ENVIRONMENTAL INCIDENT REPORT

VINTAGE PRODUCTION CALIFORNIA LLC
TAR CREEK CRUDE OIL AND PRODUCED WATER SPILLS

VENTURA COUNTY

30 JANUARY 2007
AND
6 FEBRUARY 2007

PREPARED BY JOSH CURTIS - ENVIRONMENTAL SCIENTIST
DEPARTMENT OF FISH & GAME, OFFICE OF SPILL PREVENTION AND RESPONSE

19 JUNE 2007

PCA/INDEX CODE: H2262/N400
OES #'S 07-0625 AND 07-0844

<u>ENVIRONMENTAL INCIDENT REPORT</u>

I. SYNOPSIS

Date of Incidents: 30 January 2007 1400 hrs & 06 February 2007 1800 hrs (per OES).

Reporter: Jim Lovins, Vintage Production California LLC (Vintage).

Location: Sespe Oil Field - Tar Creek Lease, an unincorporated area of Ventura County (7 miles north of the City of Fillmore).

Product: Crude oil (API 27) and produced water.

Source: Both spills were from the same transfer line.

Responders: Environmental Scientists - Josh Curtis, Ken Wilson, and Chris Thixton; Lt. Chris Long, Warden Matt Rickard, Warden John Castro; and Oil Spill Prevention Specialists – James Foto, Bill Scott, and Carlos Fonseca.

Spills: The first spill (OES# 07-0625) arose from a break in a transfer line. Spilled material entered the actively flowing Tar Creek and significantly oiled at least 3.21 miles of this waterway between the broken pipeline and just upstream of the confluence of Tar and Maple Creeks. The second spill (OES# 07-0844) was from the same transfer line but was not discovered until one week after the original incident. Most of the spilled material from this pill soaked into sediments surrounding the transfer line which was buried at the spill source. Some material flowed down a dry creek bed and contaminated approximately 100 feet of stream above a road culvert but did not enter the culvert or the actively flowing stream below.

Cleanup: Control, containment, and cleanup of oil and oiled materials were conducted by Vintage and their contracted oil spill response organizations. In general, free oil and oiled sediments were swept downstream for mechanical collection or removal by hand crews. Oiled rocks and surfaces were washed with either hot or cold, high or low pressure water. Petroleum contaminated materials (including vegetation, sediments, woody debris, sorbents, and other waste) were bagged and stored in containment bins for quantification and disposal.

Habitat: The area of Tar Creek is predominantly chaparral and annual grassland interspersed with stands of oak and California black walnut. The canyon bottoms support intermittent and perennial streams some of which provide habitat for both aquatic and riparian associated plants and animals. Tar Creek comes to confluence with Sespe Creek only 1.8 miles below the downstream limits of the visible spill path.

Natural Resource Injuries: Throughout the spill area, oil coated vegetation and woody debris; entered animal burrows and crevices; covered surfaces of boulders and cobbles; got captured as droplets in algae; and penetrated streambed alluvium, soil, sand and mud substrata in the bed of the stream. Petroleum sheening and odor were noted throughout the spill path. Large numbers (~ thousands) of macroinvertebrates, one song bird, and one two-striped garter snake (CA Species of Special Concern) were seen oiled and dead within the spill path. Overall, the spills and their associated cleanup caused significant impacts to the habitat and biota within and near the spill. A reasonable estimate for the complete recovery of the impacted habitats and species to pre-spill conditions can be expected to be at least 2 years.

Natural Resource Damage Assessment: DFG/OSPR estimates the restoration costs that can compensate for the resource services lost as a result of the Tar Creek spill to be $50,351. These injuries can be compensated by contributing to a project that restores/enhances in-stream biota of small rocky streams (both perennial and intermittent).

