

**A PROPOSAL FOR
COMPREHENSIVE EROSION
CONTROL AND
GULLY EROSION
MITIGATION PROGRAM FOR
IMO STATE**

Develop Program Goals

- Goal #1- Develop a comprehensive erosion control and gully erosion mitigation program for the Government of Imo State, Nigeria in conformance with State program goals.
- The main objective is to promote “Best Management Practices” that will mitigate current problems while preventing future erosion problems in Imo State.

OJIINTL/CALIFCO UTILITIES JOINT VENTURE

- The OJI International/Califco Team and our technical partners have assembled a multi-disciplinary team of specialist in the Civil Engineering, Hydrology and Hydrogeological Engineering, Environmental Engineering & Planning, Environmental Management and Landscape Architecture sector to develop a comprehensive erosion control and gully erosion mitigation for the Government of Imo State, Nigeria in conformance with the policy and programmatic direction of your Ministry.

PROJECT PRINCIPAL TEAM LEADER

- Engineer Augustus Ajawara our assigned Project Principal has over twenty-five years of professional civil engineering experience, providing capital improvement programs management and infrastructure development for clients, including the State of California, Los Angeles County Public Works Department, Riverside Transportation Agency, City of Compton and other local government agencies in California and Texas. His public sector experience included serving as Director of Planning for Riverside Transit Agency

PROJECT PRINCIPAL

- Engineer Ajawara also served as Director of Municipal Services Departments for the City of Compton. As Director of Municipal Services for the City of Compton, he was responsible for the management of six divisions, including, the Public Works/Engineering Division, Transportation and Capital Improvement Programs Division, Municipal Water Resources Division, General Services Division, Facilities Management, Solid Waste Management Division and the Infrastructure Construction and Maintenance Services Division.

Develop Program Goals

- Goal #2: Provide Immediate Mitigation Measures for Gully Erosion and Ecologically damaged sites that have been identified in Imo State through construction of new culverts, and reconstruction of damaged and collapsed Culverts, filling gullies with lateritic materials, construction of diversion roadways, reconstruction and paving of roadways with new and improved roadway culverts.

Problem Definition, Gully Erosion in Eastern Nigeria

- South-eastern Nigeria is a densely-forested region including rolling, hilly terrain. But this lush, green land could soon become an arid badland that's [unsuitable] for cultivation, dangerous for human habitation, and well on the way to becoming a parcel of useless land, warns [Frank Simpson](#), a sedimentologist at the [University of Windsor](#). The culprit for this problem is gully erosion.

Gully Erosion

- Gully Erosion occurs due to:
 - Deforestation
 - Unsustainable Farming Practices
 - Path and Road Construction
 - Poorly Constructed Drainage systems
- Gully erosion takes place when wear-and-tear on the surface land causes rainwater to accumulate in one area, causing loss of vegetation cover, localized erosion, and the formation of gullies
- Flood Debris that overwhelm existing structures

Gully Erosion

- Gully Erosion problem grows as interconnecting systems of gullies spread across the land surface. The resulting run-off from the hillsides often pollutes the water supply, while landslides threaten villages and highway travelers.
- A number of gullies in southeastern Nigeria are caused by the overflow of concrete rainwater gutters at the side of highways, leading to erosion — particularly at the point where the gutter and the road meet — that destabilizes hillsides and undermines roadbeds.
- Other gullies result from flood debris that overwhelm undersized and/or blocked culverts from lack of maintenance.

Gully Erosion from Flood Debris

Gully Erosion from Flood Debris and Blocked Culverts

- Gully Erosion sometime occurs when roads are extensively damaged by debris flood deposits and sections of saturated road edge fills collapses, especially around the hair-pin bend section of the road showing typical Road Gully on hilly roads.
- Ground observations at such sites shows that many of the culverts carrying very small side streams were unable to cope with the very high flood flows partly because of the large volume of water, but mainly because they were blocked with gravel.

ROADSIDE GULLIES

- A number of gullies in southeastern Nigeria, including Imo state were caused by the overflow of concrete rainwater gutters at the side of highways, leading to erosion — particularly at the point where the gutter and the road meet. This destabilizes hillsides and undermines roadbeds. When these are unchecked, the resultant gully most of the time under-scours and cuts the entire road bed.



Protective Measures

Construction of hydraulic regulation works that integrate a drainage network with storage ponds to cut off flood crest and lower hydraulic loads of interceptor canals.

