

DESIGN AND OPERATION OF TRASH SCREENS CASE STUDY

PLATT FIELDS

1.0 SCREEN REQUIREMENT

1.1 The Site

The site is situated on the Chorlton Brook in Fallowfield, Manchester within the boundaries of a public park. The brook runs into culvert within the park.



Figure 1.1 General view of Platt Fields trash screen site looking upstream showing silt trap, hard standing and emergency overflow weir. Note that the weir and hard standing are at coincident levels.

1.2 Reason for Installation

There was no previous history of flooding due to blockage of the culvert, however the site is adjacent to a boating lake. A child was killed in an accident in the culvert downstream of the site, in an incident involving a boat.

The screen was installed to exclude the public and particularly children from entering the large culvert. However, the culvert is approximately 100m downstream of the screen. It is 2.8m in height and 2.4m wide. (*Manual, Section 2.1 discusses site history and its influence in determining whether to screen or not*).

1.3 Decision process

It is believed that the decision to install the screen was taken by the Environment Agency's predecessors. The factors considered in the process are not known. (*Manual, Section 2.2 details the approach to risk assessment and risk scoring for the decision process. Evaluation of the key factors presented in the manual does not provide clear recommendations to screen*).

1.4 Consultation

It is not believed that any consultation took place with stakeholders during the scheme appraisal and design stages. It is known that the operators had no knowledge of the screen until it was handed over to them after construction.

2.0 DESIGN

2.1 Designer

A suitably qualified consulting engineer was engaged to undertake the design of the installation.

2.2 Design Parameters

The screen has been designed to prevent unauthorised entry to the downstream culvert. It appears that the design has not taken into account catchment parameters, amount and type of debris in calculation of the screen area.

It would also appear that the recommendations of the interim guidance notes have not been taken into account, although they were available at the time of the design. (*Manual, Section 3.2 details the data requirements needed to evaluate screen need and final design*).

2.3 Screen Area

The total screen area is 28.8m², being of two stages of equal sizing. The raked screens are each 2m in height and are placed at an angle of 75 degrees to the horizontal. The working platforms are 1.6m in width.

The interim guidance note for small amounts of debris recommends a screen size of 20.16m² and therefore the total area of screen is acceptable although the working areas/platforms are included as part of the effective area. (*Manual, Section 3.3.3 details screen size calculations*).



Figure 2.3 General view of the screen. The top handrail position makes raking difficult, also the steps down to the lower working platform have different rises. The screen rake is steeper than recommended in the Manual.

2.4 Features

Platt Fields is a manually cleaned two-stage trash screen that includes an emergency overflow channel. The area immediately upstream of the screen consists of a vertical sided brick lined channel, with local widening to provide for a silt trap.

The screen is formed of two stages with an intermediate landing. The two screens are 4m wide and approximately 4m high raked at an angle of 75° to the horizontal. Bar spacing is 200mm. Ladder access is provided to the watercourse at the foot of the lower screen. (*The manual recommends a bar spacing of 150mm if the exclusion of unauthorised persons is a requirement*).

The emergency overflow is in itself a slot and is capable of becoming blocked by large floating objects. Access to remove these objects is very difficult. The overflow flies past the lower screen and is fitted with bars that prevent access by operatives. The screen is fitted with upstream/downstream telemetry. Gauges are housed within an off line chambers that silt up and are considered by the operators to respond slowly. No access is available to the downstream side of the screen through the screen itself.



Figure 2.4 Trash clearance from the screen using rakes is made difficult by;

- **Position of the top handrailing**
- **Position of the screen bar supports**
- **The interface between the raking bars and the platform bars**

2.5 Access Arrangements

Good access and hard standing is available for plant and equipment in the area adjacent to the silt trap. However, the ground level is coincident with the emergency overflow level and therefore when the screen blocks and the overflow comes into use the hard standing is flooded. Barriers to the vertical walls are designed for pedestrian loadings only.

Pedestrian access is available to the lower working platform, which has a safety line for use with harnesses. *(Manual, Section 3.4.1 provides guidance on screen access requirements. In this case, the access arrangements have clearly been thought about, however the ergonomics could have been better designed).*

3.0 OPERATION

3.1 Operational Development

It does not appear that an operational clearance plan had been formulated before completion of the installation and consequently the clearance operation has developed through experience.

Cleaning of the screens is carried out manually by operatives from the working platforms. Small debris may be removed by barrow although pedestrian access is via several small flights of stairs and is on the opposite side to the hard standing. Large objects can be removed from the lower screen and its landing by a vehicle mounted Hiab grab, although the position of the overflow restricts the operators vision. It is not possible to operate the Hiab and see the material to be

removed. Sections of handrail have been removed and replaced by safety chains to allow the Hiab to access the screen. (*Manual, Section 3.4.2 details alternative approaches to screen clearance. In this case the manual clearing arrangement has been made particularly difficult by the placing of obstacles to clean raking. Also, the rake angle is very steep increasing the operative effort required to clear debris*).

The screen was handed over to the operatives in 1993. Since then a number of modifications have been made subsequently that have improved ergonomic aspects of the site, these include:

- Provision of ladder access to bed of watercourse;
- Further handrails added;
- Handrails removed and chains fitted to provide access at key location and
- Grid fitted to overflow adjacent to trash screen.

The fundamental nature of some of these modifications emphasises the need for liaison with the operator during the design stage and the need to establish a firm understanding of the manner in which the screen will be worked.