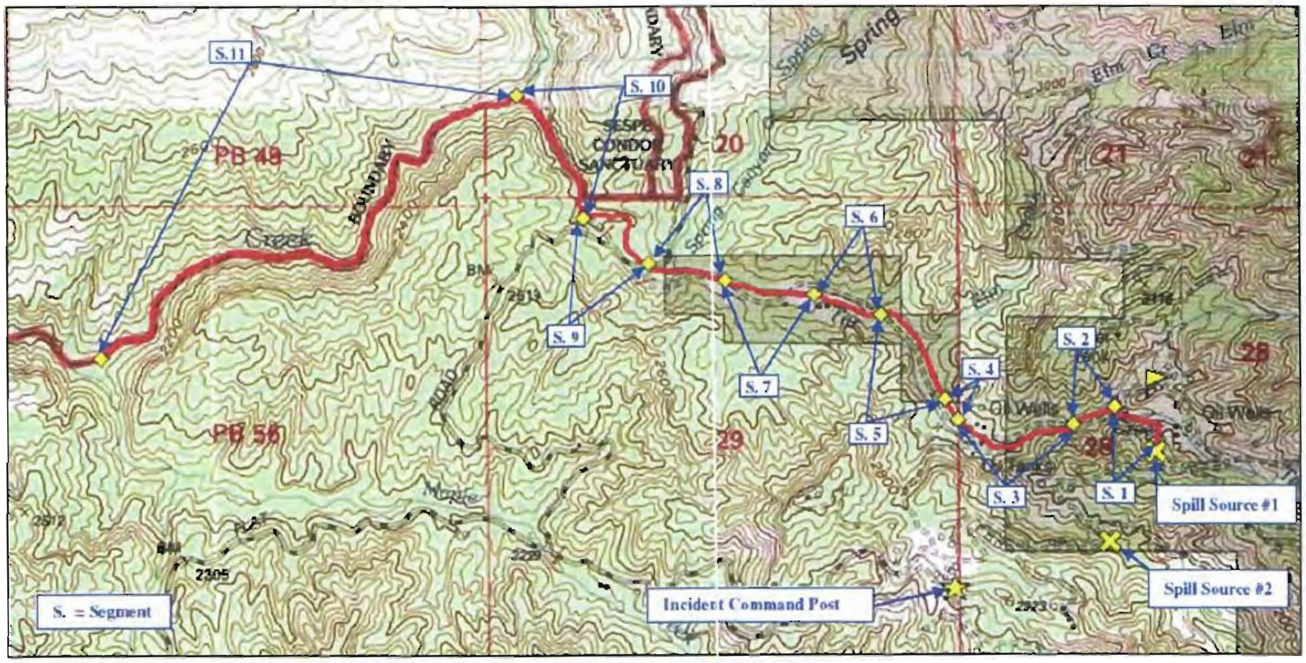
II. RESPONSE AND CLEANUP

On January 30, 2007 at 1400 hours, Jim Lovins of Vintage Production California LLC (Vintage), reported a pipeline break and release of crude oil and produced water into Tar Creek in an unincorporated area of Ventura County. The amount of material spilled was originally reported as approximately 85 barrels of mixed fluids which allegedly included 5 barrels of crude oil (API ~27), and 80 barrels of produced water. On that day, Department of Fish and Game (DFG) – Region 5 officers, Lt. Chris Long and Warden Matt Rickard responded to the scene. Upon examining the area, Lt. Long requested assistance from DFG - Office of Spill Prevention and Response (OSPR) staff.

Picture 1- Surface flows in Segment 5 were not present in channel by the time the cleanup got underway. Spilled oil became stranded on/in streambed as natural stream flows diminished. ACTI work crews were clearing debris from low-flow channel to facilitate cleanup and to prevent underflow dams from clogging in case of rain. (pic id: 228_kw, pic date: 02/06/07)

Beginning January 31, 2007, DFG and DFG-OSPR responders included, but were not limited to: Environmental Scientists (ES) - Josh Curtis, Ken Wilson, and Chris Thixton; Lt. Chris Long, Warden Matt Rickard, Warden John Castro; and Oil Spill Prevention Specialists – James Foto, Bill Scott, and Carlos Fonseca. Off-site assistance was provided by Region 5 Biologist Maurice Cardenas. DFG personnel inspected the site with Jim Lovins, Vintage's environmental coordinator, and other Vintage personnel to determine the cause of the spill,

Map 1 - Overview of Spill Path and Response Segments



provide cleanup recommendations, monitor the progress of cleanup operations, and assess injuries to the environment.

Other agency and interested party representatives assisted in the response as well. These included, but were not limited to individuals from the: U.S. Forest Service, U.S. Bureau of Land Management, and CA Department of Oil, Gas and Geothermal Resources.

On February 6, 2007 at 1800 hours, approximately one week following the original incident, a second spill was discovered by Vintage personnel during an examination of the failed line. Their examination concluded that this incident most likely occurred simultaneously with the first spill. This second spill was originally reported to have involved approximately 20 gallons of crude oil and approximately 2 barrels of produced water.

Picture 2 - Oil filled bags from vicinity of Segment 11. Awaiting helicopter pickup. (pic id: 215_kw, pic date: 02/06/07)

Response and monitoring of both spills continued until February 20, 2007. A final post response survey was conducted on 17 April 2007.

The first spill was divided into 11 segments for response (see Map 1 and Tables 1 and 2). Segment 1 was upstream of the first concrete road crossing of Tar Creek. Segments 2 through 9 were established along the facility access roads in locations where Tar Creek crossed access roads. Segments 10 and 11 were established in Tar Creek in the canyons downstream of the access roads. Segments 10 and 11 were accessible only by foot. The second spill was contained within a single response area (~100 feet).

