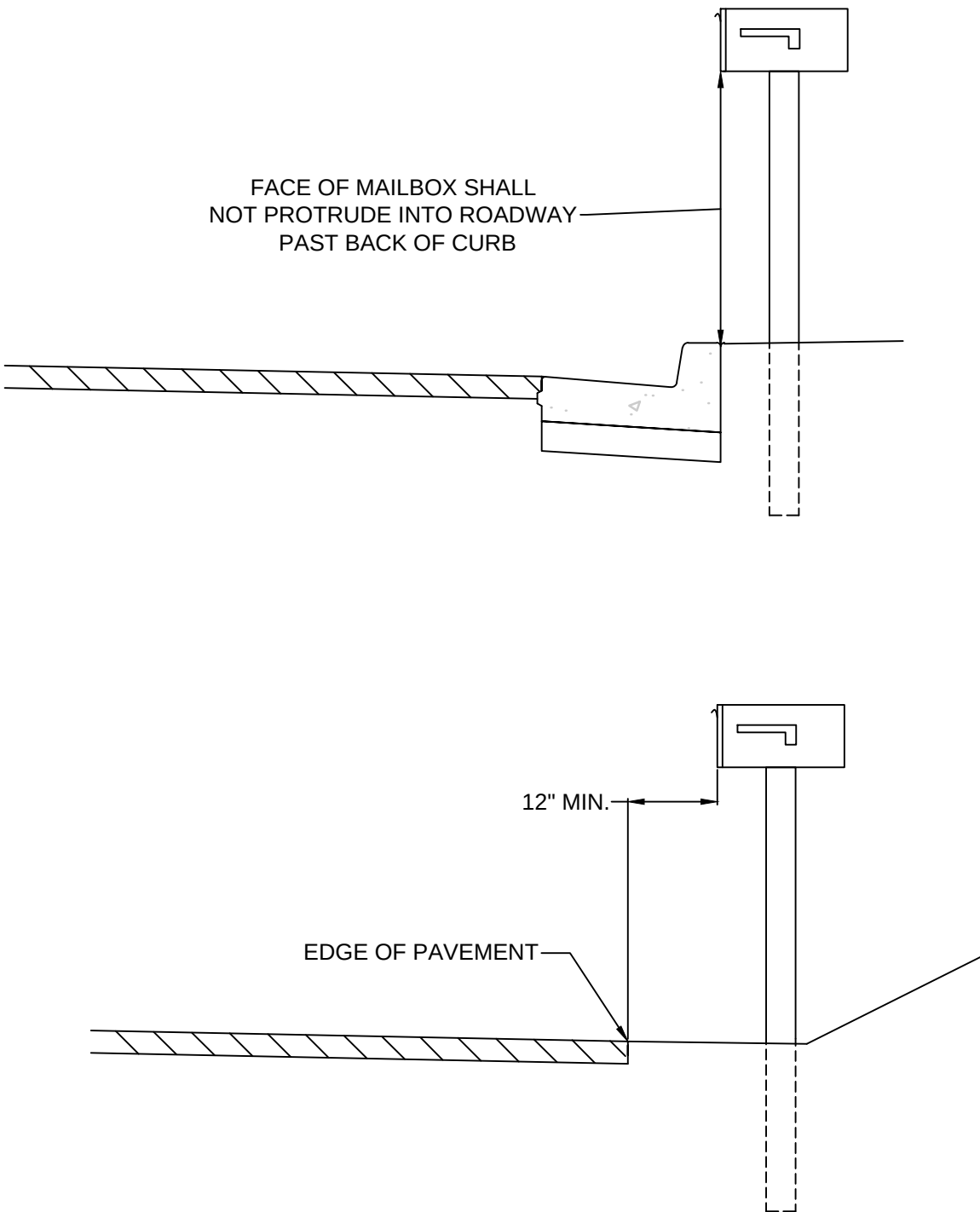
By:
JMY

Checked By:
SLB

Design Guideline:
SECTION 6

ROAD CUTS, UTILITY
TRENCHES, AND EXCAVATION

Drawing No:
VI-7



Date Revised:	APRIL 2014
By:	JMY
Checked By:	SLB

CITY OF OSAGE BEACH
TYPICAL DETAIL
MAILBOX LOCATION

Design Guideline:	SECTION 6
	ROAD CUTS, UTILITY TRENCHES, AND EXCAVATION
Drawing No.:	VI-8