Temporary Measures

- Ditch checks
- Silt Checks
- Straw Bales
- Temporary Berms
- Temporary Slope Drains
- Temporary Seeding and Mulching
- Mulching and Crimping
- Brush Piles
- Sediment Trap
- Sediment Removal
- Road Closure
- Temp Pipe
- Temp Sediment Basin
- Surface Roughening

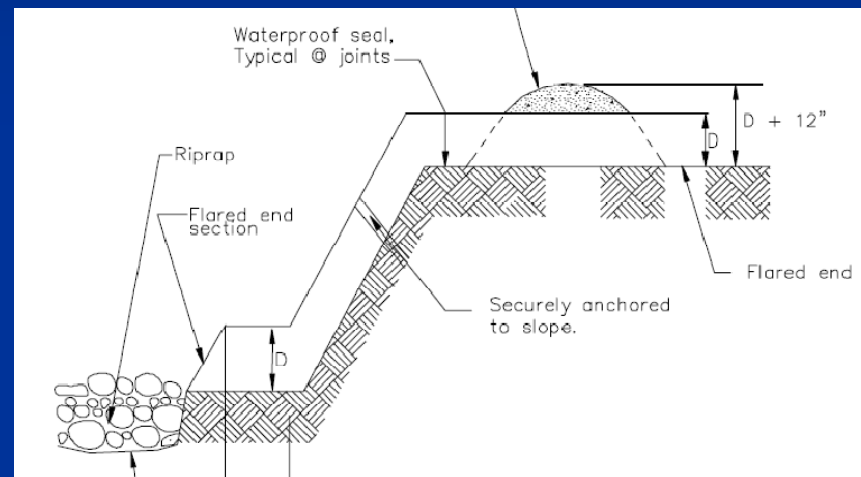
Permanent Measures

- Sediment Basins
- Rock Dams
- Type C Berms
- Permanent Diversions
- Culverts /Baffles
- Energy Dissipators
- Detention Ponds

Temporary Measures

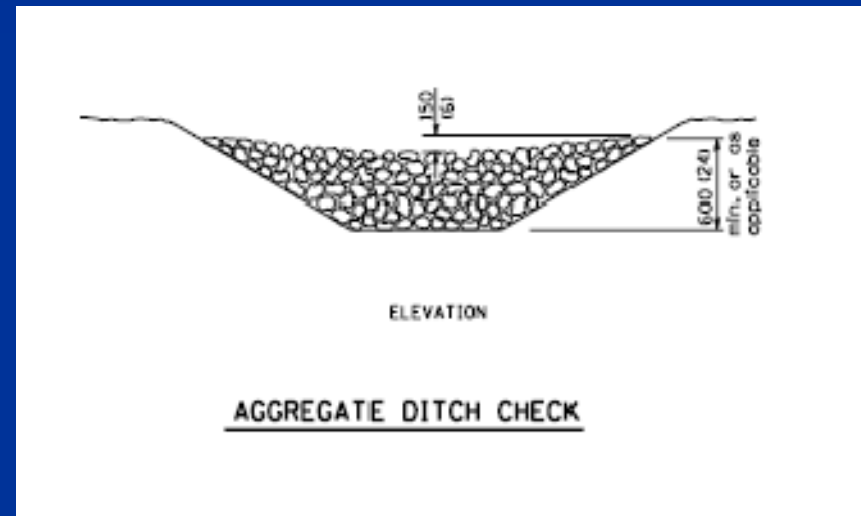
Temporary Slope Drains

- A temporary slope drain is a flexible or rigid conduit used to effectively transport runoff down disturbed slopes



Temporary Ditch and Inlet Checks

- A ditch check is a small, temporary obstruction in a ditch or waterway used to prevent erosion by reducing the velocity of flow. Ditch checks are used to reduce runoff velocity and to contain sediment on the construction site.



Sediment Basin

- A sediment basin is an effective temporary impoundment that is used to detain runoff from disturbed drainage areas so that sediment can settle before it is released



Temporary Seeding and Mulching

- This work shall consist of preparing and fertilizing a seedbed, furnishing and sowing of seed, and mulching. The purpose of temporary seeding and mulching is to produce a quick ground cover to reduce erosion in disturbed areas that are expected to be redisturbed at a later date.