Table 1 - Segment Lengths for Spill 1

Segment #	Distance (miles)	Segment #	Distance (miles)
1	.16	7	.20
2	.10	8	.18
3	.28	9	.23
4	.06	10	.33
5	.25	11	1.27
6	.15	**Total**	**3.21**

<u>Response Measures:</u>

In general, free oil and oiled sediments were swept downstream for mechanical collection or removal by hand crews. Oiled rocks and surfaces were washed with either hot or cold, high or low pressure water. Petroleum contaminated materials (including vegetation, sediments, woody debris, sorbents, and other waste) were bagged and stored in containment bins for quantification and disposal. However, due to the varying habitat and oiling conditions between segments, some variation in clean-up strategies existed. Table 2 describes this variation by segment.

Table 2 - Response Measures by Segment for Spill 1

Segment #	Description
1	Soil excavation, debris removal, underflow oil containment dam, hot and cold water flush (partial), sorbent and vacuum truck oil recovery.
2 - 4	Clear vegetative and rock debris, sweep, hot and cold water flush, underflow oil containment dam, and sorbent and vacuum truck oil recovery.
5	Clear vegetative and rock debris, cold water deluge, steam clean and cold water flush, underflow oil containment dam, and sorbent and vacuum truck oil recovery.
6 - 9	Clear vegetative and rock debris, hot and cold water flush, sweep, underflow oil containment dam, and sorbent and vacuum truck oil recovery.
10	Clear vegetative and rock debris, sweep, underflow oil containment dam w/sorbent oil recovery.
11	Clear vegetative and rock debris, sorbent oil recovery with helicopter assist for material placement and recovery.

The response measures used for the second spill included sediment removal, hot water washing, and collection of water and oil with a vacuum truck.

III. OIL AND PRODUCED/INJECTION WATER CHARACTERISTICS

The fluids released from this spill were a mixture of medium to light crude oil (~API 27) and produced water. Crude oil is a complex mixture of many different chemicals making the assessment of toxicity difficult. Crude oils often contain asphaltenes, aromatics, polycyclic aromatic hydrocarbons (PAHs a.k.a. semi-volatiles), and resins. The aromatics and PAHs are among the most toxic components in crude oils and some are known carcinogens such as benzene. These compounds are medium-weight components of hydrocarbon mixtures that pose significant environmental risk because they are persistent in the environment and are biologically available as well as having high toxicities. Heavy end components (i.e. asphaltenes) have the potential for bioaccumulation via sorption onto sediments.

Produced water, which is recovered from oil bearing rock during the oil extraction process, consists primarily of native water also known as 'conate' water. This water is generally saline and is associated with crude oil in the porous oil bearing rock strata. Produced water is commonly found in suspension with crude oil and often accounts for a large percentage of the fluids extracted by production wells in Ventura County. Injection water is simply produced water that has had the oil extracted from it and has been prepared for re-injection into the oil source rock formation.

The terms "produced water", "injection water", and "production water" are often used interchangeably and thus a spill of "produced" water may be either untreated produced water, produced water treated with anti-emulsion chemicals (to help separate oil from water), or injection water possibly treated with biocides and/or anti-corrosives. Therefore, a "produced" water spill may often be comprised of several different waters of different origins with varying chemical constituents that may include, but are not limited to: biocides, anti-corrosives, clarifiers, heavy metals, petroleum hydrocarbons, and brine (salt water). For the purposes of this report, the term "produced water" may be used to denote either produced water, injection water, or both.

Unlike most natural terrestrial runoff which is generally relatively low in electrical conductivity and salinity, produced water is commonly more similar to sea water in its salinity and conductivity. Even without the presence of oil, elevated salinity and conductivity can be deleterious to wildlife and aquatic species which inhabit freshwater streams. Many freshwater (aquatic) species, particularly adult and larval amphibians and some insects, have only a limited ability to balance differences between internal and external osmotic pressures associated with highly saline water and are poorly adapted to the elevated levels of dissolved salts and high conductivities associated with spills of produced waters. In addition to elevated levels of mineral salts, produced water generally contains traces (1-3%) of oil, organic acids, elevated concentrations of heavy metals (including barium, cadmium, chromium, lead, copper, and nickel), and other compounds including corrosion inhibitors, all of which can be deleterious to wildlife and aquatic species.

Produced water can soak into the stream sediments where its negative effects on biota may linger for an extended interval. Produced water is not retained by most traditional oil spill response strategies (e.g. oil sorbents and/or oil containment structures such as underflow dams) which often allow produced water to flow further than any concurrently spilled oil.

For more information on produced water, please see the attached report excerpt "A White Paper Describing Produced Water from Production of Crude Oil, Natural Gas, and Coal Bed Methane" (US Department of Energy, 2004).

IV. ENVIRONMENTAL SETTING

The two spill sites are located approximately 6.9 air miles north-northeast of State Highway 126 at Fillmore, CA and approximately 3.75 air miles northeast of the U.S. Forest Service gate which is located at the north end of Goodenough Road. The spill paths are located within both private and government lands in the Los Padres National Forest and are in the vicinity of the Sespe Condor Sanctuary. Located to the north-west of the spill sites is Sulfur Mountain and to the south-east is Hopper Mountain. This area is used by both recreational (camping and hiking) and commercial interests. Two oil companies, Vintage and Seneca, utilize the upper (northern) Sespe Field for oil production.

