

Chapter 4 Project Development and Evaluation of Alternatives



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4 PROJECT DEVELOPMENT AND EVALUATION OF ALTERNATIVES

4.1 Introduction

This chapter describes the elements of the proposed SCPX Project for which alternatives were assessed and explains the reasons why particular options were adopted for the proposed SCPX base case presented in Chapter 5. The alternatives are:

- The 'no development' option
- The development concept and the type and size of pipeline
- The pipeline route
- The type of river and road crossings
- The location of the facilities
- The location of construction camps and pipe storage areas
- The routing of access roads
- Logistics.

Alternative options are generally evaluated with consideration given to environmental and social (E&S) and health and safety (H&S) potential impacts, technical feasibility and commercial implications.

4.2 No-Development Alternative

If the SCPX Project does not go ahead, it will have no environmental and social impacts from construction or operation, but some positive benefits would also be lost:

- There would be no export route for the additional gas produced from the Shah Deniz (SD) Full Field Development (FFD) or for future gas volumes from other developments in the Caspian region
- The Azerbaijan Government would forgo the revenue earnings from the SD FFD, which could fund continued social and environmental improvement in the country
- Europe, Georgia and Turkey would forgo the security of gas supply that transport of the gas from the SD FFD provide
- The social benefits of the employment opportunities and economic stimulus that it would generate would be lost.

The lack of benefits and the potential risks associated with the no-development option were considered unacceptable by the Project proponents on financial, environmental and social grounds, and the decision was made to identify the most suitable export option for gas from the SD fields in the Caspian Sea.

4.3 Development Concept Alternatives

4.3.1 *Export Methods*

The South Caucasus Pipeline (SCP) ESIA discussed alternative methods for exporting gas from the Sangachal Terminal in Azerbaijan, including conversion to liquefied natural gas for bulk transport and conversion to electrical power for transfer by power lines. The conclusion that gas export by pipeline is the efficient and economic option is still valid.

4.3.2 **Project Concept**

The existing 42"-diameter SCP pipeline has been transporting gas from the Sangachal Terminal in Azerbaijan for 690km to the border of Georgia and Turkey since 2006, with a system design capacity of 7.41 bcma (billion cubic metres annually). Further development of the SD reservoir is planned, with the additional gas produced significantly exceeding the current capacity of the SCP.

The required flow rate can be achieved by a number of different concepts combining variations of pipeline diameter, pipeline loop length and compression power. Increasing the diameter of the pipeline reduces the rate at which the gas pressure in the pipeline diminishes, so less compression power is needed as the pipeline diameter increases. Decreasing the pipeline loop length has the effect of increasing the compression power needed.

Various options to expand the existing SCP system, to incorporate the additional gas from the SD FFD, were evaluated.

- A 42"-diameter pipeline:
 - Option 1 – a pipeline loop through Azerbaijan to the Georgia–Turkey border and one compressor station in Georgia
 - Option 2 – a pipeline loop through Azerbaijan and for some distance in Georgia and two compressor stations in Georgia
 - Option 3 – a pipeline loop through Azerbaijan and no pipeline loop in Georgia, but three compressor stations (one in Azerbaijan, two in Georgia).
- A 56"-diameter pipeline:
 - Options A and B – a partial pipeline loop for some distance in Azerbaijan and Georgia and two compressor stations in Georgia
 - Option C – a pipeline loop through Azerbaijan and for some distance in Georgia and one compressor station in Georgia
 - Option D – a pipeline loop through Azerbaijan to the Georgia–Turkey border and with one compressor station in Georgia
 - Option E – a pipeline loop through Azerbaijan to the Georgia–Turkey border and one compressor station in Azerbaijan.

Note all options require additional compression power at the Sangachal Terminal in Azerbaijan, which is outside the scope of this ESIA.

In each case, options were evaluated in terms of:

- Health and safety (H&S) – accessibility, construction hazards, operational hazards
 - H&S-Operation
 - H&S-Process and Locational
 - H&S-Construction
- Environmental and social (E&S) impacts
 - ES-Operation
 - ES-Construction
- Technical feasibility (geotechnical constraints, constructability and operational constraints)
 - Accessibility for Operation
 - Soil Conditions
 - Accessibility for Construction
 - Topography
- Commercial implications (capital expenditure, operating expenditure).

The evaluation process was carried out by a multidisciplinary team that:

- Took account of the relative importance of H&S, E&S, technical and commercial considerations
- Scored the construction and operation of each option using professional judgement, previous experience and the results of early baseline surveys
- Totalled the scores for each option.

The concept with the lowest score was deemed the concept that best balanced H&S, E&S, technical and commercial constraints.

4.3.2.1 Environmental and Social Assessment

Each of the three options was assessed against Environmental and Social sensitivity indicators that were adapted from BP’s Group Defined Practice, “Environmental and Social Requirements for Acquisition, Negotiations, Major Projects, New Access Projects, and International Protected area Projects”. The indicators have been applied against construction impacts and operation impacts separately.

The assessment of each environmental and social impact is based on the sensitivity of the indicator and the level of impact. This is achieved by assigning each indicator a “sensitivity” ranging from low to very high based on the description against each indicator. Once the sensitivity has been assessed the potential impact of each indicator is assessed using the criteria provided in the x-axis guidance (see Figure 4-1). This will lead to a minimum score of 1 for low sensitivity, low impact, and a maximum score of 16 for higher sensitivity, higher impact. The option that generates the lower total is the most favourable environmentally. Environmental and social information about sensitive/protected areas, endangered species, etc were based on the SCPX Environmental and Social Screening Assessment (refer to Chapter 3).

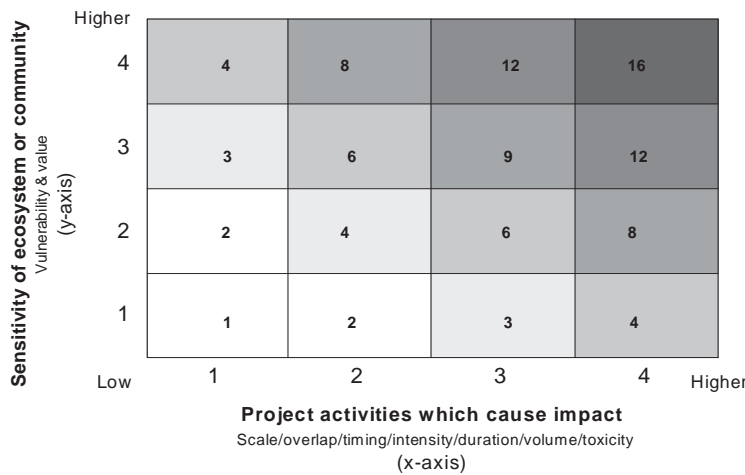


Figure 4-1: Example Option Screening Environmental and Social Impact Matrix

The overall score for each option has taken into account all aspects of the option (e.g. the entire multi-country scope of work) when scoring. The results of the assessment are described in the following subsection.

4.3.2.2 42"-diameter pipeline

The capacity of a single additional pipeline without compressor stations, i.e. a system similar to the existing SCP, would not have sufficient capacity to accommodate SCPX’s additional

gas volumes. Design considerations of flow assurance and resulting system energy efficiency resulted in a requirement to locate the compressor station close to the Azerbaijan/Georgian border. Three 42"-diameter pipeline and compressor station configurations presented in Figure 4-2 were considered.

Technically, Option 1 is the most difficult option, due to the mountainous terrain along some sections and difficulty accessing the high snow-covered sections of the route for construction and operation in winter. It is not clear whether a suitable route exists adjacent to the existing pipeline in these sections of Option 1. Option 2 is preferable to Option 3 with regard to topography.

Commercially, Option 1 involves significantly higher capital costs and Option 2 has the lowest capital cost. Operating costs are significantly greater when more compressor stations are added.

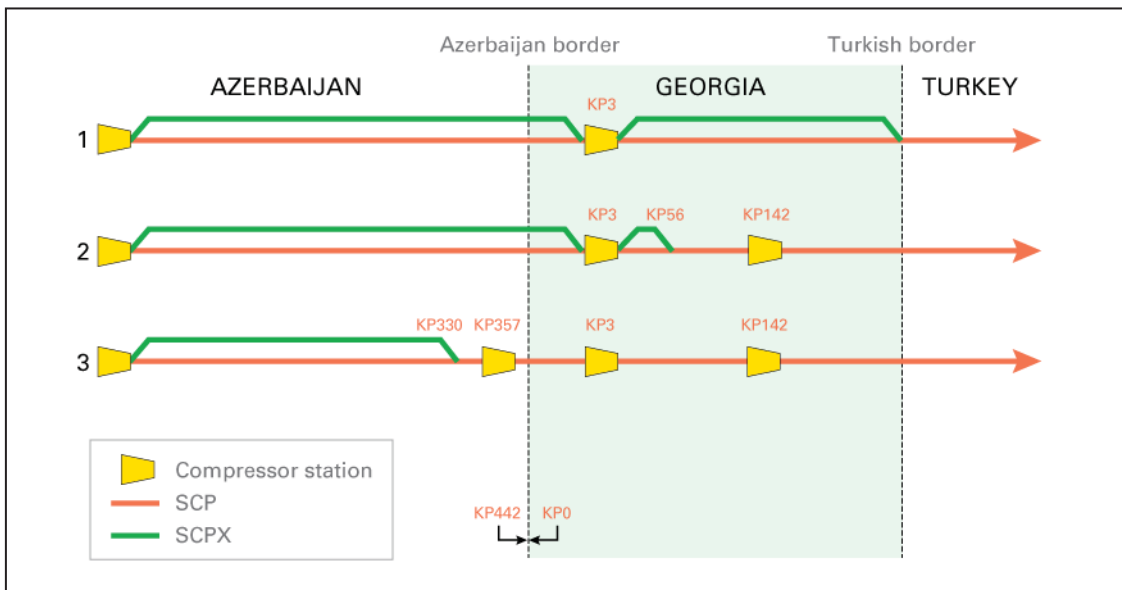


Figure 4-2: Schematic of 42"-Diameter Pipeline Options

Option 3 involves operating three compressor stations with increased numbers of staff and associated risks, but its construction was on the smallest geographical scale and it avoided the need to construct (including blasting) in difficult terrain and winter conditions. Option 1 had the lowest anticipated risks during operations as it has fewer manned facilities, but needs construction (and blasting) in difficult terrain where adverse winter weather conditions increase the health and safety hazards. Option 2 represented a balance between these, avoiding difficult terrain with adverse winter conditions, but needing to operate two compressor stations.

Option 1 has the lowest likely long-term E&S impact in the operation phase, but the highest short-term impact in the construction phase. Option 3 has the lowest construction-phase impacts because it has the smallest footprint, needs less temporary land acquisition and will cause less habitat disturbance and potential for community disturbance, but it has the highest predicted emissions and discharges and potential for community disturbance from the operation of three compressor stations. Here again, Option 2 represented a balance between the other options, with an intermediate footprint during construction and intermediate emissions during operations. Additionally, it was considered that the co-location synergies in construction and operation of Option 2, which sites the compressor station alongside the existing Georgian BTC and SCP facilities, outweighed any site within Azerbaijan, and maintained the overall system energy efficiency.

Table 4-1 summarises the assessment, with Option 2 being the preferred option. It should be noted that the results are relative and should be interpreted independently for each discipline, with a value of 'high' representing the highest potential impact, technical difficulty or cost.

Table 4-1: Comparison of Potential Impacts of SCPX 42"-Diameter Pipeline Options

Option	Description	Technical	Commercial	Health and Safety	Environmental and Social
1	Full loop, minimum compression	High	High	Low	Low
2	Two compressor stations, partial looping	Moderate	Low	Moderate	Moderate
3	Three compressor stations, minimum looping	Moderate	Moderate	High	High

4.3.2.3 56"-diameter pipeline

Following engagement with the Azerbaijani State Oil Company, SOCAR the pipeline system was increased from 42 to 56-inch to consider future expansion beyond the current SCPX design. Evaluated Options A–E presented in Figure 4-3.