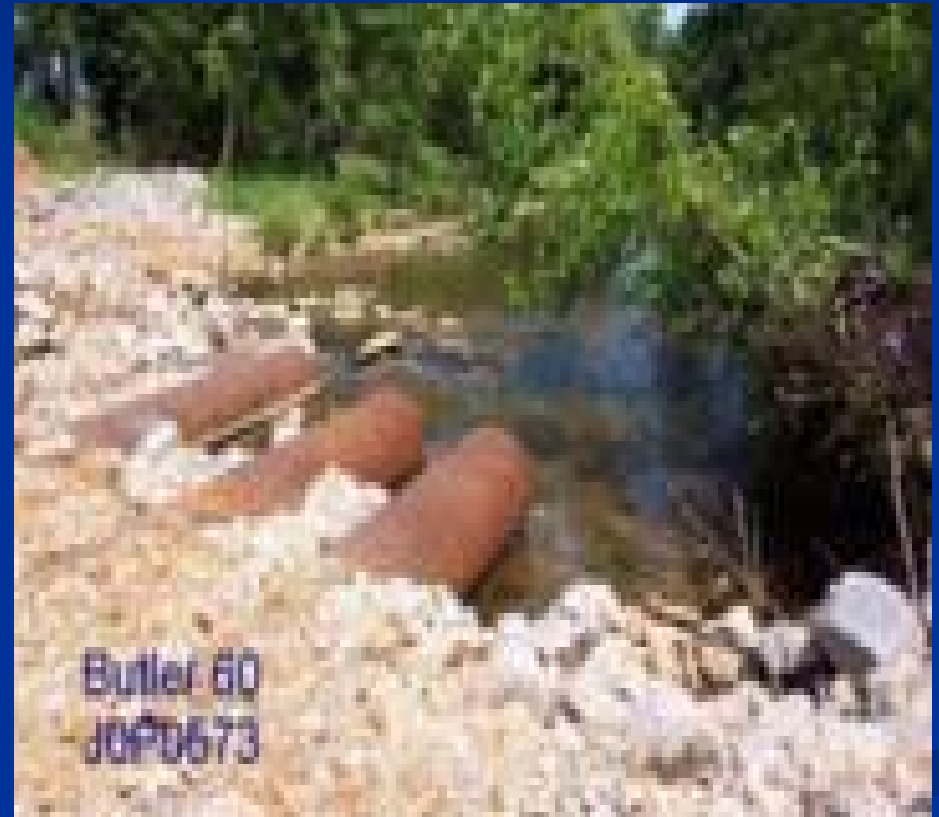
Silt Fence

- Silt fence is a temporary barrier used to filter sediment from sheet flow and decrease velocity of the runoff.



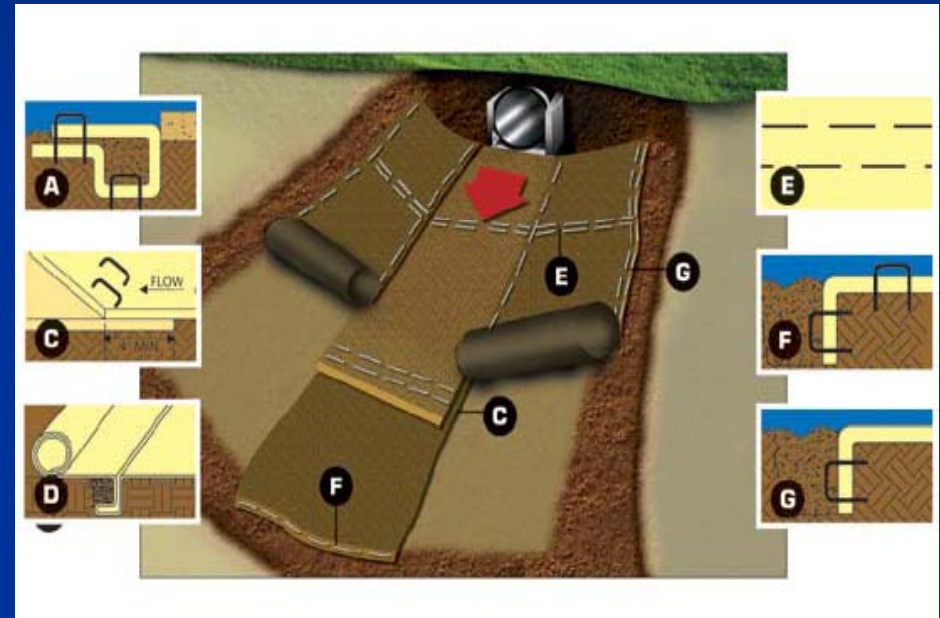
Temporary Pipe

- Temporary pipes are used to carry water under a road that handles traffic, such as a haul road or temporary crossover. The pipe is sized based on a two-year storm.



Temporary Erosion Control Blankets

- Erosion control blankets and plastic netting are used to prevent erosion of seeded areas for a period of time sufficient for the seed to produce a root system capable of providing permanent erosion protection.