Picture 3 – Typical habitat upstream of Segment 10. Boom and sorbent pads are seen in creek. (pic id: P2010069, pic date: 02/01/07)

The area is predominantly chaparral and annual grassland interspersed with stands of oak and California black walnut. The canyon bottoms support intermittent and perennial streams some of which provide habitat for both aquatic and riparian associated plants and animals. Wildfires burned though the area in August of 1997 and, again, in October 2003. Consequently the vegetation in the vicinities of the Jan 2007 Tar Creek spills was fire damaged and was in varying stages of re-growth.

All segments within the spill path support a diverse fauna which includes, but is not limited to:

- *Invertebrates (insects and spiders)*
- *Amphibians (Pacific and California tree frogs and toads)*

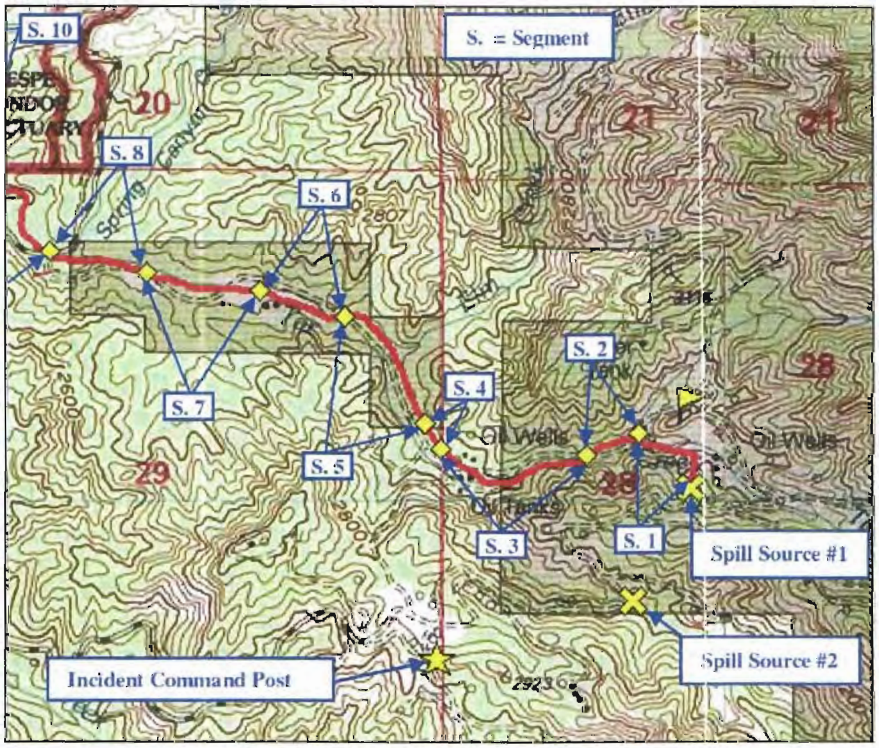
- *Reptiles (lizards and snakes and, where water is perennially present, southwestern pond turtles and two striped gartersnake [both California species of special concern],*
- *avian species (California Condors [listed as Federally and State Endangered]); songbirds; gallinaceous birds (California quail and doves); crows, raptors (red-tailed hawks and owls);*
- *Small mammals (rabbits, squirrels, raccoons); and*
- *Larger mammals (deer, bear, mountain lions, and coyotes).*

Listed species (endangered, threatened, and special concern) were noted in the California Natural Diversity Database.

No fishes were noted in any area examined within the spill path or downstream as far as the Green Cabin Road Crossing (0.8 mile below the lower limits of the visible spill path at the junction of Maple Creek and Tar Creek).

The physical and biological environment throughout the spill path varied significantly from area to area. The following gives a description of the different habitats within and surrounding each segment of the spill path.