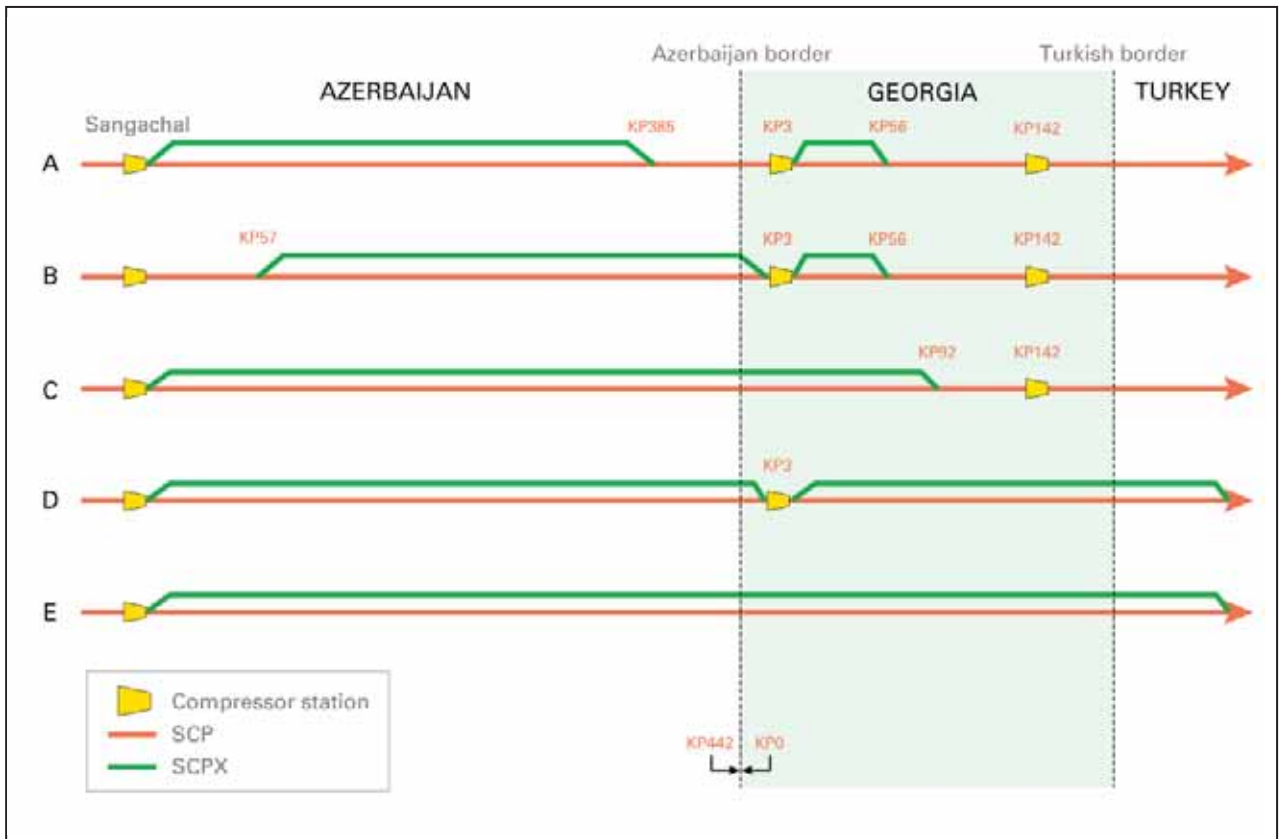


Figure 4-3: Schematic Showing the 56"-Diameter Pipeline Options

Technically, Option E does not provide sufficient extra capacity and was discounted while Option D has even larger constructability issues than the equivalent 42" option (Option 1). Technical constraints with Option C owing to low temperatures in operation exclude it as a

viable option. H&S and E&S impacts for Options A and B were similar to those of the 42” concept, with shorter pipeline length and reduced numbers of compressor stations being preferred and providing a balance between hazards and impacts in the construction and operational phases, with Option B being the preferred option. Table 4-2 presents the result of the assessment. It should be noted that the results are relative and should be interpreted independently for each discipline, with a value of ‘high’ representing the highest potential impact, technical difficulty or cost.

Table 4-2: Comparison of Potential Impacts of SCPX 56”-Diameter Pipeline Options

Option	Description	Technical	Commercial	Health and Safety	Environmental and Social
A and B	Two compressor stations, minimum looping	Low	Low	Moderate	Moderate
C	One compressor station, partial looping	High	Moderate	Low	Low
D	Full loop, minimum compression	High	High	High	Low
E	As for the 42” selection process, a complete pipeline loop in Azerbaijan and Georgia with no additional compressor stations was considered – Option E. However, the required throughput of +16bcm/a was not met for part of the year, therefore this option did not meet the Project design criteria and was discounted from a technical perspective				

4.3.2.4 Comparison of 42” Option 2 and 56” Option B

Technically, the 56” pipeline needs less compression power at each compressor station (60MW at each station compared with 80MW at the first compressor station and 70MW at the second), so it requires fewer compression trains. However, the 56” pipe needs more careful handling during construction to prevent damage or deformation. It involves more complex and technically challenging trenchless crossing techniques (e.g. micro-tunnelling or horizontal directional drilling).

Commercially, the 56” concept has higher capital cost than the 42” concept, but it also has greater potential for future expansion to accommodate additional gas volumes.

From a health and safety perspective, the need to handle heavier pipe and to use more complex lifting operations, and because of the increase in traffic movements owing to a reduction in the number of pipe sections that can be transported on one truck, increases the potential construction health and safety impacts of the 56” option.

The 56” concept offers environmental and social benefits compared with the 42” option:

- Lower fuel gas consumption and greenhouse gases (estimated at approximately 254,000 tonnes less CO₂ per year than the 42” concept) plus lower emissions of atmospheric pollutants (NO_x and CO) (see Section 4.8 for further details)
- Reduction in potential operational noise emissions at compressor stations by having fewer compression trains (compressor trains being the primary source of noise on the site)
- The 56”-diameter pipeline allowed the Project to achieve the required throughput using a shorter pipeline loop in Azerbaijan, starting at SCP KP57. The selection of the 56” option, with the requirement for a shorter pipeline loop in Azerbaijan has enabled the Project to avoid the Gobustan Cultural Reserve and Buffer Zone and avoids the area currently proposed as a nationally protected area, the Gobustan National Park.

- A similar physical footprint is achieved with the 56" option as although the construction ROW width of 36m is 4m wider than the 42" pipeline ROW the 57km shorter loop in Azerbaijan that can be achieved using the 56" case means that overall pipeline land requirements are approximately equal for both options. The shorter loop in Azerbaijan also avoids the semi-desert Gobustan area and several areas known as the Badlands, both of which contain fragile topsoil where reinstatement is more difficult.

Table 4-3 presents the comparative assessment of the 42" and 56" pipeline configurations.

Table 4-3: Comparison of Potential Impacts of SCPX 56"- and 42"-Diameter Pipeline Options

Option	Description	Technical	Commercial	Health and Safety	Environmental and Social
42"	Two compressor stations, minimum looping	Lower	Lower	Lower	Higher
56"	Two compressor stations, minimum looping	Higher	Higher	Higher	Lower

4.3.2.5 Concept selected for SCPX Project

The selected option (Figure 4-4) is a 56" loop pipeline from a start point in Azerbaijan, 57km from the Sangachal Terminal (SCP KP57) to a point on the pipeline 57km from the border with Georgia. Two compressor stations will be developed in Georgia. This will achieve the flow rate of +16bcma in the SCPX pipeline and a combined capacity of +23 bcma by maximising the use of the existing SCP pipeline.

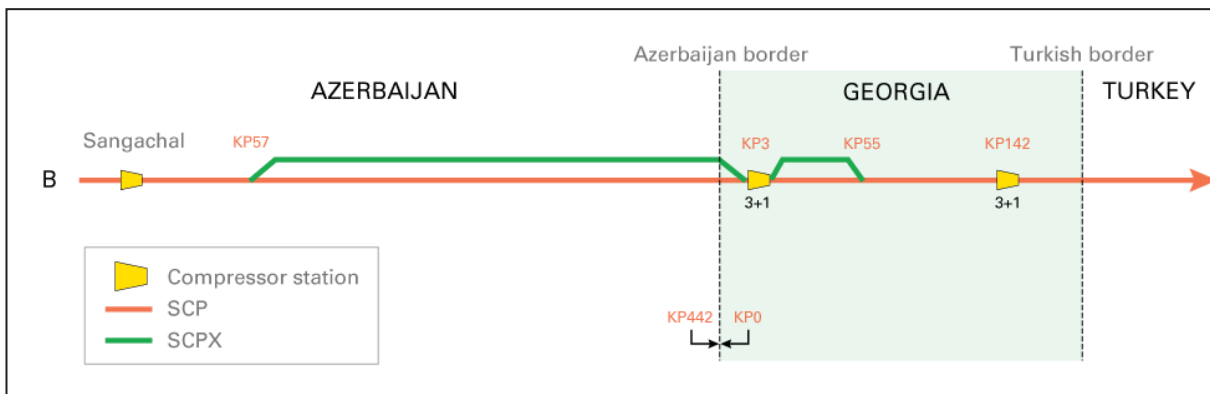


Figure 4-4: Selected 56" Option (SCP KPs are shown)

4.4 56" Concept Alternatives (Option A & B)

4.4.1 Option A

The consideration of route corridor options for the Project initially involved a review of previous pipeline routes against known constraints. Option A as shown in Figure 4-3, considered the start of the pipeline from Sangachal. The Project's preferred option was to utilise the existing BTC/SCP right of way (ROW) where possible. The BTC and SCP routes were identified following extensive engineering, environmental and social surveys and took into account an optimal secure border crossing from Azerbaijan in to Georgia. This has considerable environmental and social advantages over the establishment of a new corridor including:

- Partial overlap with a previously disturbed corridor reduces new land take and habitat disturbance
- Relationships have been established with the local communities
- Some established access routes can be used together with previously used construction camps and pipe storage areas, reducing the need for new ones
- One compressor station (CSG1) and the pressure reduction and metering station (PRMS) in Georgia can be co-located with the BTC pumping station PSG1, and the SCPX block valves can be co-located with BTC and SCP ones, reducing additional visual and landscape impacts
- Collocated facilities can share utilities to increase efficiencies.

Routing studies focused initially on the minimum safe separation distance of the SCPX ROW from the existing SCP/BTC or any other pipelines. Modelling studies (see Chapter 12) determined that the minimum separation distance between the SCPX pipeline and the BTC and SCP pipelines should generally be 20m.

Following the definition of a proposed route, specialists and sub-consultants were consulted and studies undertaken to identify the key constraints and identify and discuss various potential re-route corridor options where key constraints such as protected areas or cultural heritage was known.

4.4.1.1 *Routing Options through Gobustan (SCP KP 0-30)*

An example of how the corridor selection process and the start point of the proposed SCPX route evolved in the initial design stages is the work undertaken on route options through Gobustan. As discussed previously, the base case for routing the SCPX route was to parallel the BTC/SCP route corridor as much as possible, with a separation distance of 20m. However several challenges existed in paralleling the BTC/SCP route in certain parts of Azerbaijan, in particular the Gobustan area (SCP KP0–KP30). The key issues and sensitivities in this area are as follows:

- Gobustan Cultural Reserve (GCR) – the BTC/SCP route corridor crosses the northern corner of the GCR for approximately 800m. Since BTC/SCP construction, the GCR has been designated a UNESCO World Heritage Site. To avoid the GCR, SCPX would have to deviate from the BTC/SCP route
- Djeyrankechmez River crossing – a highly erodible, deeply incised ephemeral river, susceptible to flash flooding. This was open-cut during SCP/BTC construction, with significant bank stabilisation required during reinstatement
- Constructability – highly erodible soils are present in the area, which makes reinstatement challenging
- The presence of a number of mud volcanoes in the area (Figure 4-5)
- This area comprises sensitive semi desert habitat which takes a long time to reinstate following pipeline construction
- Mud volcano ridge (SCP KP24–KP29) – narrow ridge, difficult constructability and area of highly erodible soils
- Fault zone - crossing of the mud volcano fault – SCP KP24.1.

Owing to the difficulties in this area, particularly around the crossing of the Djeyrankechmez and avoiding the GCR, the Project investigated a number of potential alternative construction techniques and route options. Some of these options were also considered during the routing of BTC and SCP in the area, but at the time were discounted because constructability was considered too difficult.

The following options were investigated:

- Base case: a single horizontal directional drill (HDD), approximately 1300m long, beneath the Djeyranchekmez River and GCR
- Option A: a potential route was identified 1.6km north of the SCP/BTC location (see Figure 4-6). This route requires an HDD/micro-tunnel installation of the Djeyranchekmez River. This route is 0.8km longer than the base case and would create a new pipeline corridor through sensitive semi desert habitat
- Option B: a route mostly parallel to the WREP was identified, which allowed for open-cut of the pipeline for its full length. The route diverges at WREP KP18.4 and rejoins at WREP KP22 because of diverging ridges (see Figure 4-6). This route is 13.2km longer than the base case and would create a new pipeline corridor through sensitive semi-desert habitat between WREP KP18.4–KP24, where the route crosses an area of ridges. The entire route can be open-cut, with no HDD required
- Option C: a route was identified that parallels WREP for the first 2.5km out of Sangachal Terminal before moving away for the next 9km and then generally rejoining the WREP route at KP17 and then paralleling WREP up to KP30 (see Figure 4-6). This route is 8.7km longer than the base case and would create a new pipeline corridor through sensitive semi-desert habitat between WREP KP2.5–17 and KP18.4–KP24. The entire route can be open-cut, with no HDD required
- Option D: this route was identified to provide an alternative to route to B and C between WREP KP18.4 and KP22, an area of complicated ridges. This route is 7.6km longer than the base case and would create a new pipeline corridor through sensitive semi-desert habitat between WREP KP2.5–KP24. The entire route can be open-cut, with no HDD required.