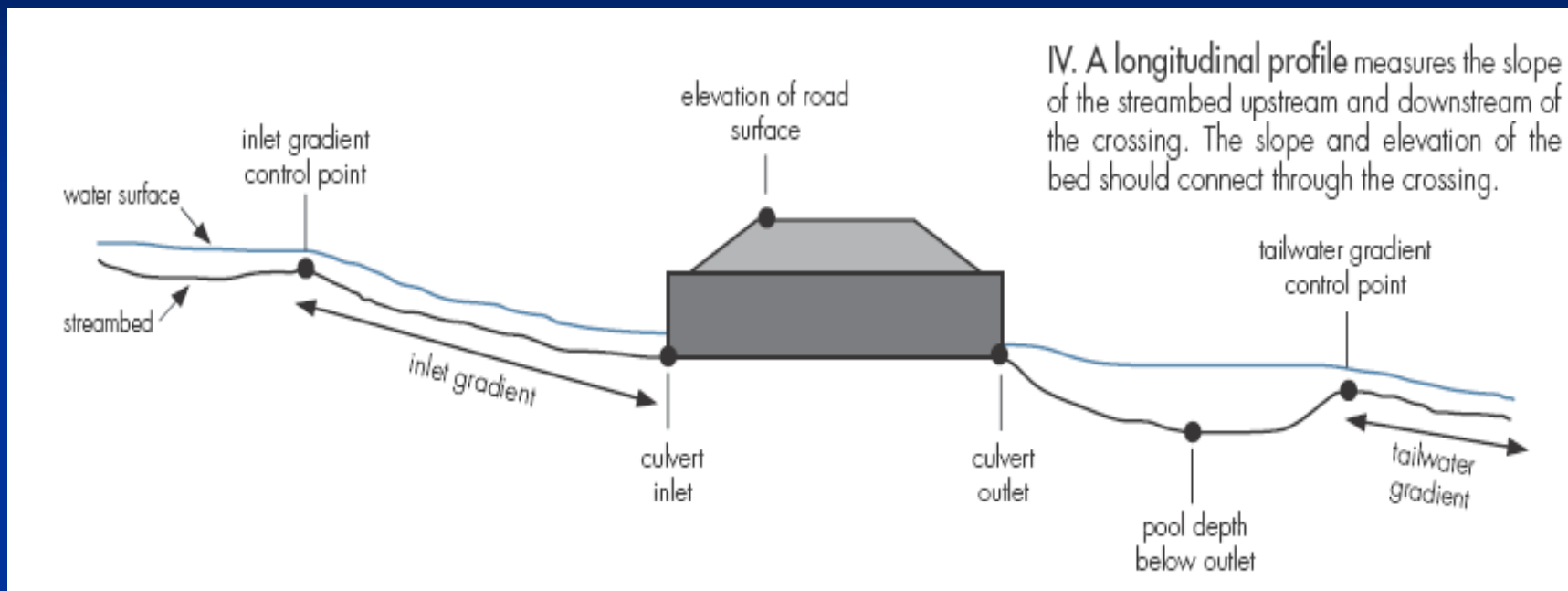


Use of Erosion Control Blankets

- Fill slopes greater than 10 feet high
- Ditch slopes greater than 10 percent
- Highly erodible soils
- Fluctuating water levels
- High ditch flows
- High sheet flow
- Standard seeding and mulching will not withstand anticipated runoff
- Around high quality water bodies.



Temporary Stream Crossing



- Temporary stream crossings are provided to facilitate movement of contractor's equipment across streams in compliance with Corps of Engineer requirements. The crossing is to be constructed such that minimal impact is subjected to the stream and aquatic life.

Contractor's Erosion Control Plan

- To ensure that contractors use Best Management Practices, Contractors must prepare, submit and receive approval for Erosion Control Plans.
- The contractor must ensure that soil erosion is minimized and eroded soil does not leave the construction project into streams or onto adjacent property
- Timely installation of silt control devices, such as silt fence and ditch checks, will help to prevent this damage from occurring.
- Items to be used:
 - Location and timing of silt fence and silt basins and other temporary erosion control measures
 - Schedule for seeding

Best Management Practices

Ditch Erosion

- Ditch erosion is controlled by widening ditches, flattening ditch grades, or by application of proper ditch protection such as mulch, sodding, ditch checks, erosion control blanket, rock ditch liner and paved ditches.