City of Osage Beach

Design Guideline Revision - Items Removed

Section 2 - Water

- Page 2 - System Water Data removed as it is included in the water master plan and not necessary for design information
- Page 4 - Section C. 3. Removed as the minimum allowable mains size was changed to 6-inch diameter per DNR requirements
- Page 8 - Section A. 2. Removed as the minimum allowable mains size was changed to 6-inch diameter per DNR requirements
- Page 8 - Section C. 2. Removed to prevent development from using pipes not intended for water service construction
- Page 9 - Section D. 2. a. 2) Removed as SDR 21 fittings are industry standard for fittings and pipe listed above
- Page 9 - Section D. 2. b. Removed to all proper connection to pipes being made and decided by designer
- Page 10 - Section E. 4. Removed to not allow check valves installed on the City's system
- Page 11 - Section D. 2. d. Removed due to the City no longer installing and maintain the pressure reducing valve, all pressure reducing valves are to be on the customer's side of the meter
- Page 11 - Section D. 3. e. Removed due to the City no longer installing and maintain the pressure reducing valve, all pressure reducing valves are to be on the customer's side of the meter
- Page 11 - Section D. 3. f. Removed as the back flow will be on the customer's side of the meter allowing them to choose the back flow assembly installed
- Page 14 - Section D. 1. a. Removed the pressure reducing valve being installed in the City's meter pit as it should be installed on the customer's side of the meter
- Page 14 - Section D. 2. a. Removed the pressure reducing valve being installed in the City's meter pit as it should be installed on the customer's side of the meter
- Detail II-6 - Removed the pressure reducing valve from the detail in the meter pit
- Detail II-9 - Removed as concrete thrust block is preferred by City Staff, restrained joint pipe is allowable, but not permitted in lieu of concrete thrust blocks

Section 3 - Sewer

- Page 1 - Overview Second Paragraph. Removed last line as this was updated per the City's new standard for providing station packages to developers
- Page 1 - Referenced City Ordinances. Chapter 410.130 removed as the heading has changed
- Page 2 - Average Daily Flow. Table removed and DNR is referenced
- Page 2 - Equivalent Population. Table removed and DNR is referenced
- Page 3 - Gravity Sewers Section 1. c. Removed to allow private sewer laterals to be any length and prevent the City from owning small sections of gravity sewer main prior the other gravity main or pump station

- Page 3 - Gravity Sewer Section 1. d. Removed allowance of ductile iron fittings as PVC fittings are industry standard for lateral pipe size and type
- Page 3 - Gravity Sewer Section 2. b. i. Removed ductile iron pipe having issues with sewer pipe failure
- Page 3 - Gravity Sewer Section 2. b. ii. Removed ductile iron pipe for gravity sewers being removed
- Page 3 - Gravity Sewer Section 2. b. v. Removed due to schedule 40 pipe not typically being used for the application
- Page 4 - Gravity Sewer Section 2. d. Removed to allow private sewer laterals to be any length and prevent the City from owning small sections of gravity sewer main prior the other gravity main or pump station
- Page 6 - Gravity Sewer Section 12. g. x. Table information for pipe size 4-removed and 6-inch removed as these pipe sizes will not be accepted into City inventory
- Page 6 - Pressure Sewer Section 2. b. Removed ductile iron due to issues with pipe degradation
- Page 7 - Pressure Sewers Section 9. Removed as check valves should not be installed on the system unless in a grinder station or valve vault, check valves are referenced in those sections
- Page 8 - Design of Grinder Pumps and Sewage Lift Stations. Removed as the City plans to provide grinder station packages and an alternate pump will not be an option
- Page 10 - Additional Limitations or Specifications for Grinder Pumps Section 3. Removed per DNR all commercial development should have duplex station with two pumps
- Page 10 - Additional Limitations or Specifications for Grinder Pumps Section 7. Removed so all stations have stainless steel discharge piping and uniformity across the City
- Page 10 - Additional Limitations or Specifications for Grinder Pumps Section 8. Removed per City Staff request only check valves will be installed in the grinder station and an isolation valve at the connection point to the City's system
- Page 11 - Grinder Station Electrical Panel Section 1. Removed Electric Control Company to allow for different ABS panel suppliers to provide panels if ECC is not capable
- Page 12 - Required Inspections, Testing, and Start Up Procedures Section 6. Removed to allow for the building occupancy permit to be issued, however a non-conforming station would not be accepted into City inventory
- Page 13 - Requirements for Authorized Private Sewage Disposal Systems Section 1. Removed due to Department of Health Regulations changing and sections no longer relevant or other sections are relevant

Section 5 - Roads, Streets and parking areas

- Page 3 - Residential Parking and commercial Parking Areas Section B. 1. c. Removed requirement for reinforcement bars in concrete as bars called out are non-standard and allow developer to decide parking lot paving section

Section 6 - Road Cut, Utility Trench and Excavation Permit

- Page 3 - Utility Trenches Section A. 5. Removed max depth cover and referred to the section which utility the cover relates
- Page 5 - Utility Trenches Section D. Removed as use of 1-inch minus base rock prevents water from following the trench pipe
- Detail VI-6 - Removed as use of 1-inch minus base rock prevents water from following the trench pipe
- Detail VI-8 - Removed per DNR concrete encasement is not an acceptable protection for pipe