Map 2 – Close-up of Spill Path and Response Segments 1 – 8



<u>Segment 1:</u>

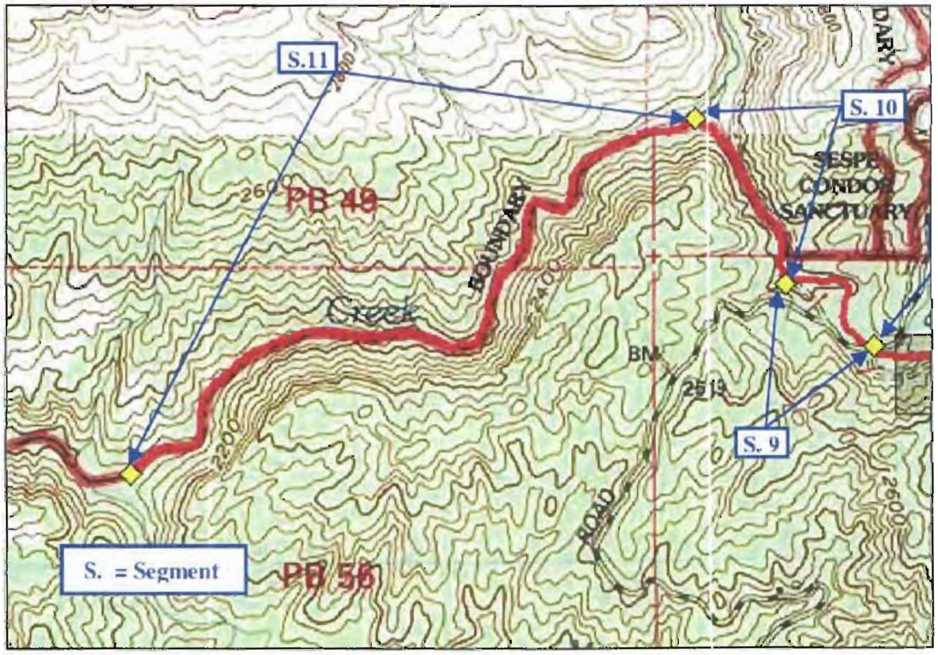
The upper portion of the spill path was characterized by a steeply sloped 2-3 ft wide channel with intermittent flows. This area supported annual and perennial grasses and resprouting chaparral vegetation (recovering from previous wildfires). The lower portion of segment 1 was bordered on the south side by an overstory of oaks. The spill path entered an actively flowing unnamed, intermittent tributary to Tar Creek just upstream of the first road crossing. The unnamed tributary joined with Tar Creek in the immediate vicinity of the first road crossing.

<u>Segments 2 to 3 (midway):</u>

Crowded between the roadway and a steep north facing cliff, the canyon and streambed were relatively narrow in Segment 2 and upper portion of Segment 3. Active stream flows were observed within this reach. This area was characterized by a sparse overstory of previously-burned California sycamores and a sparse to moderate understory of willows where water and sunlight were adequate. Little or no aquatic vegetation was present.

Segments 3 (midway) through 9:
The canyon gradually widened into a broad alluvial area which was predominated by boulders, cobbles, gravel, shale sand, and clay loam. The alluvial area began near the middle portion of Segment 3 and extended downstream to the beginning of Segment 10. This alluvial area reached a maximum width of approximately 150 - 200 yards. This area contained the majority of the oil production facilities: wells, pipelines, separation and waste water tanks, operational pads, access roads, etc. The actively flowing (oiled) channel ranged from 3 to 10 feet in width and had a sparse to moderate overstory of burned sycamore snags which were root crown-sprouting. Willows and mulefat shrubs lined the more open areas along the stream channel where the overstory was sparse and the sub-surface water flows were adequate. Active surface flows all but ceased in the middle two-thirds of Segment 5. Aquatic plants were observed in the lower portion of Segment 9 where the overstory was sparser and water flows were more persistent.

Map 3 - Close-up of Spill Path and Response Segments 9 – 11



Segment 10:
Extending downstream from the last underflow dam at road end to Redrock Creek, this area was only accessible by foot. The streambed of Tar Creek narrowed as the canyon once again narrowed. This area had a trace overstory of previously burned sycamores and shrubs. Stands of willows were noted streamside. Where shale sands occurred, aquatic vegetation covered shallow pooled areas along 10 to 25% of the shorelines. Common Macroinvertebrates included but were not limited to: ferocious water bugs, water boatmen, at least two species of adult beetles, water striders, and aquatic larvae of flying insects (mosquitoes and dragon flies).

Segment 11:
Accessible only by foot, this segment extended downstream from Redrock Creek to Maple Creek. The area was surrounded by steep canyon walls and hillsides which often cut through sandstone bedrock and clay sills. Where the canyon was narrow, the stream channel ran through sluices carved into bedrock outcroppings. Here there were pools 4 to 6 foot in depth. Where the canyon walls were further apart, boulder, cobble, gravel, and shale sand alluvia were observed and the streambed was 6 to 30 feet in width. Shrubby willows and mulefat were sparsely distributed through the portions of Segment 11 where alluvial deposits had more sand and gravel. Few mature trees occurred within the streambed or on its banks in this area, because these areas are subject to severe flash flooding and debris flows.

Sespe Creek

While outside of the visible spill path, Sespe Creek is close enough and significant enough to warrant discussion. Tar Creek comes to confluence with Sespe Creek only 1.8 miles below the downstream limits of the visible spill path. Sespe Creek is known to support steelhead trout (a federally listed endangered species), which would likely have been passing through during concurrent flows, as well as an abundant resident rainbow trout population. Sespe Creek is designated as a Wild Trout Stream by DFG and is thought to provide the best remaining wild habitat for endangered steelhead trout within the Santa Clara River Watershed. Most steelhead spawn between December and April with the eggs hatching approximately 30 days later. The fry (an early stage of development in young salmonids) live within the gravel for another 30-45 days before moving into shallow, protected areas along the creek margins. Thus at the time of the spill, it is possible that Sespe Creek and its tributaries held steelhead adults, juveniles, fry, and eggs.