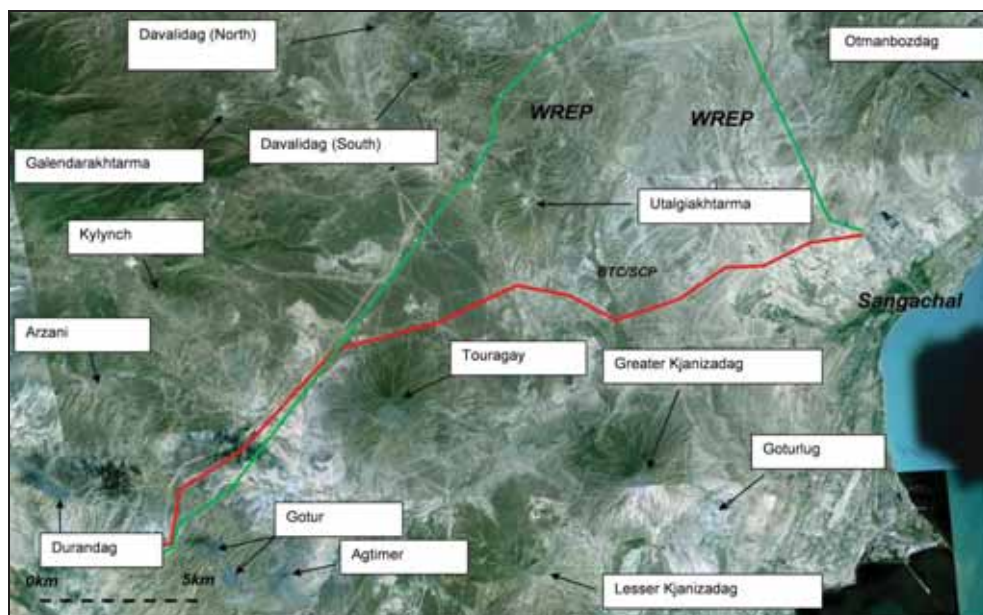


Figure 4-5: Mud Volcanoes Close to the BTC/SCP and WREP Pipeline Corridors

Following analysis of the alternatives, the base case HDD beneath the Djeyranchekmez and GCR was considered the optimum route, from an environmental perspective, as it minimises the impact on undisturbed sensitive habitat. It also had fewer issues associated with reinstatement, erodible soils and ridges.

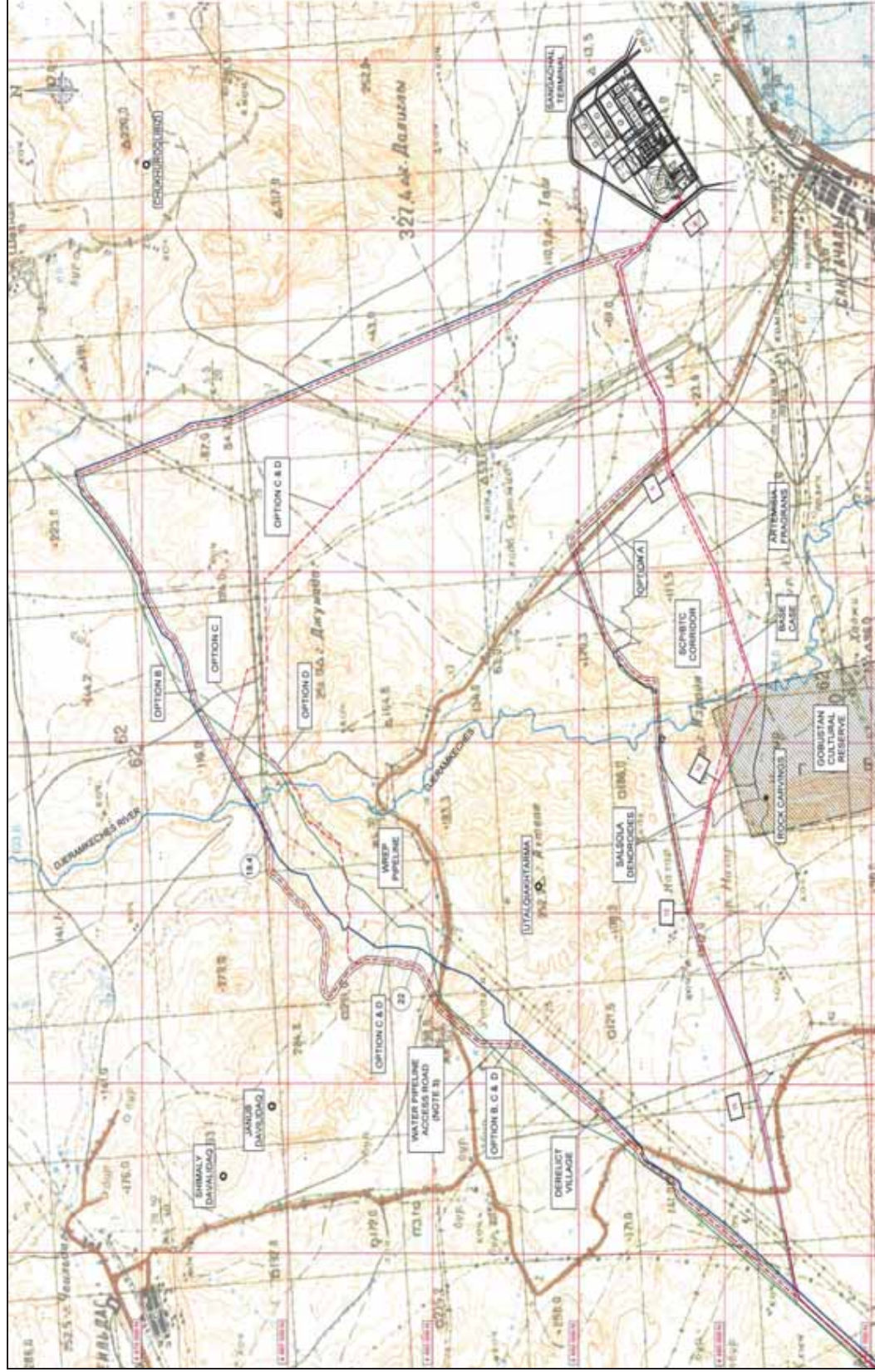


Figure 4-6: SCPX Route Options A to D through Gobustan

4.4.2 **Option B**

In conjunction with the assessment of the route alternatives through Gobustan (KP0–KP30), consideration was also being given to whether it was possible to start SCPX at an alternative point along the SCP route, avoiding Gobustan altogether. Further detailed engineering studies, including hydraulic analysis were undertaken to investigate the feasibility of this option. Taking into account the results of these studies, and environmental and social considerations, the decision was made to start SCPX at SCP KP57.

Option B (as shown in Figure 4-6) has the advantage of avoiding the Gobustan area, and also avoids two geological faults at Hajigabul at SCP KP49.9 and KP50.9. Option B was selected as the preferred initial route alignment.

4.4.3 **Detailed Routing**

As discussed above, the base case for SCPX routing is to parallel the BTC/SCP route corridor where possible, with a separation distance of 20m.

The initial route alignment was submitted to the specialists and sub-consultants for baseline studies and comments. Potential re-routes have been defined using remote sensing and a field walk in 2011. Where paralleling the BTC/SCP corridor presents technical difficulties or where obstacles such as irrigation canals, electricity pylons, topography, cultural heritage sites or population encroachment are encountered, potential re-routes have been investigated. Revisions were made to the proposed route alignment to accommodate specialist and sub-consultant comments. The proposed route option presented in the ESIA was generated following this detailed review. Table 4-4 describes the short sections of the SCPX loop in Azerbaijan which have been re-routed. Section 4.4.4 gives more detailed examples of three of the cultural heritage re-routes.

Table 4-4: Re-routed Sections of the SCPX Route away from the BTC/SCP Corridor

From SCP KP	To SCP KP	Description of Route Change
152	159.7	Route shown was too close to parallel canals and was moved 20m further north, away from the canals
162	164.8	Minor route changes to avoid an orchard and cemetery and to provide a better approach to a canal crossing, that was more perpendicular
161.1	163.9	The current corridor passes between two buildings in Chiny Village and there is no room for SCPX HDD. A new route was identified that takes SCPX around the village
166.3	178.7	The current corridor passes between two buildings in Quarabyork and there is no room for SCPX. New route identified that takes SCPX around the buildings
189.1	193.9	Better crossing point of Turianchay was identified
190	191.2	Re-route to avoid the corner of WREP PS5 and buildings located at KP190
203.75	206	Route around potential archaeology comprising a Classical Period settlement and cemetery found and partially excavated during SCP/BTC
234		Route moved to avoid a high-voltage overhead power line
243.4	244.85	Crossing of Karabakh canal moved as existing crossing passes too close to projected buildings
281.7	283.5	No room for original route as it was too close to a cemetery and two very tall trees
288.6		Crossing of pipeline corridor moved by 100m to avoid a medieval settlement found on BTC/SCP. The site will not be completely avoided, but damage will be reduced by not having the crossing points in the area of greatest density of archaeology
315.8	317.9	A Bronze Age Settlement and recent cemetery on the line. Re-route suggested is very difficult, so some form of trenchless crossing could avoid damage to the cemetery, but not to the archaeological site
332.7	338.4	Probable Archaeology on existing route. The site is a Bronze Age burial mound part of which was not fully excavated in BTC/SCP. Proposed route would have crossed

From SCP KP	To SCP KP	Description of Route Change
		remaining parts so SCPX was re-routed
341.7	342.2	Slight change to avoid difficult terrain, moving original line back next to SCP corridor
348.3	356	Series of three archaeological sites avoided by moving the route from one side of the pipeline corridor to the other, and then back again to avoid a medieval cemetery
377.4	378.1	Probable Archaeology on existing route. Site is a late Bronze Age cemetery. Existing route would cross the edge of this. Re-route avoids the site entirely
404.8	408.5	Probable Archaeology on existing route. The site is a very deeply stratified late neolithic settlement with later elements. Re-route is to avoid going through the area thought to be the most densely occupied area.

4.4.4 **Cultural Heritage Re-routes**

Following a field walkover visit, a number of re-routes were required to avoid areas of key sensitivities. A more detailed explanation of three cultural heritage re-routes as discussed in Table 4-4 is given below.

SCP KP315.8-317.9

The WREP, BTC and SCP pipelines all discovered human burials during their construction that had to be reburied. These burials are part of the cemetery that lies to the south of the pipeline route. There were no identifiable surface markers on the surface so the discovery of the burials during construction was unexpected. The BTC and SCP also saw archaeological excavations that identified a Bronze Age period settlement and a burial from the Antique period.

The original suggestion for the route of the SCPX was to go south of the existing BTC/SCP pipeline corridor. This unfortunately lies very close to the surface markers for graves that extend towards the modern and currently used cemetery to the south. This suggested route would have potentially damaged graves. The alternative route selected is further away from the known area of burials and avoids concentrations of pottery seen on the ground surface indicating the presence of archaeological remains (see Figure 4-7).