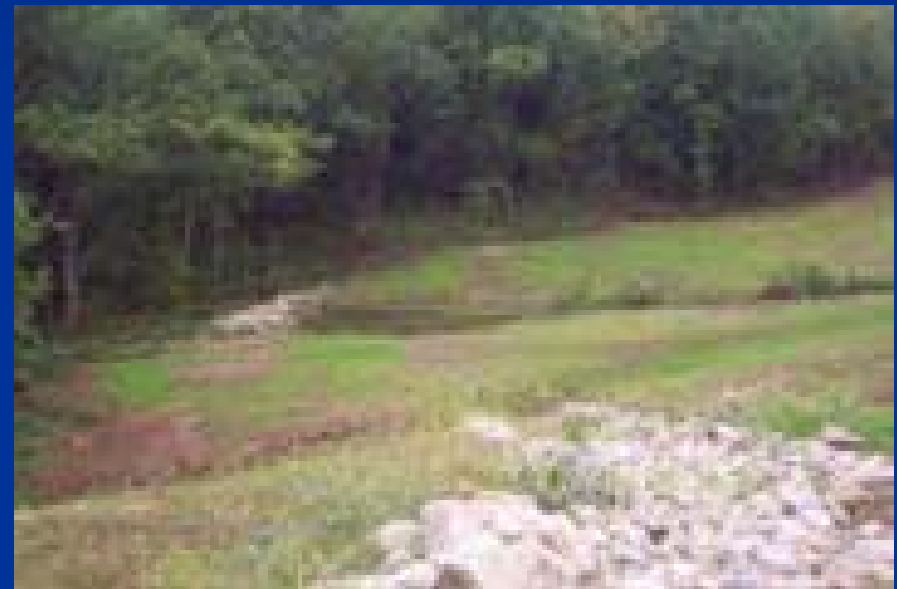
Silt Fences

- Silt fences should be placed around culvert ends to prevent sediment from entering the drainage ditch.



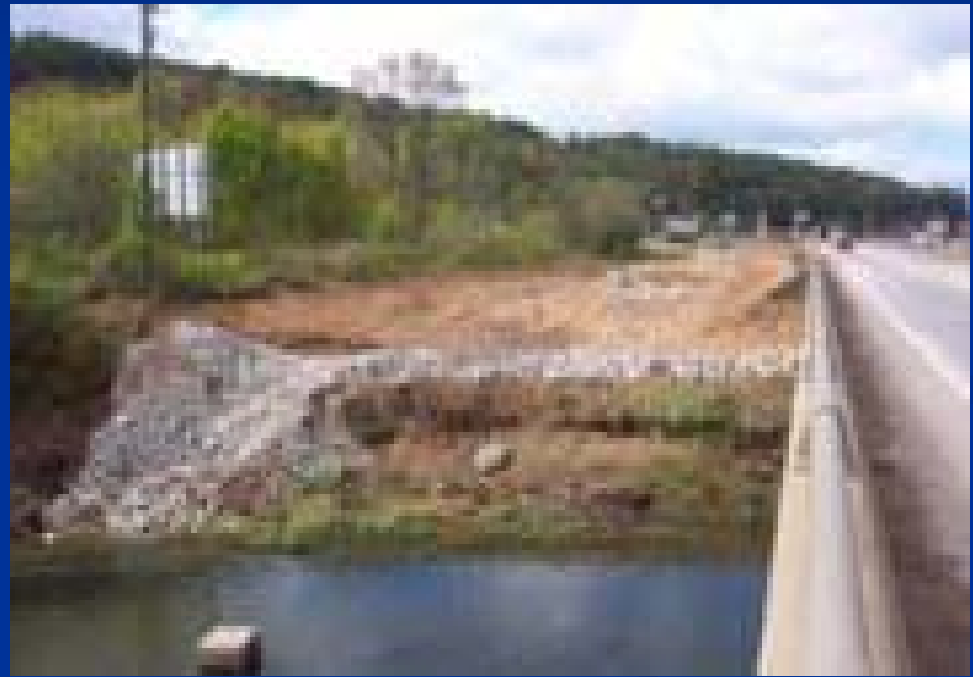
Borrow Areas or Rock Dams

- A Type II ditch check or Type C Berm along the low side of the borrow area could minimize the potential of the silt leaving the site.
- A rock dam is an oversized Type II rock ditch check that serves to impound water and sediment.



Type C Berms

- Type C berms are specified at the toes of spill slopes around bridge construction operations and will be constructed to the specified dimension



Slopes

- Erosion of slopes is controlled by use of interception ditches and by application of proper slope protection measures such as fertilizing, mulching, seeding, blankets or sodding.



