



INDUSTRIAL CITIES
M e s a i e e d • R a s L a f f a n

DEVELOPMENT PLANNING & ENGINEERING

Development Engineering Section

Guidelines for Site Grading and Drainage

QGL-CE-004

**Guidelines for Site Grading and
Drainage**

QGL-CE-004

Rev. No: 02
Draft No: Final
Date: 21-08-2014
Page No.: 1

 <p>قطر للبترول Qatar Petroleum INDUSTRIAL CITIES Mesaieed • Ras Laffan</p>	Guidelines for Site Grading and Drainage	QGL-CE-004
		Rev. No: 02 Draft No: Final Date: 21-08-2014 Page No.: 2

CONTENTS

1.0	OBJECTIVES	3
2.0	SCOPE	3
3.0	POLICY	3
3.1	Grading Policy	3
3.2	Drainage Policy.....	3
4.0	DEFINITIONS / ABBREVIATIONS	3
5.0	RELATED DOCUMENTS	4
6.0	PROCEDURE AND REQUIREMENTS.....	5
6.1	Baseline Assessment.....	5
6.1.1	Site Survey:.....	5
6.1.2	Services Survey.....	5
6.1.3	Topographical Survey:.....	5
6.1.4	Geotechnical Investigation.....	6
6.2	Information provided by QP-DC	6
6.3	Grading and Drainage Design Criteria	6
6.3.1	Grading Design Criteria	6
6.3.2	Drainage Design Criteria.....	9
6.4	Requirements for Off-Plot Storm Water Drains	9
6.5	Grading and Drainage Plans.....	10
6.5.1	On-Plot Drawings/Documents	10
6.5.2	Off- Plot Drawings/Documents	11
6.6	Disposal of Surplus Excavated Material.....	11
7.0	RESPONSIBILITIES.....	11
7.1	End-Users	11
7.2	QP-DC.....	11
8.0	Attachments	12
8.1	Attachment-1- Rainfall Intensity Calculation.....	12

 <p>قطر للبترول Qatar Petroleum INDUSTRIAL CITIES Mesaieed • Ras Laffan</p>	Guidelines for Site Grading and Drainage	QGL-CE-004
		Rev. No: 02 Draft No: Final Date: 21-08-2014 Page No.: 3

1.0 OBJECTIVES

The objective of this document is to set out the general guidelines for Grading and Drainage for sites within Ras Laffan Industrial City.

2.0 SCOPE

These guidelines cover the basic principles and requirements for Grading of the plots & allocated corridors and drainage on the End-User plots. These guidelines apply to all End-Users leasing industrial plots and corridors in Ras Laffan Industrial City.

3.0 POLICY

QP-DC policies on Grading and Drainage are as given below:

3.1 Grading Policy

Site Grading of the plots and corridors allocated to the End-Users must comply with overall grading philosophy of QP-DC as stipulated in this guideline

3.2 Drainage Policy

Storm water and fire water from End-User plots shall be managed and controlled within the plot boundaries. No dewatering discharge is permitted in QP-DC drains without the prior concurrence of QP-DC Operation & Maintenance Department and meeting their requirement. Discharge of storm water to the Gulf shall be approved by Ministry of Environment (MoE), State of Qatar.

4.0 DEFINITIONS / ABBREVIATIONS

This section contains definitions and acronyms which must be clearly understood by the End-Users.

Definition	Description
Approval	Agreement to proceed with specified activities.
Approve	To accept as satisfactory, permit or officially agree
Contractor	A party engaged by End User to perform works / or services under a contract

 قطر للبترول Qatar Petroleum INDUSTRIAL CITIES Mesaieed • Ras Laffan	Guidelines for Site Grading and Drainage	QGL-CE-004
		Rev. No: 02 Draft No: Final Date: 21-08-2014 Page No.: 4

End User	A Company or firm that uses services, facilities and occupies QP-DC land for the purpose of manufacturing a product or providing a service to QP-DC or other tenants within QP-DC.
Guideline	Similar to a procedure but less prescriptive in nature. Contains general instructions/guidance to carry out a series of actions.
Shall	A mandatory action
Should	A preferred course of action or activity

Abbreviation	Definition
QP-DC	QP Industrial Cities
QNHD	Qatar National Height Datum
QHDM	Qatar Highway Design Manual
QCS	Qatar Construction Specification
FGL	Finished Grade Level

5.0 RELATED DOCUMENTS

Documents as listed below are provided by QP-DC to End-Users, upon their written request:

It is incumbent to End-Users/Contractors to confirm that the latest revision of the Regulation / Guideline / Procedure / Document / Drawing is employed.