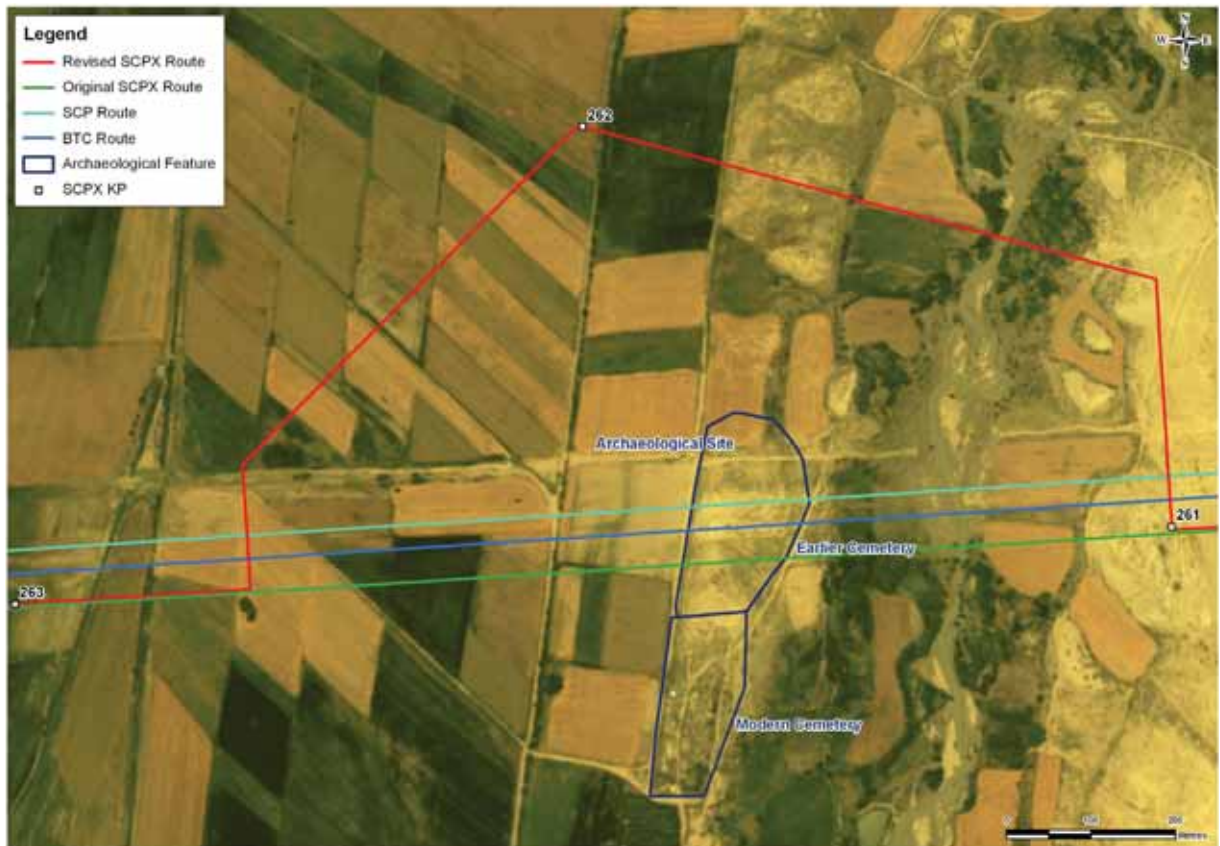


Figure 4-7: Re-route to Avoid Bronze Age Cemetery

SCP KP332.7 to 338.4

During BTC/SCP construction, three large and important features were uncovered. Two of these were Bronze Age period burial mounds, while the third was an Antique period settlement that had a later Christian period building, possibly a chapel together with a cemetery of over 90 burials some using Christian rites while others were Muslim in style.

The original design for SCPX followed the route of the earlier pipelines and would have caused additional damage to the known extent of all three of these sites. Identification of a suitable route to avoid them was difficult. However, the line of the SCPX where it crossed the Shamkirchay River was changed. This made it possible to move the pipeline a substantial distance away from the existing pipe routes and avoid all the areas of known archaeology (see Figure 4-8 below).

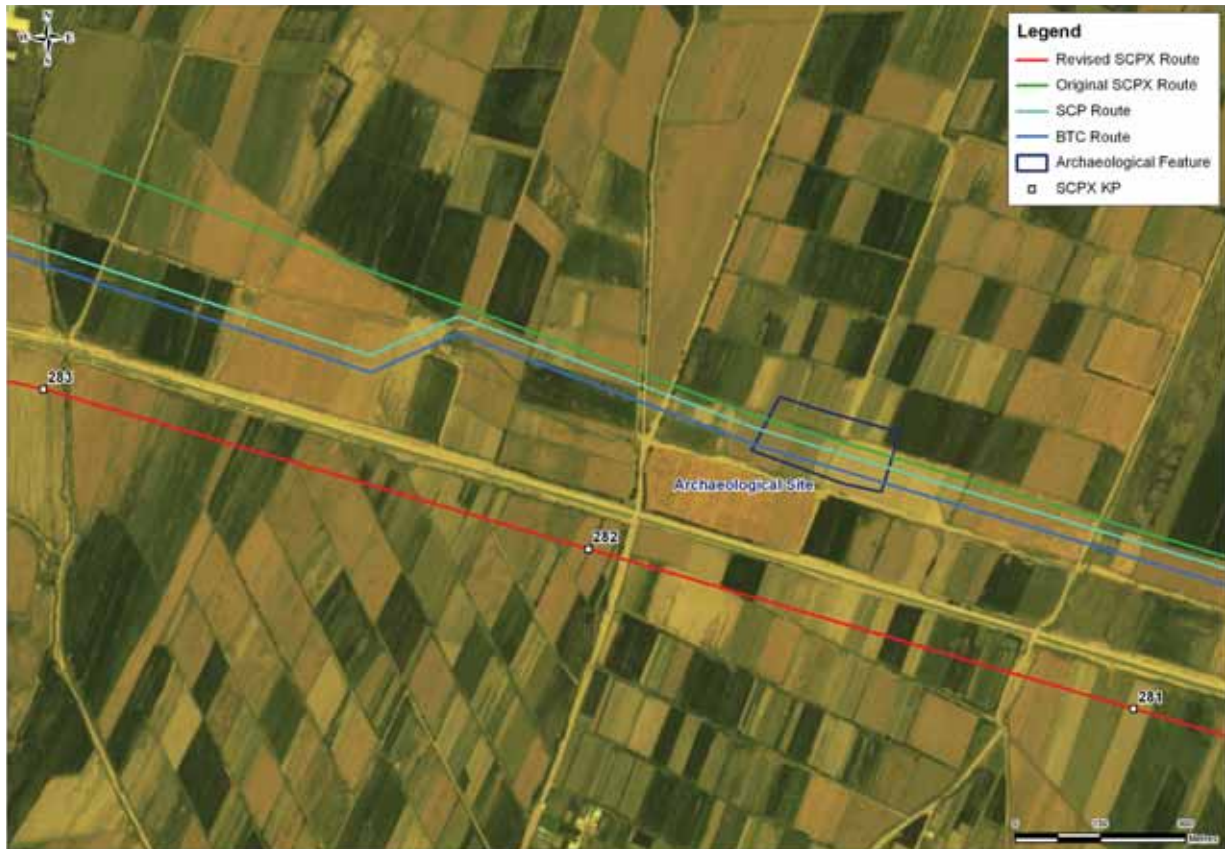


Figure 4-8: Re-route to Avoid Bronze Age Burial Mounds and Antique Period Settlement in Shamkir Valley Area

SCP KP404.8 to 408.5

The area around the Girag Kasaman cemetery was crossed by the WREP pipeline in 1997 and human remains were found in an area adjacent to the known marked cemetery. The BTC and SCP pipelines were thought to be far enough away from this, but they also came across burials that needed to be reburied. The BTC and SCP pipelines also uncovered evidence of a medieval settlement underlying the area.

The original SCPX design lay to the north of the existing pipes but very close to them. The topography suggested that there was a very high chance that a further extent of the cemetery would be found on this route. The archaeological features would also be found in this area. An alternative pipeline route was designed that moved the pipe down from the terrace onto the lower terrace of the Kura valley and away from any known features (see Figure 4-9).

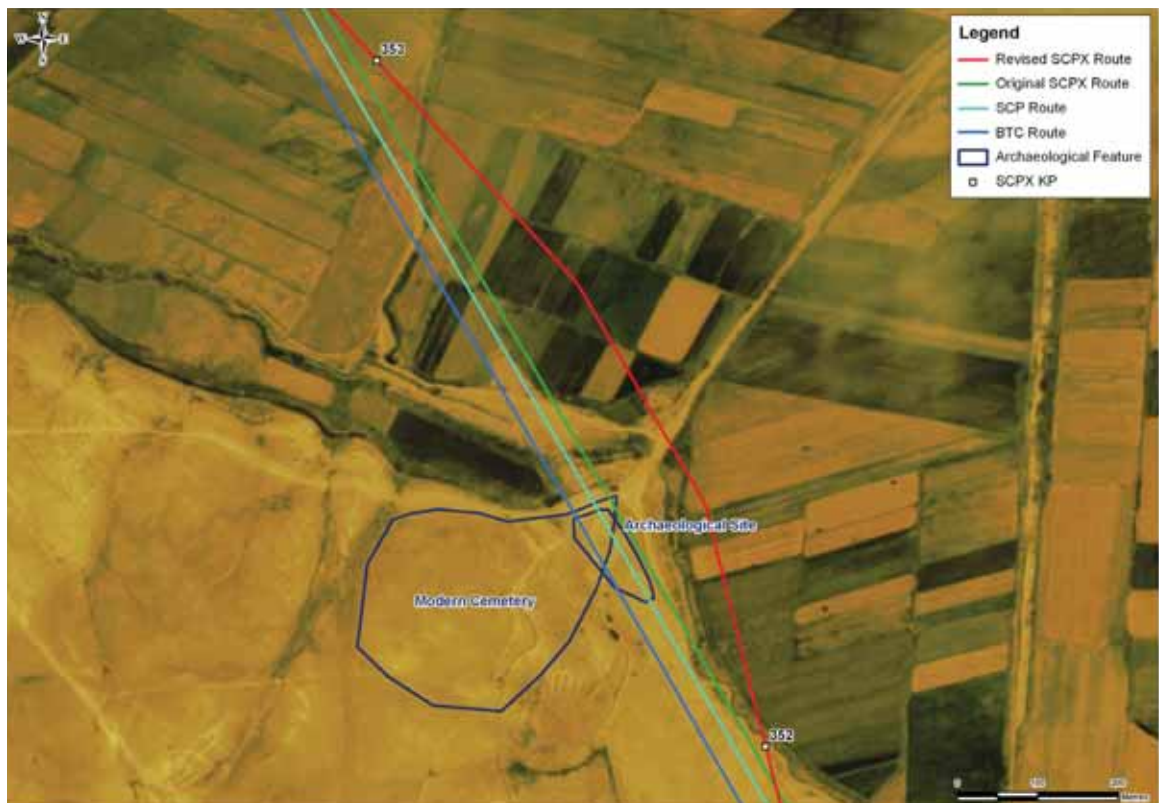


Figure 4-9: Re-route to Avoid Girag Kasaman Cemetery

4.5 Pipeline River and Road Crossing Alternatives

4.5.1 River Crossings

The technical options for constructing river crossings are:

- Wet open-cut crossings that excavate a trench across the bed of the watercourse, install the pipe, backfill the trench and reinstate the banks, without stopping the flow of water
- Dammed open-cut crossings that dam the watercourse upstream and downstream of the crossing, pump water round the trench and release it downstream of the crossing. The pipe trench is excavated and the pre-welded pipe is installed before the trench is backfilled with the excavated material
- Flumed open-cut crossings that maintain water flow by installing suitably sized flume pipes placed in the bed of the watercourse to accommodate the river flow. The watercourse is dammed allowing water to flow through the pipes. The pipe trench is excavated and the pre-welded pipe is installed before the trench is backfilled with the excavated material. The flume pipes are then removed and the banks of the watercourse are reinstated
- Non-open-cut crossings that install the pipe below the watercourse by drilling or tunnelling from one bank to the other. Non-open-cut techniques include:
 - Micro-tunnelling (see Figure 4-10). Concrete pipes are lowered into a launch pit in one bank and hydraulic jacks push them behind a steerable laser guided tunnel-boring machine (TBM) to line a tunnel to a reception pit on the other bank. When the tunnel is complete, the pipeline is installed into the tunnel and the space between pipeline and tunnel wall is filled with grout

- Guided auger boring/auger boring. A pilot hole is opened by augers from a launch pit on one bank to a reception pit on the other. The pilot hole is enlarged to accommodate the pipeline using larger augers and steel casing. The pipeline is lowered into the launch pit and welded to the steel casing. It is then pushed into the cased hole, displacing the casing that is removed in the reception pit
- Horizontal directional drilling (HDD). An inclined drilling rig drills a small-diameter pilot hole from the surface on one bank to the surface on the other bank, using a rotating drill bit attached to the end of a string of drill pipe. The resultant borehole is reamed to a diameter suitable to accept the product pipe. Drilling fluid is pumped repeatedly through the drill string, bit and annulus while the hole is drilled and reamed. A pulling head on a pre-formed length of pipeline is attached to the drill pipe, and the pipeline is pulled through the bore in a single operation.