Interception of Ditches and Levees

- Interception levees and ditches should be installed at the top of backslopes to prevent gullies from forming on the cuts.

Permanent Diversions

- On large, steep back slopes permanent diversion berms or terraces are used transverse to grade to divert runoff to stabilized slope drains.



Sediment Basins

- A sediment basin is a water storage area with rock riprap placed in inlet and outlet areas with defined side slopes



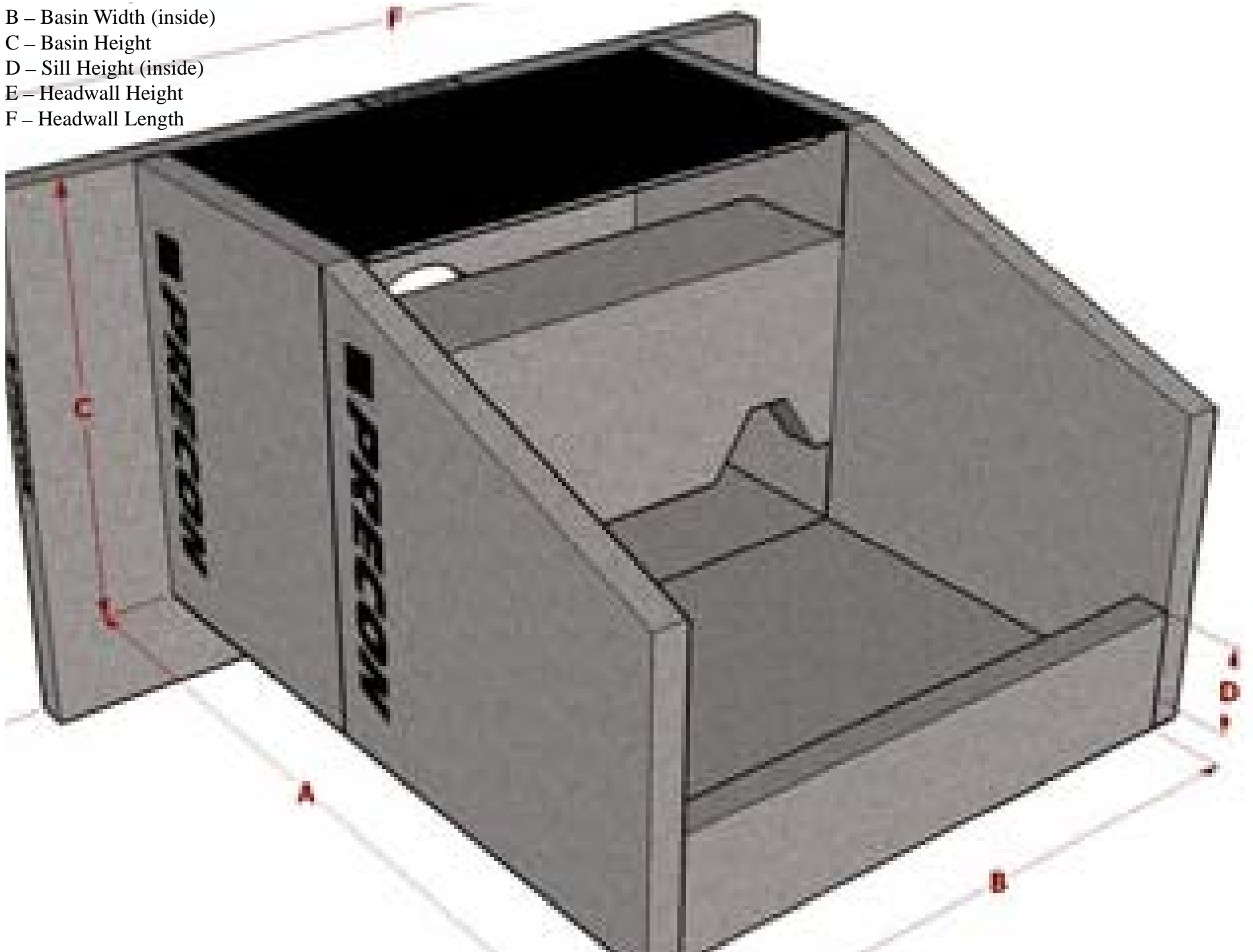
Maintenance During Construction

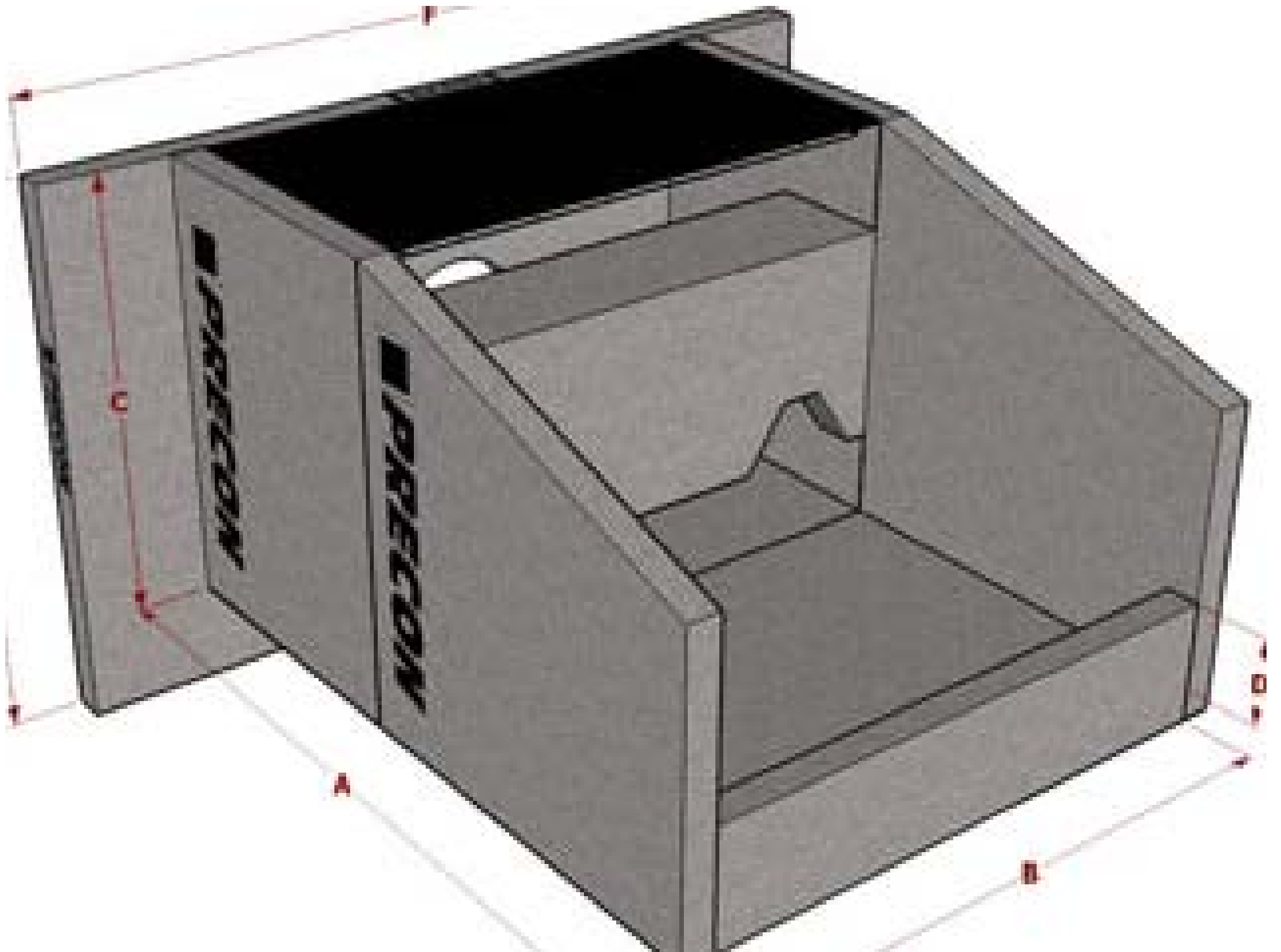
- Inspection personnel assigned to erosion control work should review project plans, specifications, special provisions, and road standards pertaining to erosion control.

Permanent Erosion Control Measures

- Permanent erosion control measures are installed to reduce maintenance costs and to improve appearance.