- **Fugro Report** - contains information on soils and the geo-hydrology of Ras Laffan Industrial City
- Drawing No. **SK-RLC-02319** – Ras Laffan Industrial City Profile of Earthworks for Corridor Grading
- Drawing No. **SK-RLC-00163** - Utility Crossings and Pipe Culvert Details
- **Environmental Regulations** for Ras Laffan Industrial City-2005
- **QPR-RHT-REG-001** - Health, Safety and Environment Regulations
- **QPR-RHE-002**– Waste Management Procedure
- **QPR-RIE-010** – Procedure for Use of the Consolidated Permit to Work for Ras Laffan Industrial City Common Areas

 <p>قطر للبترول Qatar Petroleum INDUSTRIAL CITIES Mesaieed • Ras Laffan</p>	Guidelines for Site Grading and Drainage	QGL-CE-004
		Rev. No: 02 Draft No: Final Date: 21-08-2014 Page No.: 5

- **QPR-RHE-019**– Permit Procedure for Surplus Soil Material Handling within RLIC

Other related documents

- Qatar Highway Design Manual (**QHDM**)
- Qatar Construction Specification (**QCS**)

6.0 PROCEDURE AND REQUIREMENTS

6.1 Baseline Assessment

End-Users shall conduct their own baseline assessment concerning the following:

6.1.1 Site Survey:

Site survey will identify and describe significant on-site features such as vegetation and any other features important from the point of preservation of the natural environment.

6.1.2 Services Survey

Services survey will identify all the existing aboveground and belowground services like cables, pipelines, drains, utilities based upon the available information in the As Built drawing and/or physical investigation.

6.1.3 Topographical Survey:

The topographical survey will be carried to meet the following requirements:

- i. To identify high and low areas, general level of the area and contours.
- ii. To establish requirement of grading and levelling, cutting and filling and quantities of imported or surplus fill as the case may be.
- iii. To establish quantity of surplus soil for transfer to QP-DC in the case of surplus fill.
- iv. Topographical Survey must include an area of 100 m from the End-User plot boundaries or the nearest roads, services, other End-Users plots; whichever is nearer.
- v. To assess drainage patterns and the possible effects of topography on both On-plot and Off- Plot storm water run-off.
- vi. To reflect Off-Plot topography in the design of On-Pot storm water drainage system

 <p>قطر للبترول Qatar Petroleum INDUSTRIAL CITIES Mesaieed • Ras Laffan</p>	<p>Guidelines for Site Grading and Drainage</p>	QGL-CE-004
		<p>Rev. No: 02 Draft No: Final Date: 21-08-2014 Page No.: 6</p>

- vii. Topographical survey shall also be done for the corridors allocated to the End-Users.
- viii. The topographical survey shall be based on **QNHD and CD(Chart Datum)**

6.1.4 Geotechnical Investigation

Geotechnical investigation will be carried out to assess soil properties and the geo-hydrology to determine possible effects on the strength, stability, and safety of buildings and structures and to prevent the pollution of subsurface water.

End-Users must submit copy of report of the Site Survey, Services Survey, Topographical Survey and Geotechnical Investigation to QP-DC.

6.2 Information provided by QP-DC

QP-DC, upon request in writing, will provide End-Users with the following information:

- i. Co-ordinates of the Plot boundaries. End-Users shall conduct their own land survey to locate beacons in accordance with the co-ordinates issued.
- ii. Geotechnical information from available Site Geotechnical Investigation Reports concerning any boreholes and test pits located on the plot.
- iii. Topographical information based on Qatar National Height Datum, if available.
- iv. The geotechnical and topographical information provided by QP-DC to the End-Users is only for information purpose. QP-DC shall not be held responsible for the accuracy and correctness of the same. End-Users shall conduct their own geotechnical investigation in respect of soil and groundwater and topographical survey to meet their requirements.
- v. As-Built drawings as available related to the existing aboveground and underground services.

6.3 Grading and Drainage Design Criteria

End-Users shall adhere to the following design criteria with regard to the Grading of plots and corridors and Drainage on the plots:

6.3.1 Grading Design Criteria

- i. The plots shall be allotted to the End-Users on “As is where is” basis after the necessary lease agreement has been signed. Grading of the plots shall be End-User responsibility.
- ii. The Finished Grade Level of End-Users plots shall be maintained as mentioned in Table-1 below with respect to Ras Laffan Industrial City.
- iii. In the event of the plot allotted to an End-User is not covered by the Table-1 below, QP-DC (Ras Laffan) will provide End-Users with the required Finished Grade Level for such plots.