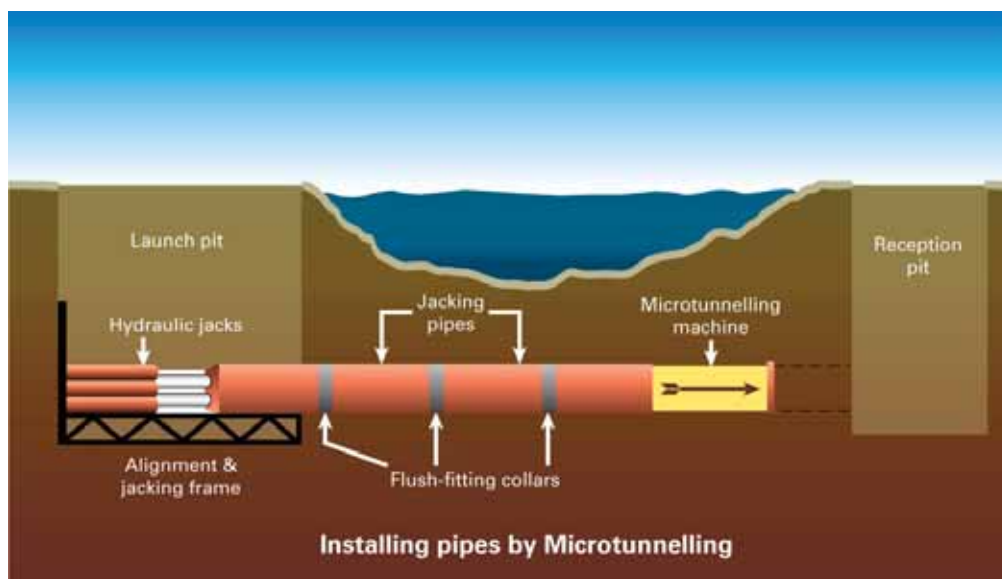


Figure 4-10: Schematic of Micro-tunnelling

The different crossing methods are suitable for different types of watercourse. The Project has assessed the most appropriate method to use for each watercourse crossing the ROW, taking into account the geotechnical characteristics at the location and the depth of cover required. For further discussion, and details of the crossing method selected for each of the major river crossings see Section 5.6.1.

4.5.2 Watercourse and Canal Re-routes

A revised crossing location is being considered for the Karabakh canal at SCPX KP189. The proposed re-route will avoid the HDD passing under existing buildings (see Figure 4-11).

A revised crossing location is also being considered at the Kura West River and further discussions with the relevant Ministries are required to understand the implications of the proposed re-route. The existing route is the base case that has been presented in this ESIA for impact assessment. Any deviations from the proposed route will require additional verification studies and will be presented in the final ESIA.



Figure 4-11: Karabakh Canal Re-route

4.5.3 Road and Rail Crossings

There are currently an estimated 45 roads and 6 railways that will be crossed by the proposed SCPX Project in Azerbaijan. They will be crossed using one of the following non-open-cut techniques:

- Direct-burial pipe jack (carrier pipe). A carrier pipe is installed behind a protective shield using a combination of mining techniques and hydraulic jacks to drive the pipe forward. The excavated material is removed through the exposed end of the pipe. As each pipe progresses forward, another is welded on until the crossing is finished
- Micro-tunnelling (see Figure 4-10). Concrete pipes are lowered into a launch pit in one bank and hydraulic jacks push them behind a steerable laser guided tunnel-boring machine (TBM) to line a tunnel to a reception pit on the other bank. When the tunnel is complete, the pipeline is installed into the tunnel and the space between pipeline and tunnel wall is filled with grout.

4.6 Facilities Location Alternatives

The proposed SCPX Project requires the following facilities in Azerbaijan:

- One pigging station
- Five block valve stations.

4.6.1 Pigging Station Location

There is a requirement for the integrity of the pipeline to be monitored periodically using a pipeline integrity gauge (pig). In Azerbaijan, a new pigging station will be constructed at the start of the pipeline loop at SCPX KP0 (SCP KP57). Pigs will travel the full length of the pipeline loop in Azerbaijan to a new pig-receiving station constructed at compressor station

CSG1 in Georgia. A second pig launcher at CSG1 will permit the pigging of the Georgian pipeline loop.

There are no pre-existing SCP or BTC aboveground installations in the vicinity of SCPX KP0. Field surveys have identified that the surrounding area is relatively homogenous, with no ecological, social or cultural heritage factors that would constrain the location of the pig launching facility. Therefore, the exact location has been determined by pipeline hydraulics and verified by multidisciplinary site surveys to be a suitable site for the pigging station.

4.6.2 Block Valves

It is necessary to install block valves (BVR) that can isolate the pipeline loop from the SCP to allow for maintenance work or the repair of damage to the pipeline. The SCPX BVR stations will be collocated with BTC and SCP ones, thereby reducing additional visual and landscape impacts, and maximising sharing of utilities to increase efficiencies.

This will also mean that existing access roads to the SCP and BTC facilities can be used, thereby reducing the permanent land take requirements for the SCPX Project.

SCPX will not increase the SCP operating pressure (90 barg), so no additional block valves are considered necessary on the existing SCP pipeline. The locations of block valves are discussed further in Chapters 5 and 12.

4.7 Construction Camp and Pipe Storage Area Location Alternatives

During the construction of the SCPX Project temporary facilities will be needed for pipe storage, mechanical maintenance, fuelling, warehousing, Project offices and worker accommodation.

Potential camp and pipe storage areas have been investigated at suitable locations along the pipeline route as discussed above. Some locations were considered for both camps and pipe storage, others were designated as either camp or pipe storage areas.

The proposed pipeline route has been divided into five sections to consider the construction logistics and transport and travel. The approximate section boundaries with SCPX Project KPs are as follows and are shown on Figure 4-12.

- Section 1: Mugan to Kurdemir (KP0–94)
- Section 2: Kurdemir to Turianchay crossing (KP94–145)
- Section 3: Turianchay crossing to Borsunlu (KP145–235)
- Section 4: Borsunlu to Zeyamchay crossing (KP235–306)
- Section 5: Zeyamchay crossing to Georgian border (KP306–390).

Within each section there is likely to be one construction camp with a potential satellite camp being discussed for the micro-tunnel operations at Kura East River. However, there may be several pipeline storage and offloading areas in each section, with the precise numbers and sizes to be determined following ongoing acquisition, engineering, environmental and social assessment.

There have been two phases of site identification for camp and pipe storage identification assembling the options into two groups called Alternatives 1 and Alternatives 2.

4.7.1 Alternatives 1

A desktop review initially identified suitable location options (Table 4-5) for camp, pipe storage and rail offloading areas. The original pipeline camp and pipe storage yard location

philosophy and surveys (also referred to as Phase 1 surveys in the ESBR) considered the following criteria for selection of camp, pipe storage locations and associated rail infrastructure:

- Camps previously utilised for SCP/BTC construction
- Road and rail access
- Health, safety and environment
- Avoidance of archaeological sites
- Utility supplies
- Area requirements
- Topographical/geotechnical constraints.

The selection of preferred locations for further study was then finalised following a multidisciplinary site visit, where the following topics were assessed:

- Land use (historical and current)
- Current ground cover
- Existing contamination
- Proximity to surface water
- Groundwater wells/abstraction
- Groundwater
- Land ownership
- Land constraints
- Proximity to settlements
- Legacy issues
- Proximity to nearest residence
- Community safety
- Infrastructure
- Cultural heritage.

Table 4-5: Alternatives 1 – Camp, Pipe Storage and Rail Spur Locations

Section No.	Site Name
1	Mugan Camp Option 1
	Mugan Camp Option 2
	Mugan Camp Option 3
	Mugan Pipe Storage (Offloading Area and Rail Spur) *
2	Kurdemir Camp Option 1
	Kurdemir Camp Option 2
	Kurdemir Camp and Pipe Storage Area (Mususlu)*
3	Yevlakh Camp Option 1*
	Pipe Storage Area Option 1
	Pipe Storage Area Option 2

Section No.	Site Name
4	Ganja Camp Option 1
	Ganja Camp Option 2
	Ganja Camp Option 3
	Ganja Camp Option 4
4	Camp and Pipe Storage Goranboy 1*
	Camp and Pipe Storage Goranboy 2*
	Dallar Pipe Storage and Rail Spur *
	Zazali Rail Spur and Offloading area*
5	Tovuz Camp Option 1
	Tovuz Camp Option 2
	Tovuz Camp Option 3
	Tovuz Camp Option 4
	Tovuz Camp Option 5*
	Tovuz Pipe Storage Option 1
	Agstafa Pipe Storage Option 1
	Agstafa Pipe Storage Option 2*
	Agstafa Pipe Storage Option 3*
	Agstafa Rail Spur and Offloading area Option 4*
	Agstafa Pipe Storage Option 5*

* Bold text is the site that was selected for further study

Within this chapter, reference is made to temporary camp and pipe storage areas that have been considered as part of the proposed SCPX Project. The sites that were initially selected for further investigation (known as Alternatives 1), including desktop study and field surveys, were subjected to a review against a new philosophy that gave increased priority to safety (primarily the avoidance of road accidents) and construction logistics (in particular optimising site selection in relation to access to the ROW). Following a Project review, the new philosophy was adopted, resulting in new sites being identified and the development of a second set of alternative locations referred to as 'Alternatives 2'. There are a number of exceptions: Mugan Pipe Storage Area, Dallar Pipe Storage and Rail Spur, Kurdemir Camp and Pipe Storage Area (Mususlu) which is now considered as only a pipe storage area (known as Kurdemir Pipe Storage Area Option 1 (Mususlu)).

4.7.2 Alternatives 2

The new philosophy included additional criteria for evaluating camp and pipe storage locations. The additional criteria were as follows:

- Minimise disturbance/interference to local communities
- Provision of fit-for-purpose and adequately sized locations with safe access and egress
- Minimise the use and crossings of the public road system
- Optimum location to enable access to the ROW to minimise travelling time within each section of the pipeline construction spread
- Minimise distance between rail offloading and pipe storage areas.

This resulted in a number of new camp locations and additional pipe storage locations (Alternatives 2) being identified (Table 4-6). One of the key objectives was to minimise utilisation of public roads and reduce the risks of accidents on the main east-west (Baku to Georgia) highway. To achieve this, the new site review looked at locating the construction camps and pipe storage and offloading sites on the same side of the main Baku highway as the ROW where possible. Table 4-6 below shows the preferred locations for the various temporary facilities for camp, pipe storage and rail spurs/offloading areas. See Figure 4-12 for locations of temporary facilities.

Table 4-6: Alternatives 2 – Camp, Pipe Storage and Rail Spur Locations

Section No.	Site Name
1	Kurdemir Camp Option 1
	Kurdemir Camp Option 2
	Kurdemir Camp Option 3
	Kurdemir Camp Option 4*
	Kurdemir Camp Option 5*
	Mugan Pipe Storage Area (Offloading and Rail Spur)*
2	Ujar Camp Option 1
	Ujar Camp Option 2
	Ujar Camp Option 3
	Ujar Camp Option 4
	Ujar Camp Option 5*
	Kurdemir Offloading Area and Rail Spur* (Mususlu) Option 1
	Kurdemir Pipe Storage Area Option 1* (Mususlu)
	Kurdemir Pipe Storage Area Option 2* (Mususlu)
3	Goranboy Camp Option 1
	Goranboy Camp Option 2
	Yevlakh Camp Option 1
	Goranboy Camp Option 4
	Goranboy Camp Option 5
	Yevlakh Camp Option 2
	Goranboy Camp Option 3*
	Yevlakh Pipe Storage Area, Offloading Area and Rail Spur*
4	Samukh Camp Option 1
	Shamkir Camp Option 1
	Samukh Camp Option 2
	Samukh Camp Option 3*
	Dalimammadli Rail Spur and Offloading Area
	Dalimammadli Pipe Storage Area
	Dallar Pipe Storage Offloading Area and Rail Spur*

Section No.	Site Name
	Gazanchi Pipe Storage Area, Offloading Area and Rail Spur*
	Dallar Pipe Storage Area (Bayramli)*
	Kochasker Rail Spur and Offloading Area
5	Agstafa Camp Option 1
	Tovuz Camp Option 1
	Agstafa Camp Option 2
	Agstafa Camp Option 3*
	Saloglu Satellite Camp *
	Saloglu Pipe Storage Area*
	Saloglu Rail Spur and Offloading Area*
	Poylu Pipe Storage, Offloading Area and Rail Spur*

*Bold text is the site that was selected for further study and is the preferred option

Table 4-7 summarises the comparative assessment of the different camp, pipe storage and rail spur options.