Arroyo toads, mountain yellow-legged frogs, southwestern pond turtles, and two-striped garter snakes are known to exist in Sespe Creek beyond the known downstream limits of the spill path. Irvin Fernandez of the U.S. Forest Service, reports that California Condors frequent water holes at the confluence of Sespe and Tar Creeks only 1.7 miles to the west of the densest, largest, and most persistent pools of accumulated oil which arose as a result of the Tar Creek Spill.

V. IMPACTS TO THE ENVIRONMENT

Throughout the spill area, oil coated vegetation and woody debris; entered animal burrows and crevices; covered surfaces of boulders and cobbles; got captured as droplets in algae; and penetrated streambed alluvium, soil, sand and mud substrata in the bed of the stream. Petroleum sheening and odor were noted throughout the spill path. The following table summarizes the oiling that occurred within each segment.

Table 3 - Description of Oiling by Segment

Segment(s)	Description	Length
1	Spill arose from a transfer line break on a chaparral covered hillside and ran through unnamed intermittently flowing 2-3 foot wide secondary and primary tributaries to the first concrete road crossing in Tar Creek. Significant amounts of produced water and oil soaked into shale sand. Petroleum odor and sheening were observed.	0.16 mile
2 - 4	Active but diminishing water flows were present during spill response. Significant leaf fall and rock debris trapped oil along spill path in pools, eddies, and along banks. Petroleum odor and sheening were observed.	0.44 mile
5	Active streamflows ceased early in the incident. Fresh oil coated virtually 100% of the sediments, rocks, and in pools in the stream channel within this segment. Significant leaf fall and rock debris trapped oil along spill path. Significant amounts of oil sank into sediments and were discovered down to 6 – 8 inches beneath the creek's surface. Petroleum odor and sheening were observed.	0.25 mile
6 - 10	Active flows present throughout the incident. Significant leaf fall and rock debris caused fresh oil to coat and stain sediments, rocks, and in pools in the stream channel within these segments. Significant amounts of oil sank into sediments and were discovered down to 6 – 8 inches beneath the creek's surface. Within Segment 10, significant amounts of oil were discovered within both algae and stream sediments. Much oil trapped in aquatic vegetation in Segment 9. Petroleum odor and sheening were observed.	1.09 miles

Segment(s)	Description	Length
11	Tar Creek from the confluence of Redrock and Tar Creeks downstream to the last boomed area above Maple Creek. Active streamflows. Significant oil transport on water surface for approximately 1 mile downstream of Redrock Creek. Oil distribution patchy but thick oil pads noted in approximately five pools. Significant amounts of oil were discovered within both algae and stream sediments within this segment. Otherwise banks were generally free of visible oil.	1.27 miles

Picture 4 - Seven Belostomids and 29 unidentified beetles in a 10-cm square area. All are oiled and dead. (pic id: 167_kw, pic date: 02/03/07)

Two dead, non-oiled Pacific treefrogs were observed approximately ½ mile downstream of the visible spill path. One dead, oiled two-striped garter snake (*Thamnophis hammondii* - a state listed species of special concerned) was found at the containment dam at the top of Segment 2. Large numbers (~ thousands) of oiled, dead macroinvertebrates including many ferocious water bugs (belostomatids) were found in section 10 and 11 on the second and third day of the spill clean-up (See Picture 4). One dead, oiled songbird was noted. One California treefrog was observed swimming in an oiled pool at the downstream end of Segment 5.

Overall, the two spills and the associated cleanup for each caused significant impacts to the associated habitat and biota within and near the spill paths. In addition, four access roads (a total distance of 0.05 mile) had to be graded across the streambed to allow access to the actively flowing stream channel in order to facilitate collection of oil by vacuum trucks.

VI. OTHER ENVIRONMENTAL CONSIDERATIONS

In addition to the environmental impacts that were observed and listed above, the following is information regarding potential environmental impacts that may have occurred or may occur in the future due to this spill. This includes impacts that are likely but not observed nor quantitatively analyzed for (e.g., no bioassays were conducted on contaminated creek sediments).

Although gross oil contamination can be removed from a watercourse, it is virtually impossible to remove all spilled oil. Oil sheening and minor spots of crude oil were observed along the creek bed as well as leaking out of holes (made by small rodents and old roots) in the creek's banks throughout the spill clean-up. Fresh oil was discovered within sediments, algae, and under rocks throughout much of the spill path. While an effort to remove this material out of the environment was made, much of it was unrecoverable and will remain within the environment for an extended period of time.