 <p>قطر للبترول Qatar Petroleum INDUSTRIAL CITIES Mesaieed • Ras Laffan</p>	Guidelines for Site Grading and Drainage	QGL-CE-004
		Rev. No: 02 Draft No: Final Date: 21-08-2014 Page No.: 7

- iv. Finished Grade Level of +2.10 m QNHD shall be maintained as the minimum requirement for End-Users plots in Ras Laffan.
- v. The corridors shall be allocated to the End-Users on “As is where is” basis after the necessary lease agreement has been signed. Grading of the corridors shall be End-User responsibility.
- vi. The Finished Grade Level of the corridors allocated to End-Users in Ras Laffan shall comply with “Drawing No. SK-RLC-02319 – Ras Laffan Industrial City Profile of Earthworks for Corridor Grading”.
- vii. In the event of the corridor allocated to an End-User in Ras Laffan is not covered by the above drawing, Finished Grade Level of +1.80 m QNHD shall be maintained as the minimum requirement.
- viii. End-Users shall transport the top soil and surplus soil material in compliance to QP-DC requirements to the designated areas.

Table-1 -Finished Grade Level for End-User Plots at Ras Laffan

Plot Designation	FGL in m QNHD	Existing End-User/Future Allocation of plot
Lot E1	Refer SK-RLC-2319, latest Rev	Tank Farm Area
Lot E2	Refer SK-RLC-2319, latest Rev	Oryx GTL Ltd.
Lot E2A	Refer SK-RLC-2319, latest Rev	Future industry
Lot E3	Refer SK-RLC-2319, latest Rev	Future industry
Lot E4	Refer SK-RLC-2319, latest Rev	Future industry
Lot E5	Refer SK-RLC-2319, latest Rev	RLIC East Side Support Service Area
Lot E6	Refer SK-RLC-2319, latest Rev	RLIC Camp 2
Lot E7	Refer SK-RLC-2319, latest Rev	RLIC Camp 1
Lot E8	Refer SK-RLC-2319, latest Rev	RLIC Golf Course
Lot E9	Refer SK-RLC-2319, latest Rev	Waste Management Facility
Lot LNG-1	-	Qatar Gas
Lot LNG-2	-	RasGas

Guidelines for Site Grading and Drainage

QGL-CE-004

Rev. No: 02
 Draft No: Final
 Date: 21-08-2014
 Page No.: 8

Plot Designation	FGL in m QNHD	Existing End-User/Future Allocation of plot
Lot W1	Refer SK-RLC-2319, latest Rev	Laffan Refinery Co. Ltd. Phase-I
Lot W1A	Refer SK-RLC-2319, latest Rev	Laffan Refinery Co. Ltd. Phase-I & Future Industry
Lot W2	Refer SK-RLC-2319, latest Rev	Future Industry
Lot W3	Refer SK-RLC-2319, latest Rev	Future Industry
Lot W4	Refer SK-RLC-2319, latest Rev	Ras Laffan Olefins Co. Ltd.
Lot W4A	Refer SK-RLC-2319, latest Rev	Future Industry
Lot W5	Refer SK-RLC-2319, latest Rev	Future Industry
Lot W5A	Refer SK-RLC-2319, latest Rev	Poly Silicon Plant Phase-I
Lot W6	-	Dolphin Energy
Lot W6A	Refer SK-RLC-2319, latest Rev	Future Industry
Lot W7	Refer SK-RLC-2319, latest Rev	Qatar Shell GTL Ltd.
Lot W8	Refer SK-RLC-2319, latest Rev	Al Karaana
Lot W9	Refer SK-RLC-2319, latest Rev	Al Sajeel
Lot W10	Refer SK-RLC-2319, latest Rev	Qatar Shell GTL Ltd. & Future Industry
Lot W11	Refer SK-RLC-2319, latest Rev	Future Industry
Lot W12	Refer SK-RLC-2319, latest Rev	Future Industry
Lot W13	Refer SK-RLC-2319, latest Rev	Future Ethylene Petrochemical Complex1
Lot W14	Refer SK-RLC-2319, latest Rev	Future Ethylene Petrochemical Complex2
Lot W15	Refer SK-RLC-2319, latest Rev	Future Ethylene Petrochemical Complex3
Lot W16	Refer SK-RLC-2319, latest Rev	Ras Girtas Power Co. (IPP-3)