Table 4-7: Comparative Assessment – Camp, Pipe Storage and Rail Spur and Offloading Locations

Alternatives 2 - Section	Option	Difficult Ground Conditions	Access Constraints (Physical)	Land Constraints	Close Proximity to Community	Ecological Value	Cultural Heritage	Health and Safety Concerns
SECTION 1	Kurdemir Camp Option 1	lower	moderate	lower	very low	lower/moderate	very low	lower/moderate
SECTION 1	Kurdemir Camp Option 2	lower	moderate	lower	very low	lower/moderate	very low	lower/moderate
SECTION 1	Kurdemir Camp Option 3	lower	moderate	lower	very low	lower/moderate	very low	lower/moderate
SECTION 1	Kurdemir Camp Option 4	lower	lower	lower	very low	lower/moderate	very low	lower
SECTION 1 <u>PREFERRED OPTION</u>	Kurdemir Camp Option 5	lower	lower	lower	very low	lower/moderate	very low	lower
SECTION 1 <u>PREFERRED OPTION</u>	Mugan Pipe Storage Area and Rail Spur and Offloading Area	lower	lower	lower	lower	very low	very low	very low
SECTION 1	Mugan Camp Options 1 & 2	lower	lower	lower/moderate	lower	lower	very low	very low
SECTION 2	Ujar Camp Option 1	lower	moderate	lower	lower/moderate	lower/moderate	very low	moderate
SECTION 2	Ujar Camp Option 2	lower	moderate	lower	lower/moderate	lower/moderate	very low	moderate
SECTION 2	Ujar Camp Option 3	lower	moderate	lower	moderate	lower/moderate	very low	moderate
SECTION 2	Ujar Camp Option 4	lower	moderate	lower	lower/moderate	lower/moderate	very low	moderate

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Alternatives 2 - Section	Option	Difficult Ground Conditions	Access Constraints (Physical)	Land Constraints	Close Proximity to Community	Ecological Value	Cultural Heritage	Health and Safety Concerns
SECTION 2 <u>PREFERRED OPTION</u>	Ujar Camp Option 5	very low	lower	very low	lower/moderate	lower/moderate	very low	moderate
SECTION 2 <u>PREFERRED OPTION</u>	Kurdemir Pipe Storage Option 1 (Mususlu)	very low	lower	lower	lower/moderate	very low	very low	lower/moderate
SECTION 2 <u>PREFERRED OPTION</u>	Kurdemir Pipe Storage Option 2 (Mususlu)	very low	very low	lower	lower/moderate	lower	very low	lower/moderate
SECTION 2 <u>PREFERRED OPTION</u>	Kurdemir Offloading Area and Rail Spur (Mususlu) Option 1	very low	lower	lower	lower/moderate	lower	very low	lower/moderate
SECTION 3	Goranboy Camp Option 1	lower	moderate	moderate	moderate	moderate	very low	moderate
SECTION 3	Goranboy Camp Option 2	lower	moderate	moderate	moderate	moderate	very low	moderate
SECTION 3	Yevlakh Camp Option 1	lower	moderate	moderate	moderate	moderate	very low	moderate
SECTION 3	Goranboy Camp Option 4	lower	moderate	moderate	moderate	higher	very low	moderate
SECTION 3	Goranboy Camp Option 5	lower	moderate	moderate	moderate	moderate/higher	very low	higher
SECTION 3	Yevlakh Camp Option 2	lower	moderate	moderate	moderate	moderate	very low	moderate
SECTION 3 <u>PREFERRED OPTION</u>	Goranboy Camp Option 3	very low	very low	lower	lower	lower	very low	lower

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Alternatives 2 - Section	Option	Difficult Ground Conditions	Access Constraints (Physical)	Land Constraints	Close Proximity to Community	Ecological Value	Cultural Heritage	Health and Safety Concerns
SECTION 3 <u>PREFERRED OPTION</u>	Yevlakh Pipe storage, Offloading Area and Rail Spur	lower	very low	lower	lower/moderate	very low	very low	lower/moderate
SECTION 4	Samukh Camp Option 1	lower	moderate	lower/moderate	lower/moderate	moderate	lower	moderate
SECTION 4	Shamkir Camp Option 1	lower	moderate	lower/moderate	lower/moderate	moderate	lower	moderate
SECTION 4	Samukh Camp Option 2	lower	lower	lower/moderate	lower/moderate	moderate	lower	moderate
SECTION 4 <u>PREFERRED OPTION</u>	Samukh Camp Option 3	lower	lower	lower	lower	lower	lower	lower/moderate
SECTION 4 <u>PREFERRED OPTION</u>	Gazanchi Rail Spur and Offloading Area	lower	lower	lower/moderate	lower/moderate	very low	lower	lower
SECTION 4	Dalimammadli Pipe Storage Area, Offloading and Rail Spur	lower	lower	lower/moderate	moderate	very low	lower	lower/moderate
SECTION 4 <u>PREFERRED OPTION</u>	Gazanchi Pipe Storage Area A and B	lower	lower	lower/moderate	lower/moderate	very low	lower	lower/moderate
SECTION 4	Gazanchi Pipe Storage Area Option C	lower	lower	moderate	lower/moderate	very low	lower	lower
SECTION 4 <u>PREFERRED OPTION</u>	Dallar Pipe Storage Option 1A	lower	lower	lower	lower/moderate	very low	lower	lower/moderate
SECTION 4 <u>PREFERRED OPTION</u>	Dallar Rail Spur and Offloading Area	lower	lower	moderate	lower	very low	lower	lower/moderate

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Alternatives 2 - Section	Option	Difficult Ground Conditions	Access Constraints (Physical)	Land Constraints	Close Proximity to Community	Ecological Value	Cultural Heritage	Health and Safety Concerns
Section 4	Kochasker Rail Spur and offloading Area	lower	lower	lower	lower/moderate	very low	lower	moderate
SECTION 5	Agstafa Camp Option 1	lower	lower	lower/moderate	lower/moderate	moderate	lower	moderate
SECTION 5	Tovuz Camp Option 1	lower	moderate	lower	lower/moderate	moderate	lower	moderate
SECTION 5	Agstafa Camp Option 2	lower	lower	lower/moderate	lower	moderate	lower	moderate
SECTION 5 <u>PREFERRED OPTION</u>	Agstafa Camp Option 3	lower	lower	very low	lower	lower/moderate	lower	lower
SECTION 5 <u>PREFERRED OPTION</u>	Saloglu Rail Spur and Offloading Area	moderate/higher	lower	lower/moderate	lower	lower/moderate	lower	lower/moderate
SECTION 5 <u>PREFERRED OPTION</u>	Saloglu Pipe Storage Area & Satellite Camp	moderate/higher	lower	lower	lower	lower/moderate	lower	lower
SECTION 5 <u>PREFERRED OPTION</u>	Polylyu Pipe Storage Area	lower/moderate	lower	lower	lower	lower/moderate	lower	lower
SECTION 5 <u>PREFERRED OPTION</u>	Polylyu Rail Spur and Offloading Area	lower/moderate	lower	lower/moderate	lower	lower	lower	lower

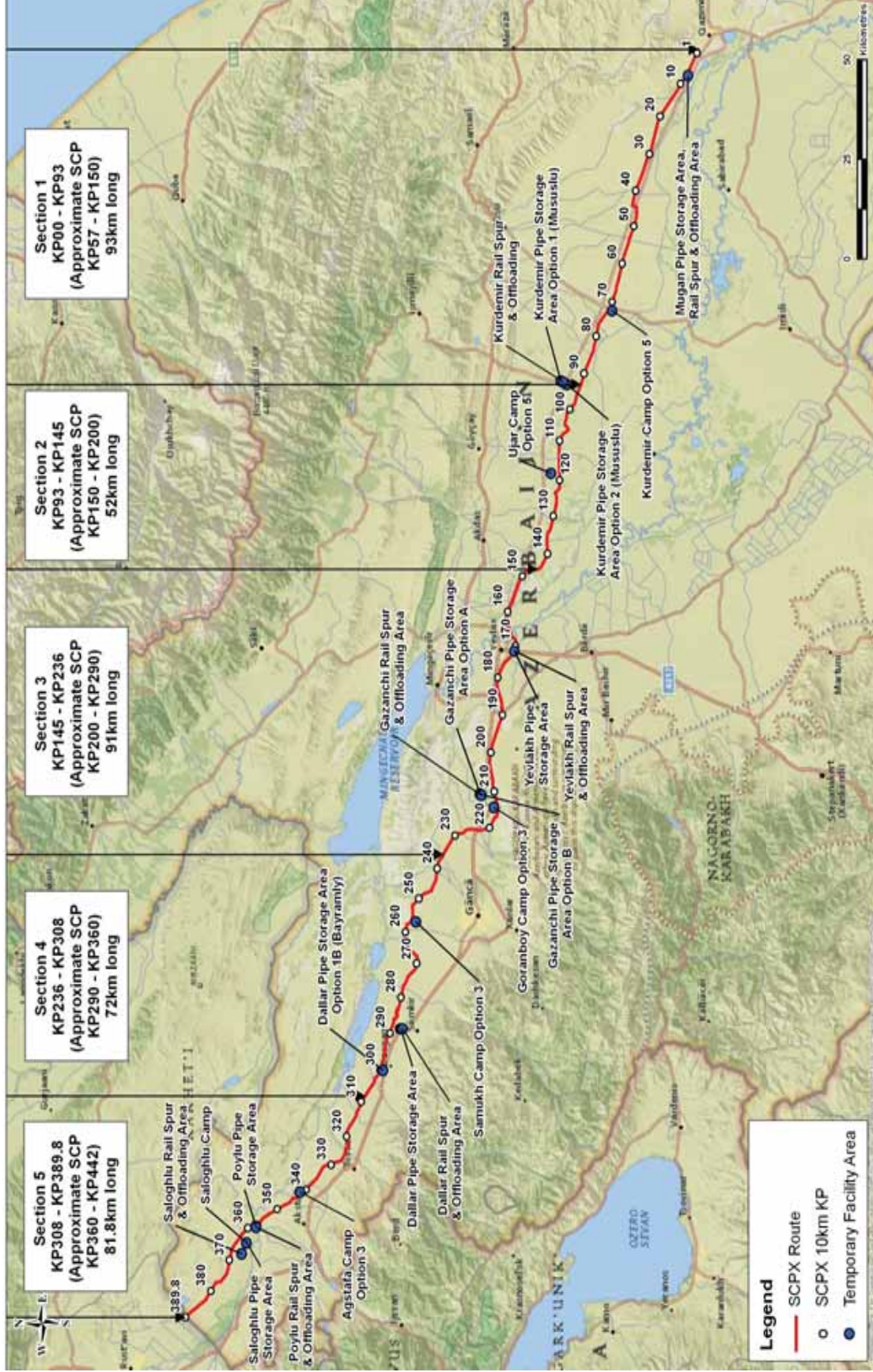


Figure 4-12: Approximate Section Boundaries along Proposed SCPX Route and Indicative Locations of Temporary Facilities

4.7.3 Construction Camp and Pipe Storage Area Location Options

4.7.3.1 Section 1: Mugan to Kurdemir

Alternative 1

The Project considered three options for a construction camp location close to Mugan within Section 1 during its initial review of locations. Option 1 was considered less favourable owing to safety and logistics concerns associated with the proximity of an uncontrolled railway crossing and low-voltage overhead cables. The land on which Option 2 is located was identified as not being in municipal custody and was therefore not easily available. Option 3 was chosen as the option to take forward for further study because it was large enough to accommodate the camp and did not have the safety and logistical concerns associated with Option 1. This area was also best placed to utilise the nearby Mugan Pipe Storage, Offloading Area and Rail Spur, which was the chosen option for rail offloading and pipe storage.

Alternative 2

The Project considered five alternative options for a construction camp location within Section 1.

Kurdemir Options 1, 2 3, and 4 were all rejected at an early stage because they did not have good access and their use would impact on a number of private land holders. Option 5 was selected as the preferred option for Section 1. The land is flat and well drained and there is minimal preparation at this site. There is a wide asphalt road that leads south 1.1 km from the highway turn-off point, to the selected area. Option 5 is situated away from communities and close to the ROW, so the impact expected to local traffic is lower than other options.

The Mugan Pipe Storage area remained the preferred location for rail off-loading and pipe storage. See Figure 4-13 below for the different options.