The trash screen at Platt Fields is designed so that the overflow operates at a one in twenty year return period storm. In reality, however, if the screen is not cleared promptly water rapidly rises to this level, the majority of the blockages being caused by leaves and small debris clinging to the bars; material which would readily pass down the culvert

During site visits and discussions with site personnel several problems that primarily relate to poor detailed design have been highlighted:

Screen Back Stays

The backstays to the screen are formed of circular hollow sections, to which the bars are welded. When dragging a rake through the screen it either snags on the stay, with a risk of jarring injury or the rake needs to be moved out, with a risk that collected material is lost.

Position of Bottom of Screen

The bottom backstay is close to the surface of the water at normal flows. This leads to a ready accumulation of small vegetative debris that can ultimately lead to the screen becoming blocked. If the stay were positioned either above or below the normal flow, this material would pass through the screen without impediment.

Intermediate Landing

The level of the intermediate landing is below the level of the overflow. If the screen is blocked it is necessary to enter the water to commence cleaning (or possibly clear a 'hole' in screen by leaning over handrails!). To gain access to the screen there are two steps down, a difficult (and unnecessary) feature to traverse when they are below water level. Again very little thought has been put into the detailing here.

Access to Foot of Screen

At low flows operators frequently clear screens by descending into the watercourse and pushing loose debris through the bars. Initially no access was provided to the foot of the screen, although one has subsequently been retrofitted. This ladder also provides a means of access/egress from the channel should it be necessary for other maintenance purposes or in case of accident.



Figure 3.1 The vertical bars at top right protect the entry to the emergency overflow channel. These were fitted after initial commissioning.

Position of Emergency Overflow

The emergency overflow is positioned on the same side as the vehicle access. The provision of vehicular access allows Hiab fitted wagons to visit the site. Hiab grabs can be used to clear the screen of large objects or remove accumulations of detritus material.

At Platt Fields, this operation is made difficult by the presence of the overflow structure that restricts the Hiab operators visibility and prevents the wagon being brought close to the screen. By positioning the road access on the opposite side to the overflow (or visa versa) this deficiency could be overcome.

Level of Hard Standing

The level of the hard standing is coincident with the level of the overflow weir. This means that during flood events the entire area is beneath water.

By raising the level of the hard standing by 300 to 400mm, it would be possible to carry out screen clearing without the need to stand or bring vehicles onto ground that has already been flooded.

Overflow Safety

The overflow is constructed in part alongside the trash screen and to prevent access to a significant vertical drop it has been necessary to fit hand railing. There is no need to bring the overflow into the trash screen area. This would avoid this hazard.

3.2 Equipment on Site

No equipment is kept on site as the installation is open to the public and has a particularly high crime and vandalism problem.

3.3 Access Arrangements



Figure 3.3 View from the screen looking towards the main access road. Note the complex detailing of the paths, steps, railing and brickwork.

The screen has excellent access off the public highway for both vehicles and operatives. Access for operatives however is compromised by poor ergonomic design, as detailed previously.

The screen is tied into an existing bridge over the watercourse. This bridge is suitable for vehicles to access the hardstanding area provided for mechanical clearance.

There is no safe access provided within the screen to the downstream side of the screen. The channel can be accessed downstream of the bridge where there are relatively shallow embankments.

3.4 Reporting and Response procedures

Written reporting and response procedures for the Platt Fields screen are held by the Environment Agency. All Environment Agency screens in this area have specified inspection and maintenance cycles. There are good records of condition from asset surveys and inspector reports.

A call out system exists for operational duty staff that is linked to telemetered level gauges upstream of the site. Experience to date has shown the level gauge to be inaccurate and that warnings to attend have not been made early enough. This problem is compounded by the difficulty operations staff have with the local traffic problems. Road usage in the area is particularly heavy and inevitably, poor weather conditions result in these difficulties being compounded for any emergency response.

These problems have been alleviated in the short term by those staff who know the area being prepared to check installations if they believe there may be problems, whether they are on call or not. This solution is only sustainable whilst those staff with a detailed knowledge of the catchment are prepared to do this. The Environment Agency is investigating enhanced response systems at the time of writing to ensure a robust response system is available in the future.



Figure 3.4 View immediately upstream of the screen showing the levels of each bank top. On the right, the position of the overflow dictates the height of the hardstanding area where debris has to be collected.

4.0 MAINTENANCE

4.1 Inspection Procedures

Inspections are undertaken on a two weekly basis and additionally in the event of any emergency. It is not believed that written clearance procedures exist, however, the operators have developed a suitable system of clearance given the limitations of the installation.

5.0 PERFORMANCE

There are many factors here that result in a screen performance that can only be described as less than satisfactory. Both in discussion with operations staff and in the technical assessment there are clear deficiencies in the overall design of the installation.

Since the commissioning of the installation there have been numerous modifications attempting to improve overall performance and the health and safety of the operatives who work on the installation.

However even with the modifications there remain a number of serious failings;

- The access arrangements for operatives provide numerous trip hazards that could have been easily avoided by consideration of ergonomics during the design process.
- The screen becomes blocked by leaves that should be able to pass through the screen. Raising the screen bars off the bottom of the channel would help this situation, as would the positioning of the lower structural support above the normal water level.

These failings demonstrate clearly the need to consider all those aspects of trash screen operation and particularly to ensure an inclusive assessment and design process.



Figure 5.1 Leaf debris is clearly visible at the bottom of the screen that should be passed through the screen. Operatives have stated that during an event the majority of their time is spent clearing leaves.