Picture 5 - View of dense black oil pad covering 80% of a 16x15 ft pool. Oil pad was so thick it was shoveled into bags. Dozens of dead oiled Belostomids in this area. (pic id: 158_kw, pic date: 02/03/07)

A post clean-up survey of the spill path was performed on 17 April 2007. During this survey, visible effects of the spill and cleanup activities were observed in or near the spill path. These included but were not limited to: 1) stream contours were changed during the removal of oiled sediments in Segment 1; 2) significant amounts of fresh oil remained trapped in sandy sediments and under rocks in several wetted areas; 3) silt layers (arising from water washdown to remove free oil and oil coating) covered sediments in most areas; 4) salt deposits were thick and extensive in the dried stream channel of Segment 5; 5) Lush aquatic vegetation removed from Segments 9 and 10 had still not recovered. While there are natural seeps throughout this area, a similar survey of a tributary (Red Rock Creek) just upstream of the spill path showed no buried oil. The oiled streambed and its banks will most likely continue to sheen for some time whenever water is present. It has been found that petroleum hydrocarbon residues can be extremely persistent in wetland and stream sediments with buried oil sometimes persisting for 20 years (Teal et al. 1992).

Rocks, vegetation, vegetative debris, and sediments in and adjacent to watercourses provide wildlife habitat for foraging, sheltering, and nesting, as well as nursery areas for a wide variety of terrestrial and aquatic animals. When vegetation and sediments are removed during clean-up activities, as was done during this clean-up, natural habitat is lost. If oiled material is missed and is not removed from the system, areas of the stream could become uninhabitable and serve as a source of chronic contamination for downstream locations and biota.

Pathways for injuries to wildlife and aquatic species as a result of oil spills and related clean-up activities are many. Injuries can be direct (e.g. organisms affected by direct exposure to oil and/or produced water) or indirect (organisms or their offspring affected by loss of food, habitat, and/or changes in fertility). Wildlife may have been killed or sickened by directly ingesting the spilled product, ingesting other oiled animals or plants, and/or during grooming activities. Oiled wildlife often go unobserved because they commonly leave oil contaminated areas, seeking protection in bushes, crevices, and burrows while they attempt to remove the oil from their bodies and/or recover. These animals may die or, if they survive, may fail to reproduce due to the debilitating properties of oil exposure.

Different types of wildlife can suffer very different impacts from oil exposure. Birds can be injured through three general mechanisms: 1) physical effects of oil on plumage, 2) the detrimental effects of oil on the surface of eggs, and 3) toxic effects. Oil on the plumage of terrestrial birds can impact their ability to fly and, thus reduce their ability to feed or avoid predation. Very small quantities of oil on the surface of avian eggs have been shown to lead to high levels of embryo mortality (Jessup and Leighton, 1996). Acute, or short term, mortality, as well as sublethal effects, can also result from toxicity after birds ingest or inhale oil. Chronic, or long term, effects of oiling likely include reduced reproduction and survivability.

Jessup and Leighton (1996) summarized the primary causes of wildlife morbidity and mortality due to oil exposure. They noted not only physical effects such as oil on skin, fur, and feathers but also irritation of skin, oral, ocular, respiratory, and gastrointestinal mucous membranes. The reproductive system, the kidneys, and the liver enzyme systems that metabolize toxins and carcinogens were also damaged due to oil exposure. In addition, they noted that there may also be suppression of the immune response and disruption or suppression of red blood cell formation.

Reptiles and amphibians can also be directly affected by oil. One study showed that, where oiling was heavy, the hatching of green tree frog eggs appeared unaffected, however, frog larvae (tadpoles) showed reduced growth and often failed to metamorphose into juvenile frogs. (Mahaney, 1994).

An entire biological community can also be impacted from an oil spill even if the spilled oil does not directly contact most of the community. Spills and clean-up activities can cause changes in populations and/or the community structure of macroinvertebrates due to toxicity, smothering, siltation, trampling, and loss of habitat. As macroinvertebrates are prey for many fishes, amphibians, reptiles, birds, and mammals, any change in the quantity, quality, and/or availability of macroinvertebrates can affect biota throughout the food web.

VII. PREDICTED RECOVERY TIME

In addition to the direct injuries observed (i.e. injury to the habitat and the dead animals), unseen but likely acute and chronic impacts to the habitat and other organisms must be considered. The recovery of such biological assemblages is a process that requires time and is influenced by numerous factors including, but not limited to: the amount of oil remaining in the environment, the severity of cleanup required, the weathering and biological degradation of the residual crude oil, climatic conditions, and the reproductive capacity of organisms of the various taxonomic groups from bacteria to birds.

A reasonable estimate for the complete recovery of the impacted habitats and species to pre-spill conditions can be expected to be at least 2 years (see Table 4). This recovery time is inclusive of the time it will take to naturally replenish the removed oiled sediments with fresh uncontaminated sediments, re-growth of removed root masses of trees and shrubs along Tar Creek, the recovery and growth of riparian undergrowth vegetation, and the re-attainment of full reproductive health of local biota.