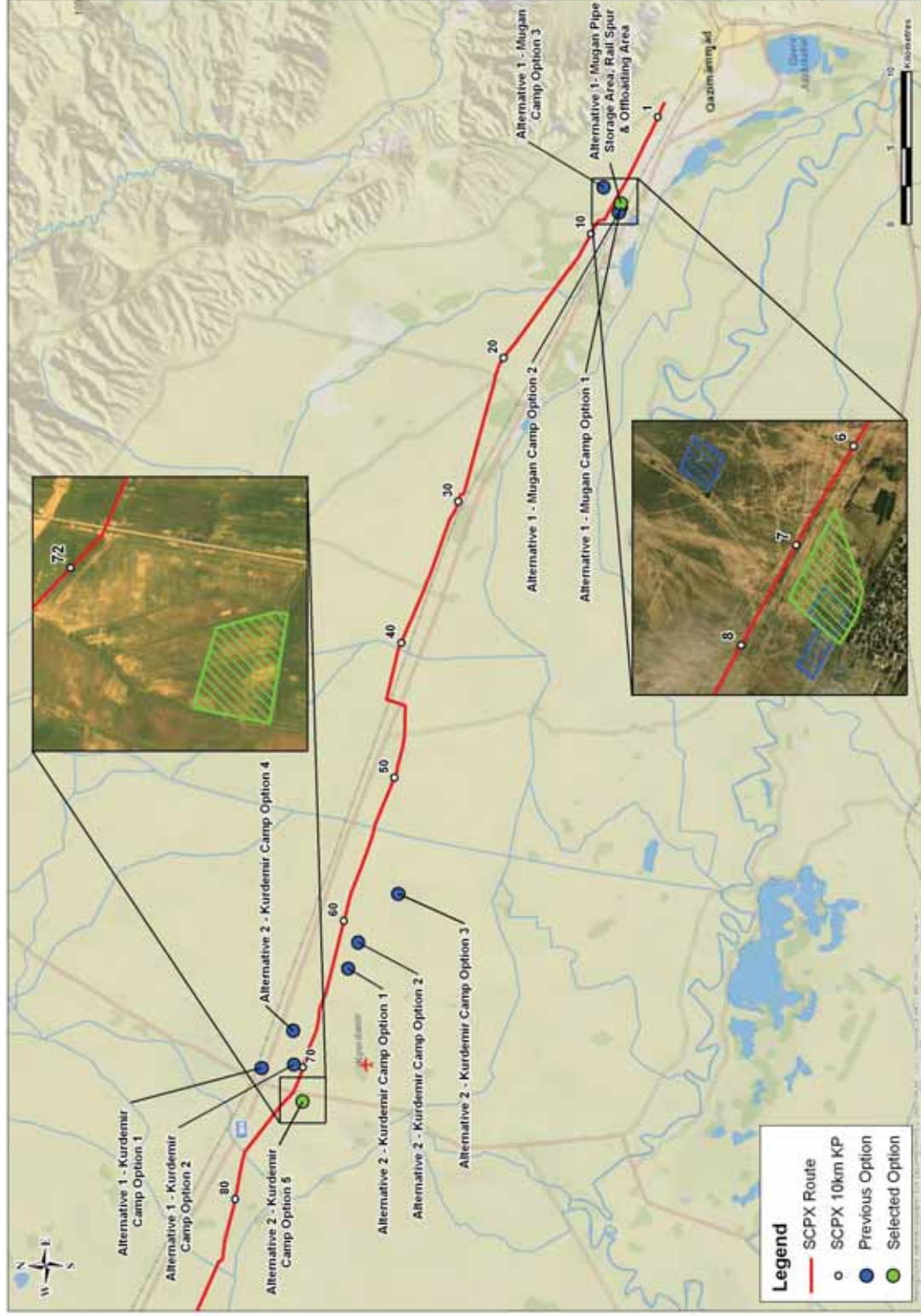


Figure 4-13: Previous and Selected Options for Temporary Facility Areas - Mugan, Kurdemir and Mususlu

4.7.3.2 Section 2: Kurdemir to Turianchay crossing

Alternative 1

The Project considered three options for a construction camp location near to Kurdemir.

Option 1 was a former BTC/SCP camp location, but was rejected because it is no longer available for lease from the landowner. Option 2 was not favoured because it presented hazards for construction personnel owing to the need to cross the main highway to access the pipeline ROW. The Kurdemir Camp and Pipe Storage Area was chosen as the best option to take forward for further study owing to its distance from local communities and proximity to the railway line for transport of pipe.

The proposed pipe storage and rail offloading area for Section 2 was situated at the Kurdemir Camp and Pipe Storage Area.

Alternative 2

The Project considered five options for a construction camp location near to Ujar.

Ujar Options 1, 2, 3 and 4 were all rejected at an early stage because they did not have good access and their use would impact on a number of private land holders. Ujar Camp Option 5 was selected as the preferred camp option for Section 2 because of ease of access. One of the reason for selecting this site, is the highway access. Other ROW sections east and west of this location can be reached from the highway intersection. There are a number of physical obstructions (mainly canals), that may prevent continuous ROW construction, and therefore use of the highway route may be essential. Ujar Option 5 is located on neglected land with no formal users which makes it particularly attractive as an option for a camp area. It was formerly cotton growing land, and suffers from saline soils. The environmental sensitivity is located mainly along the border of the site and maintaining a buffer will reduce the level of potential impact.

There are two preferred pipe storage and rail spur/offloading area options at Mususlu. Two options are being considered, close to each other; the final decision will depend on further assessment of traffic safety. Both sites have similar levels of sensitivity; Option 2 has more arable land, while Option 1 is lowland meadow used for grazing. The northern area of Option 1 has been used for illegal dumping of medical and other waste reducing the area used for grazing. See Figure 4-13 for options.

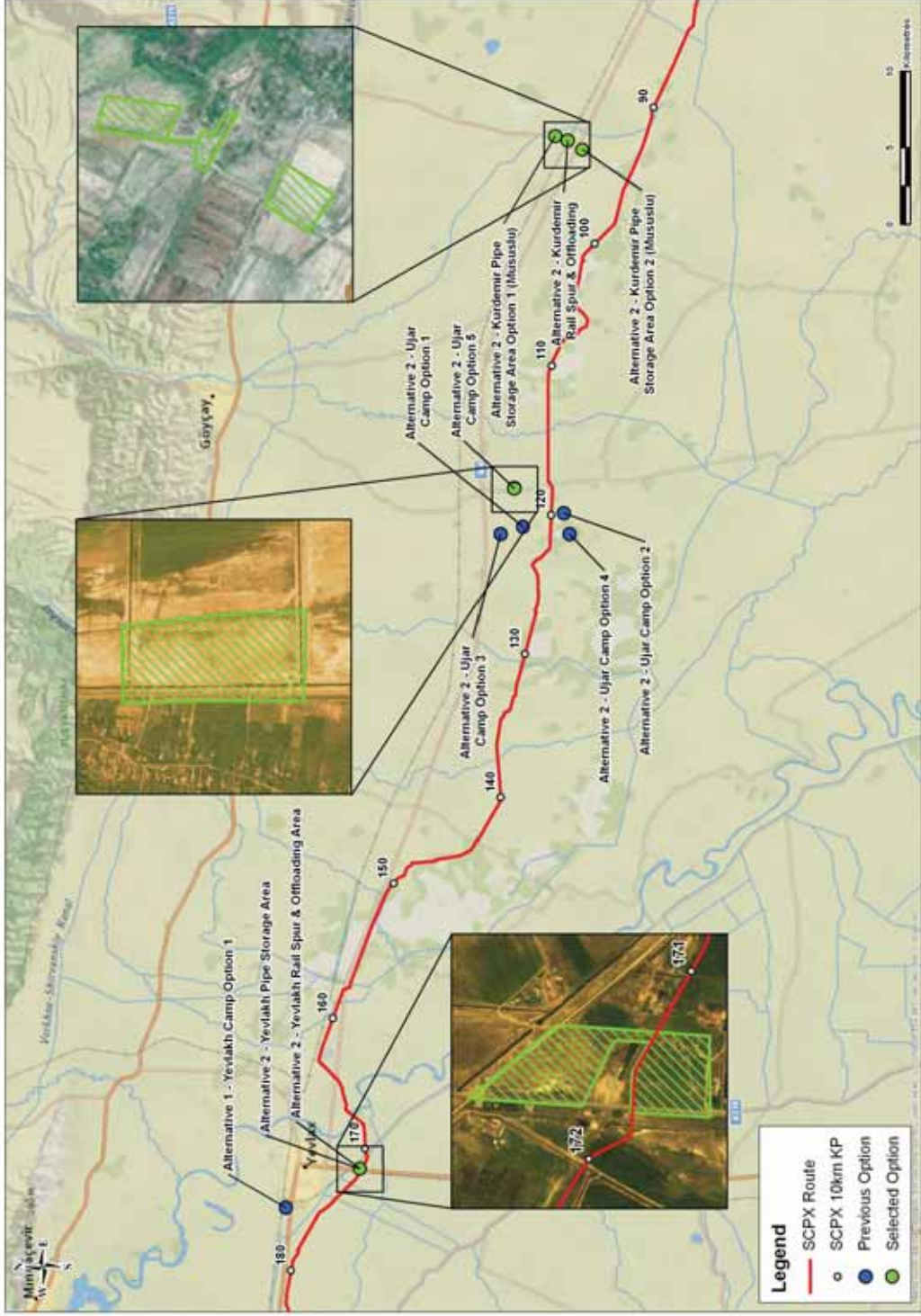


Figure 4-14: Previous and Selected Options for Temporary Facility Areas - Mususlu, Ujar and Yevlakh

4.7.3.3 Section 3: Turianchay crossing to Borsunlu

Alternative 1

The Project considered three options for a construction camp and pipe storage location within Section 3 near to Yevlakh.

The size of both Pipe Storage Area Option 1 and Pipe Storage Area Option 2 near Yevlakh was insufficient to satisfy the requirements for both a pipe storage and camp area. The camp location at Yevlakh was chosen as the best option to take forward for further study because it had good rail access and was large enough to accommodate both a camp and pipe storage area.

Alternative 2

The Project considered seven camp options within Section 3.

Yevlakh Camp Option 1 and Goranboy Camp Options 1 and 2 were all rejected at an early stage because of poor access and potential impacts on a number of private landholders. Goranboy Camp Options 4 and 5 were both sited on areas that would be difficult to reinstate after construction. Additionally, the access to Goranboy Camp Option 5 was considered poor, requiring significant work to enable its use. Access to Yevlakh Camp Option 2 is relatively good, but there was existing infrastructure that would have to be moved to accommodate construction traffic.

Goranboy Camp Option 3 has good access for construction traffic and was selected as the preferred option for Section 3. The site is relatively flat. The location is ideal from a safety aspect, as it is well suited for vehicles travelling in either east or west direction, into or out of the site. The site had a lower environmental sensitivity than other sites in the area.

Yevlakh Pipe Storage, Rail Offloading Area and Rail Spur was chosen as the preferred option for pipe storage because of the ease of access. See Figure 4-15 for options.

4.7.3.4 Section 4: Borsunlu to Zeyamchay crossing

Alternative 1

The Project considered six alternative options for a construction camp location within Section 4, including two locations for camp and pipe storage.

Option 1 is a former BTC/SCP camp location, but was rejected early because it was apparently no longer available for lease from the landowner. The land on which Options 2 and 3 were located was found to be unavailable for lease and, as such, these two options were not considered further. Option 4 was located within the SCP 500m exclusion zone and was therefore not suitable. Camp and Pipe Storage Goranboy 1 and 2 options were selected for further study as the best options in the area for camps and pipe storage areas owing to their location, good access and size.

The Project also considered, and selected for further study, two further options for a rail offloading area within Section 4. Zazali Rail Spur was a relatively small site that would require the re-routing of low-voltage overhead cables. However, the rail spur is in good condition and no work would be required to utilise the line, with ample distance available to deliver a full load of line-pipe. The site at Dallar is partially occupied and utilised by a private gravel-processing business but there is additional land within the overall site boundary that could be used by the Project, including a rail spur.