 <p>قطر للبترول Qatar Petroleum INDUSTRIAL CITIES Mesaieed • Ras Laffan</p>	Guidelines for Site Grading and Drainage	QGL-CE-004
		Rev. No: 02 Draft No: Final Date: 21-08-2014 Page No.: 9

Plot Designation	FGL in m QNHD	Existing End-User/Future Allocation of plot
Lot W17	Refer SK-RLC-2319, latest Rev	Future Industry
Lot W18	Refer SK-RLC-2319, latest Rev	Barzan
Lot N1	Refer SK-RLC-2319, latest Rev	QG II and RG LNG Tank Farm
Lot N2	Refer SK-RLC-2319, latest Rev	QG II and RG LNG Tank Farm
Lot N3	+2.40	Future LNG Tank Farm

6.3.2 Drainage Design Criteria

- i. All storm water and fire water from the End-User plots shall be collected, controlled and managed within the plot boundaries.
- ii. All Storm Water generated on the End-User plots and impact of Firewater shall be considered for the design of the drainage system.
- iii. The drainage system shall be designed for the worst case scenario.
- iv. No storm water and/or firewater shall be discharged to the QP-DC drains from End-User plots.
- v. The sizing of the storm-water drainage system shall be based upon rainfall intensity calculated from Intensity-Duration-Frequency relationship established by Ahmad and Bazaraa as given in Attachment-1.
- vi. No industrial water, waste water shall be discharged to the storm water drainage system.
- vii. The storm water drainage system shall not cause any pollution or contamination of the environment like soil and underground water.

6.4 Requirements for Off-Plot Storm Water Drains

In the event End-Users decide to construct drains, pipelines and other drainage facilities in QP-DC common areas for discharge of storm water to the Gulf, End-Users shall comply with the following requirements:

- i. Discharge of storm water to the Gulf requires prior approval from the Ministry of Environment (MoE) and shall also comply with Clause 2.1.4 of Environmental Regulations for QP-DC (Ras Laffan Industrial City-2005).
- ii. All Structures such as drains, pipelines to transport On-Plot storm water or firewater to the Gulf shall be constructed, operated and maintained by the End-Users at their own cost.

 <p>قطر للبترول Qatar Petroleum INDUSTRIAL CITIES Mesaieed • Ras Laffan</p>	<p>Guidelines for Site Grading and Drainage</p>	<p>QGL-CE-004</p>
		<p>Rev. No: 02 Draft No: Final Date: 21-08-2014 Page No.: 10</p>

- iii. The facilities shall be constructed with all the necessary protections and safety precautions so that safety of End-Users and QP-DC assets is not compromised.
- iv. The facilities shall be functional at all times and shall not hamper/ adversely affect End-Users and QP-DC facilities & services. Maintenance of facilities will be carried out in liaison with QP-DC.
- v. All drainage systems in QP-DC common areas require QP-DC review and approval therefore End-Users shall submit their proposal to QP-DC.
- vi. QP-DC may require End-Users to provide additional capacity for the proposed drainage system based upon case to case review. End-Users shall comply with such requirements of QP-DC.
- vii. The off-plot storm water drains shall be lined with concrete or stone and the drains shall be durable and aesthetically pleasing.
- viii. Design features such as sand traps, oil skimmers and shut off mechanism shall be provided to allow for the periodic cleaning, skimming of free oil and regulating flow.
- ix. Appropriate protection against possible erosion shall be provided at the point of discharge in the seabed in the form of a rock/stone mattress, or any other appropriate environmentally compatible mitigation measure as approved by QP-DC.

6.5 Grading and Drainage Plans

End-Users shall submit Grading and Drainage Plans for QP-DC review and approval prior to commencing any site works for all On-Plot and Off- Plot construction where the natural ground level is likely to be changed.

End-Users must ensure that their Grading and Drainage Plans are in compliance with the Grading and Drainage Design criteria as mentioned above. End-Users submission for Grading and Drainage Plans must include the Topographical Survey Reports for the End-User plots and corridors and on-plot and off-plot drawings and documents as below:

6.5.1 On-Plot Drawings/Documents

- i. Cross-sections of the proposed Finished Grade Level.
- ii. Estimated quantities of the top soil and surplus soil available for transfer to QP-DC.
- iii. Estimated quantity of the fill material required and source of fill material.
- iv. Vehicle routing map for disposal of top soil and surplus soil material and/or import of the fill material to and from the End-User plot and within QP-DC.
- v. The point(s) if any at the boundary of the plot for discharge of storm water to the Gulf.