VIII. NATURAL RESOURCE DAMAGES

The Department of Fish and Game - Office of Spill Prevention and Response (DFG/OSPR) estimates damages to natural resources based upon the following: (1) primary restoration and monitoring costs of restoring the impacted area; (2) compensatory damages to compensate the public for the lost habitat services between the time of the incident and full recovery; and (3) costs of assessment. The following only addressed the second component: compensatory damages.

Compensatory damages for lost habitat and organisms may be calculated as the cost of performing resource restoration/improvements that provides benefits equivalent to the resource losses sustained by the public as a result of an incident. A widely accepted approach for making such calculations is Resource Equivalency Analysis (REA) (see *Attachment C*). Critical inputs for applying this methodology include: (1) the spatial extent of the injury; (2) the magnitude of the injury per unit area; and (3) the type of restoration used for compensation.

Because of the high fixed costs associated with conducting restoration of biological resources (e.g., planning, permitting, monitoring), it is often more economically efficient to implement one large restoration project rather than multiple small projects. To allow responsible parties to take advantage of the per-unit cost savings of a larger project, this claim is made on the premise that civil damages will be combined with partnering funds.

DFG/OSPR uses the following additional assumptions to estimate the financial contribution to restoration that compensates for the resource services lost as a result of the subject Vintage Tar Creek spills:

Table 4 – Impacts and recovery times by reach.

Segment	Length of Streambed	Immediate % Loss of Resource Services	Recovery Time
1	0.16 mile	Total (100%)	1 year
2	0.10 mile	Total (100%)	2 years
3	0.28 mile	Total (100%)	2 years
4	0.06 mile	Total (100%)	2 years
5	0.25 mile	Total (100%)	2 years
6	0.15 mile	Total (100%)	2 years
7	0.20 mile	Heavy (90%)	2 years
8	0.18 mile	Heavy (90%)	2 years
9	0.23 mile	Heavy (90%)	2 years
10	0.33 mile	Heavy (90%)	2 years
11a	1.00 mile	Heavy (90%)	2 years
11b	0.27 mile	Moderate (50%)	2 years
In-stream Access Roads (4)	.05 mile	Light (25%)	1 year
Spill 2	.02 mile	Heavy (90%)	1 year
Note: Segment 11 was separated into two lengths (a & b) for impact calculations due to the significant differences in impact noted between the two areas.			

These assumptions result in a $50,351 claim for compensatory damages for injured watercourses and associated biota. These injuries can be compensated by contributing to a project that restores/enhances in-stream biota of small rocky streams (both perennial and intermittent).

IX. DOCUMENTATION

Various digital pictures were taken throughout the response and cleanup activities. Please see *Attachment B – Selected Photos and Photographic Record Log* for more information.

X. RECOMMENDATION FOR FUTURE ACTIONS

The permanent in-stream containment basin located at the bottom of Segment 8 was non-functional. Had this facility been functioning at the time of the spill, 1.83 miles of streambed, aquatic biota, and associated wildlife species would not have been injured by this release. In addition, this facility would protect the areas of the creek that are more difficult to access improving the speed and ease of response in the case of a spill. Thus, it is recommended that Vintage work with DFG and other trustee agencies to repair the current containment basin or build a new one in order to protect the downstream areas from a spill. It is also recommended that Vintage embark on an extensive preventative, monitoring, maintenance, and equipment replacement project to aid in the reduction of equipment failure related spills.

XI. CONCLUSIONS

Two pipeline breaks occurred, one entered Tar Creek and the other entered an unnamed tributary to Tar Creek. In the first incident, the spilled oil and produced water flowed down a hillside causing significant injury to a 3.21 mile reach of Tar Creek. The second spill (from the same pipeline) injured a 100 ft long reach of an unnamed tributary to Tar Creek. The creeks and nearby areas provide habitat, movement corridors, nesting, sheltering, and foraging areas for a wide variety of aquatic and terrestrial species including but not limited to California Condors. Thousands of aquatic macroinvertebrates died as a result of this incident. In addition, one dead, oiled songbird and one dead, oiled two-striped gartersnake were found. Overall, the impacts to the environment and wildlife from the effects of crude oil and produced water, as well as the disturbance to stream habitat due to cleanup, were significant.

Some of the spilled crude oil remains trapped in the sandy shale sand. None of the wastewater could be recovered. The materials remaining throughout the spill path (in the form of sheens, buried layers, oil hidden within animal burrows and plant root holes, and crude oil compounds that dissolved in the water and percolated into the soil) will remain in the environment. This residual oil will cause further environmental injuries until weathering and biological degradation occurs and eliminates the toxicity.

It is expected that full recovery of the impacted areas of Tar Creek will take a minimum of 2 years.

RESERVATION OF RIGHTS

Nothing in this report is to imply that CDFG/OSPR is abrogating or ceding any responsibility or authority inherent in its control or trusteeship over natural resources. The CDFG/OSPR reserves the right to assess and seek damages for injuries to natural resources caused by this oils spill.

Josh Curtis **Environmental Scientist** **Date**