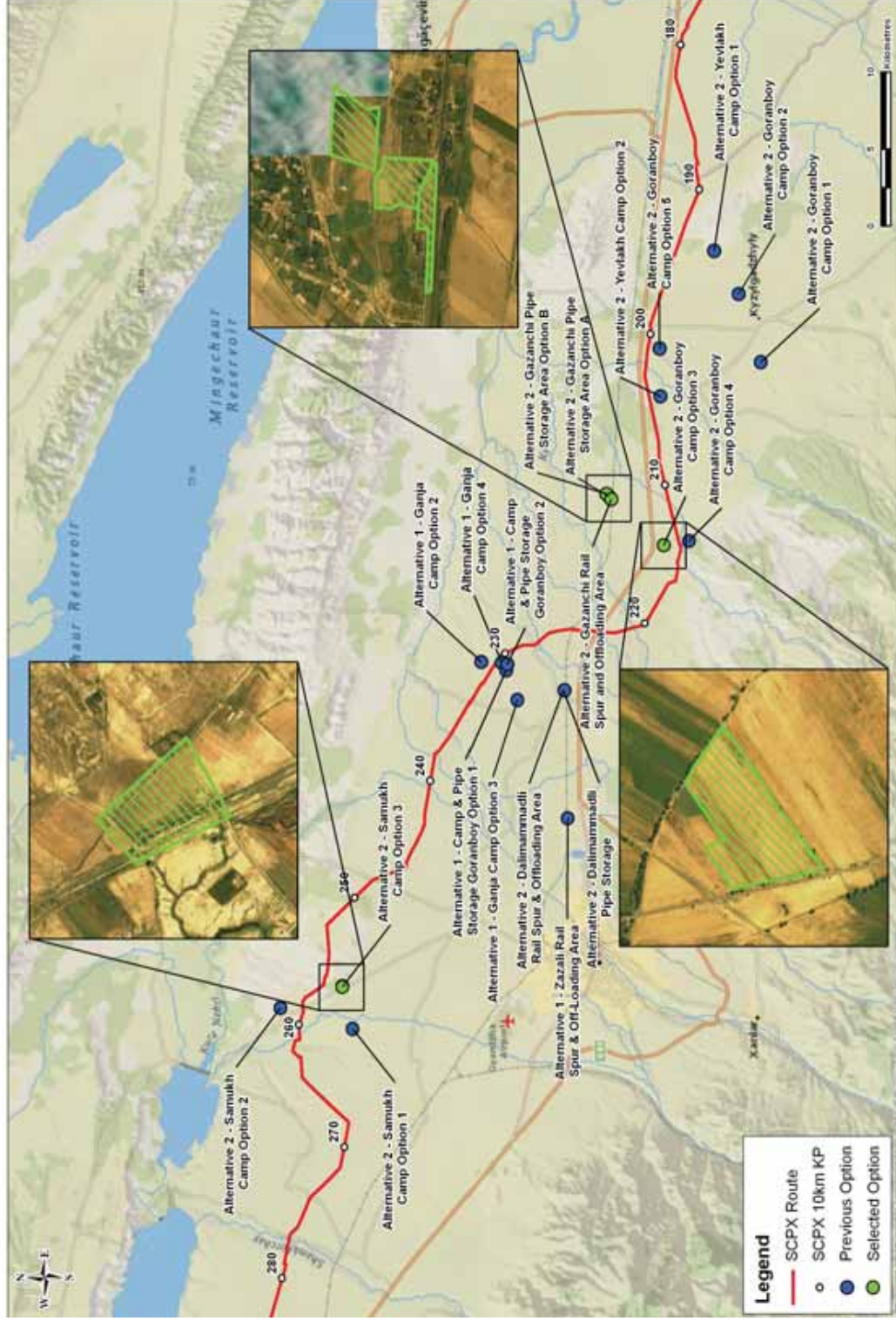


Figure 4-15: Previous and Selected Options for Temporary Facility Areas - Yevlakh, Gazanchi, Goranboy, Samukh

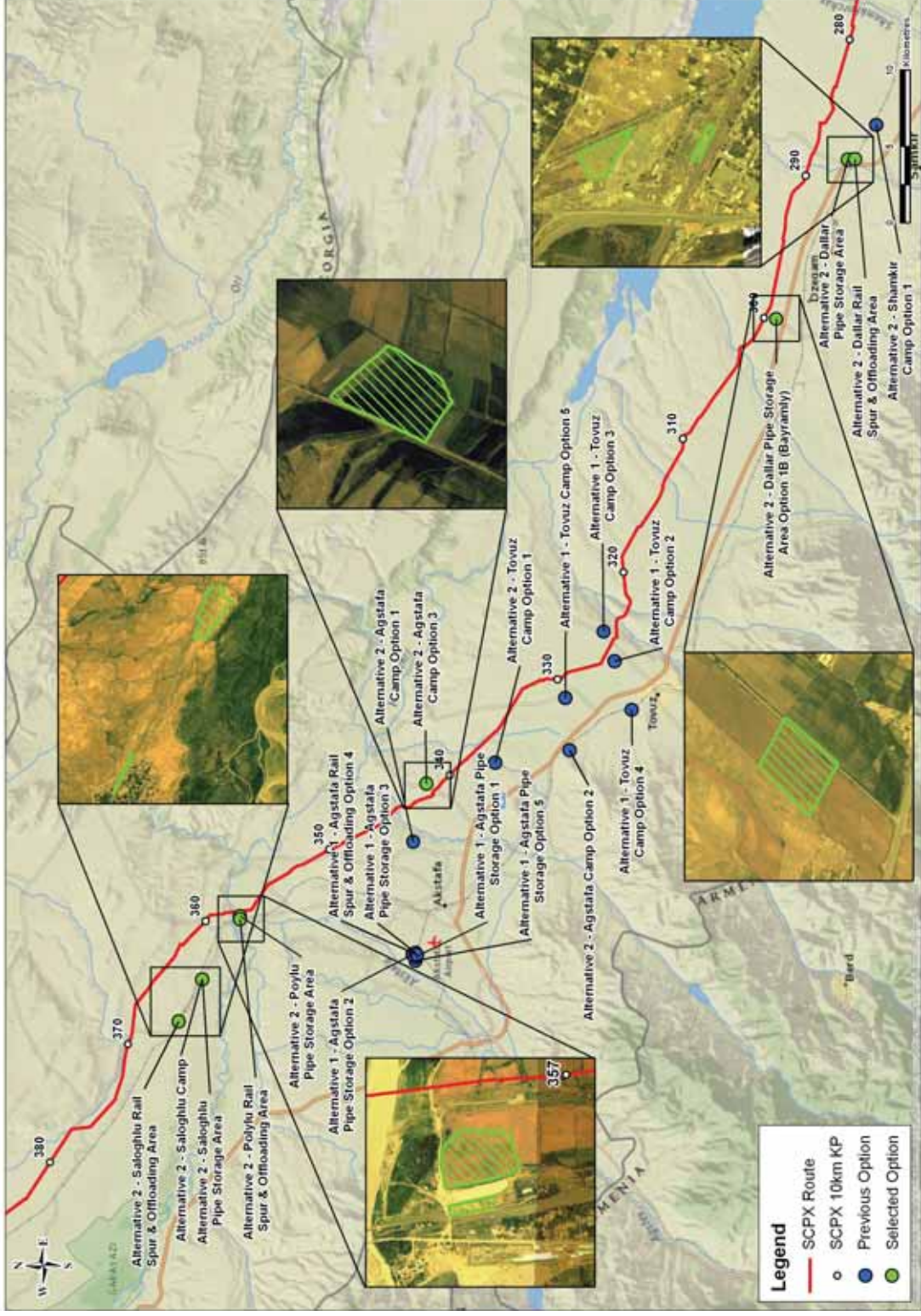


Figure 4-16: Previous and Selected Options for Temporary Facility Areas - Shamkir to Saloghlou

Alternative 2

The Project considered four options for a construction camp location near to Samukh and Shamkir. An additional site west of Dallar near the village of Bayramli has been identified. Bayramli may be utilised as an alternative to the existing pipe storage area at Dallar. This area is the closest point to Dallar rail spur, which has no influence on surrounding residents and infrastructure, whilst being convenient to the main highway and BTC/SCP/SCPX pipeline corridors.

The Dalimammadli rail spur and pipe storage area was rejected due to proximity to the community and the number of potential impacts to residences in close proximity to the sites.

Samukh Camp Options 1 and 2 and Shamkir Camp Option 1 were all rejected at an early stage because they did not have good access and their use would impact on a number of private land holders. Samukh Camp Option 3 was selected as the preferred construction camp location for Section 4. Although access to the site may involve passing through settlements, it is preferable to the other options in this section of the route. The land on this site is likely to be relatively easy to reinstate following construction. The traffic in this location is relatively low and residences are located back from the boundary of the proposed site. The environmental sensitivity of this site is lower than some of the other options examined. The site is currently used as pasture.

The Dallar and Gazanchi Pipe Storage, Offloading Area and Rail Spurs are the preferred sites Gazanchi Rail spur and offloading area. See Figure 4-15 and Figure 4-16 for options.

4.7.3.5 Section 5: Zeyamchay crossing to Georgian border

Alternative 1

The Project considered five camp options for a construction camp location near to Tovuz within Section 5.

Option 1 was a former BTC/SCP camp location, but was rejected early because it was no longer available for lease from the landowner. The land on which Options 2 and 3 was located was found to be unavailable and, as such, these two options were not considered further. Option 4 had some logistics difficulties and Option 5 was chosen as the best camp location to be selected for further study, as it has good access to the highway.

The Project considered a number of options for pipe storage locations within Section 5. Tovuz Pipe Storage Option 1 and a number of options were considered near Agstafa. Tovuz Pipe Storage Option 1 was situated on agricultural land on the north-western outskirts of Tovuz and is approximately 7km south-west of the pipeline ROW. This site was discounted owing to safety and transport management aspects associated with the control of traffic and public, especially at the junction to the main town road.

A number of options were considered for further study including the Agstafa Pipe Storage and Offloading Area/Rail Spur site. The site is located on the western outskirts of Agstafa at a former USSR textiles industrial complex. The site was used as a pipe offloading and storage area during BTC/SCP construction and there are several open adjoining areas that can be used for pipe storage and offloading.

Alternative 2

The Project considered three additional options for construction camp locations within Section 5.

Tovuz Camp Option 1 and Agstafa Camp Options 1 and 2 were all rejected at an early stage because they did not have good access and their use would impact on a number of private land holders. Agstafa Camp Option 3 was selected as the preferred location for Section 5. This site has good access with a limited number of other road users.

Within Section 5, two additional pipe storage and offloading area options have been identified as preferred options within the vicinities of Polyly and Saloglu. The proposed pipe storage area is adjacent to the Polyu rail spur and offloading area. The area is relatively flat and has good access to the RoW.

A fly camp and proposed pipe storage area at Saloghlu. It is preferred as additional areas to support the pipeline construction. Figure 4-16 for options. There were no other viable options found in the Saloghlu area.

4.7.3.6 *Summary of preferred locations for temporary facility infrastructure*

The following Alternative 2 options listed below are the preferred locations for camp, pipe storage and rail spurs.

Section 1

- Mugan Pipe Storage Area, Rail Spur and Offloading Area
- Kurdemir Camp Option 5

Section 2

- Ujar Camp Option 5
- Kurdemir Pipe Offloading Area Option 1 (Mususlu)
- Kurdemir Pipe Storage Area Option 1 (Mususlu)
- Kurdemir Pipe Storage Area Option 2 (Mususlu)

Section 3

- Goranboy Camp Option 3
- Yevlakh Pipe Storage Area, Offloading Area and Rail Spur

Section 4

- Samukh Camp Option 3
- Gazanchi Rail Spur and Offloading Area
- Gazanchi Pipe Storage Areas Option A and B
- Dallar Pipe Storage and Rail Spur and Offloading Area
- Dallar Pipe Storage Area (Bayramli)

Section 5

- Agstafa Camp Option 3
- Saloglu Pipe Storage Area
- Saloghlu camp
- Saloghlu Rail Spur and Pipe Offloading Area
- Poylu Pipe Storage, Offloading Area and Rail Spur.

4.8 Access Roads

4.8.1 *Permanent access road to the pigging station*

The location of the new permanent access road to the pigging station has yet to be defined. Where possible, existing tracks will be used when the Project is siting the new road to the pigging station. Once defined, the access road will be subject to baseline environmental and social survey, an ESIA and any additional requirements in order to comply with the formal Azerbaijan approvals process.

4.8.2 Temporary access roads

Access roads from the construction camps and pipe storage yards to the ROW have yet to be fully defined, although some potential routes are shown on the figures in Section 4.7. The Project will aim to prioritise use of existing access roads, in particular those that were used for BTC and SCP construction. These may need improving and widening in places. New temporary access roads will only be constructed where absolutely necessary. Once defined, the routes will be subject to baseline environmental and social survey, an ESIA and any additional requirements in order to comply with the formal Azerbaijani approvals process.

4.9 Logistics Alternatives

4.9.1 Transport of Line Pipe, Materials and Equipment

Process equipment and line pipe will be imported into Georgia at the port of Poti (major equipment) or Batumi (line pipe) during the early works and construction phases. The Project has considered options for forwarding line pipe from Batumi to the pipe yard in Rustavi and process equipment from Poti to the SCPX facilities by rail and by road. Transport of materials and equipment by air has been discounted except for emergency response and rapid evacuation.

Rail is a safer and more efficient mode of freight transport than road haulage. It involves less interaction with other users, is more fuel-efficient and has lower emissions, and causes less noise (due to distances from receptors) and general nuisance. Subject to the results of on-going detailed surveys of the condition and capacity of the existing rail infrastructure, rail transport will be used to transfer line pipe and major equipment from Poti and Batumi to convenient rail offloading points in Azerbaijan for the Project.

Line pipe, equipment and materials will be transferred from the rail offloading points to their final storage location or point of use by truck.

Aggregates and general construction equipment will be transported within Azerbaijan mainly by truck.

4.10 Conclusion

This section has summarised some of the key alternatives that the Project has reviewed. A continual process of environmental and social consideration of the Project design has resulted in the adoption of the optimal base-case design for the proposed SCPX Project. This base-case design is described in detail in Chapter 5. The selection of preferred solutions affects the overall environmental and social impacts of the SCPX Project that are assessed in Chapter 10 and Chapter 12.