- B – Basin Width (inside)
- C – Basin Height
- D – Sill Height (inside)
- E – Headwall Height
- F – Headwall Length





Installation of Culverts with Energy Dissipators



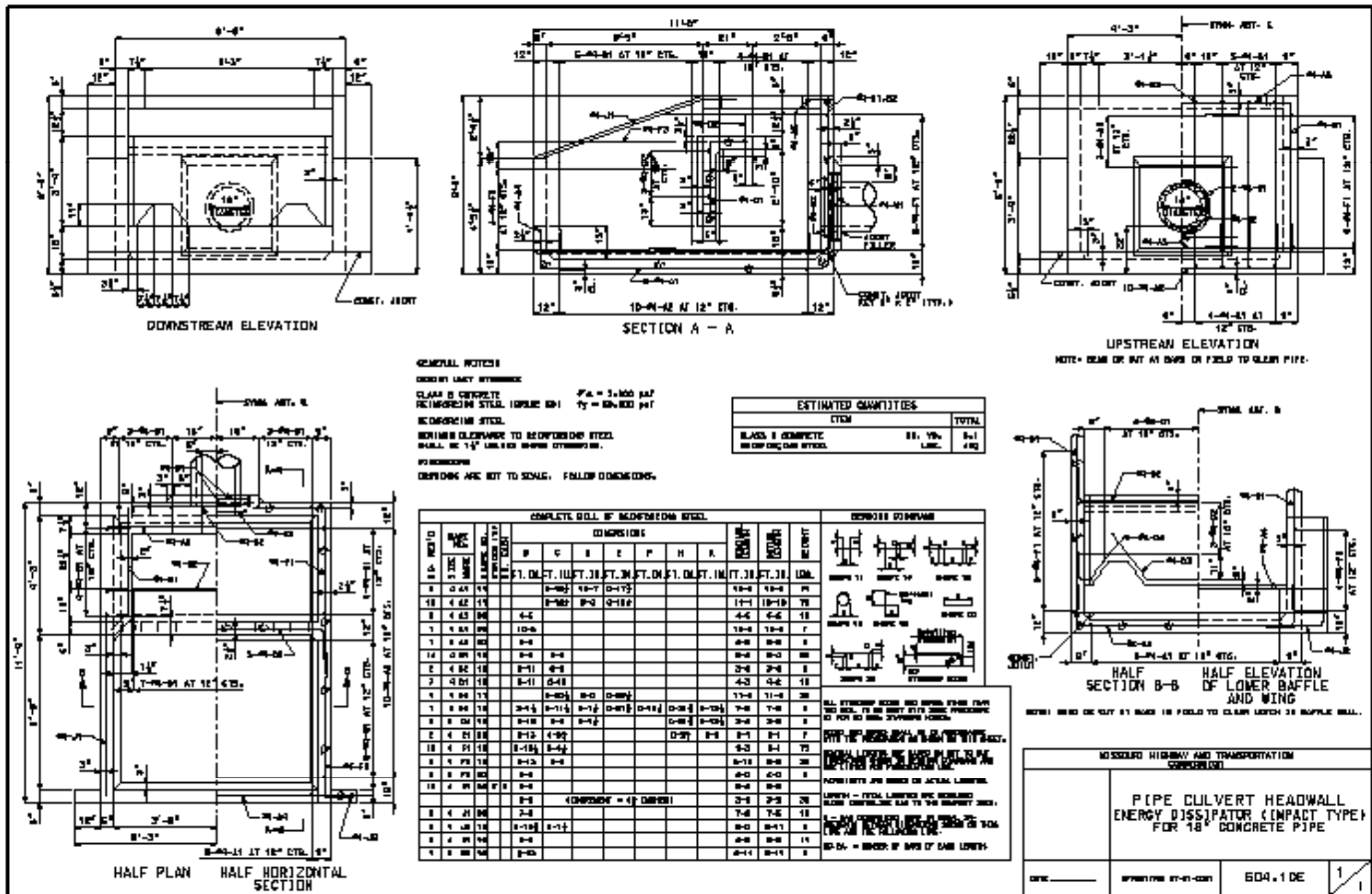
Installation of Culvert with Energy Dissipators



Rock Dams

- A rock dam is an oversized Type II rock ditch check that serves to impound water and sediment.
- It is usually installed down grade from a culvert outlet or at locations where drainages exit Road right of way. The size (length and height) of the rock dam depends on the volume of water that flows through the drainage structure, and the width of the drainage channel. Rock dams are not appropriate where impounded sediment and gravel could accumulate inside of the culvert. Also, rock dams are not appropriate in streams that are regulated by the US Army Corps of Engineers

ENGINEERING DESIGN DRAWING FOR A CULVERT



NO SLOTTED HIGHWAY AND TRANSPORTATION CONSIDERATION

PIPE CULVERT HEADWALL ENERGY DISSIPATOR (IMPACT TYPE) FOR 18" CONCRETE PIPE

DATE: _____ DRAWN BY: [Name] 604-1 DE 1/1

THANK YOU NOTES

- THANK YOU FOR THE OPPORTUNITY. WE LOOK FORWARD TO WORKING WITH YOUR AGENCY