 <p>قطر للبترول Qatar Petroleum INDUSTRIAL CITIES Mesaieed • Ras Laffan</p>	<p>Guidelines for Site Grading and Drainage</p>	QGL-CE-004
		<p>Rev. No: 02 Draft No: Final Date: 21-08-2014 Page No.: 11</p>

6.5.2 Off- Plot Drawings/Documents

- i. Requirements as mentioned at 6.4.1 above with respect to the Off-Plot Corridors particularly in reference to the grading of corridors.
- ii. The routing of the discharge channel to the Gulf from the point(s) of discharge at plot boundary, if applicable.
- iii. Engineering details of the discharge channel such as dimensions, cross sections, slope, material of construction, details of walls, channel floor, lining.

6.6 Disposal of Surplus Excavated Material

The surplus excavated material shall be disposed off to the QP-DC assigned areas in full compliance of the QP-DC requirement as covered in the Permit Procedure for Surplus Soil Material Handling within RLIC- **QPR-RHE-019** and Waste Management Procedure - **QPR-RHE-002**.

7.0 RESPONSIBILITIES

7.1 End-Users

End-User is responsible for:

- i. Baseline assessment.
- ii. Maintain FGL of the plots and corridors according to these guidelines.
- iii. Transfer all surplus soil, top soil material to QP-DC designated area(s).
- iv. Collect, Control and manage all storm water and firewater within the plot boundaries.
- v. Design, Construct and maintain Off-Plot structures.
- vi. Ensure no pollution or contamination is caused to the environment.
- vii. Coordinate with QP-DC and other End-Users as required.
- viii. End-Users/Contractors are responsible to adhere to these guidelines and any other stipulations which may be imposed by a regulation, guideline or procedure from time to time by QP-DC.

7.2 QP-DC

- i. Review and approval of End-Users/Contractors submissions related to Grading and Drainage in compliance with these guidelines and QP-DC requirements.
- ii. Updating information included in this document.
- iii. Providing, upon written request, up-to-date documents and drawings as referred to in section 4.0.

 <p>قطر للبترول Qatar Petroleum INDUSTRIAL CITIES Mesaieed • Ras Laffan</p>	Guidelines for Site Grading and Drainage	QGL-CE-004
		Rev. No: 02 Draft No: Final Date: 21-08-2014 Page No.: 12

8.0 Attachments

8.1 Attachment-1- Rainfall Intensity Calculation

Rainfall Intensity (I)

The rainfall Intensity required for the sizing of the Storm Water Drainage system will be established using Ahmad and Bazaraa equation based on the Intensity–Duration–Frequency of occurrence relationship obtained by statistical analysis of rainfall events as given below:

$$I = \frac{C.(Tr)^m}{(t + d)^n}$$

Where,

- I = Intensity of Rainfall (mm/hr)
- Tr = Return Period (Years), to be considered as 25 Years
- t = Storm duration (minutes) - T_c as calculated below
- C = Constant, 410
- m = Constant, 0.206
- n = Constant, 0.787
- d = Constant, 10

Time of Concentration (T_c)

The time of concentration is defined as the interval of time from the beginning of the rainfall to the time where the water from the most remote part of the catchment reaches the point under consideration and is used to determine the effective rainfall intensity:

$$T_c = T_e + T_f$$

T_e is the time of entry

T_f is the time of flow through the channel system to the point under consideration

Time of entry will be calculated using Bransby-Williams equation:

$$T_e = \frac{58L}{A^{0.1} S^{0.2}}$$

Where,

- T_e = Time of entry in minutes
- L = Maximum length of catchment in Km

 <p>قطر للبترول Qatar Petroleum</p> <p>INDUSTRIAL CITIES Mesaieed • Ras Laffan</p>	<p>Guidelines for Site Grading and Drainage</p>	<p>QGL-CE-004</p> <p>Rev. No: 02 Draft No: Final Date: 21-08-2014 Page No.: 13</p>
---	--	--

A = Catchment Area in Km²

S = Grade slope in m/Km

Using the Rainfall intensity as above, the peak discharge will be calculated for sizing of the storm water drainage system.